CANCER

Introduction

Cancer is the name given to a group of related diseases all characterised by having abnormal (cancer) cells which grow and divide in an uncontrolled fashion and can invade and damage nearby tissues and spread to other parts of the body.[1] The types of cancer that commonly affect children are different from those that commonly affect adults.[2]

In New Zealand around 130 children (aged 0–14 years) and 160 young people (aged 15–24 years) are diagnosed with cancer each year[3,4] and around 50 children and young people die from cancer.[5] Cancer is the third most common cause of death in New Zealand children and young people (aged 28 days to 24 years), after transport-related injuries and suicide.[5]

The most common types of cancer diagnosed in New Zealand children during 2000–2009 were leukaemias and central nervous system tumours.[3] In young people, the most common types were melanomas, carcinomas, lymphomas, germ cell and trophoblastic neoplasms, and leukaemias.[4]

Over the last half century there have been great improvements in the treatment of childhood cancer. Overall child cancer five-year survival rates in New Zealand are now around 80%, comparable to those in other developed countries.[2] Five-year cancer survival rates for New Zealand 15−24 year olds (81%) and 15−19 year olds (75%) are somewhat lower than those in other developed countries.[4]

Data sources and methods

Indicators

Incidence of cancer as notified to the New Zealand Cancer Registry (NZCR)

Data sources

Numerator: New Zealand Cancer Registry (NZCR), unless indicated otherwise

Denominator: NZ Statistics NZ Estimated Resident Population

Additional information

The NZCR records cancers diagnosed in New Zealand. NZCR registers each cancer once, in the year of first known diagnosis. Registrations cover new cases of primary cancer, or secondary cancers where the primary cancer is unknown. In the few instances where an individual had multiple registrations for the same cancer, only one registration for the same cancer has been kept.

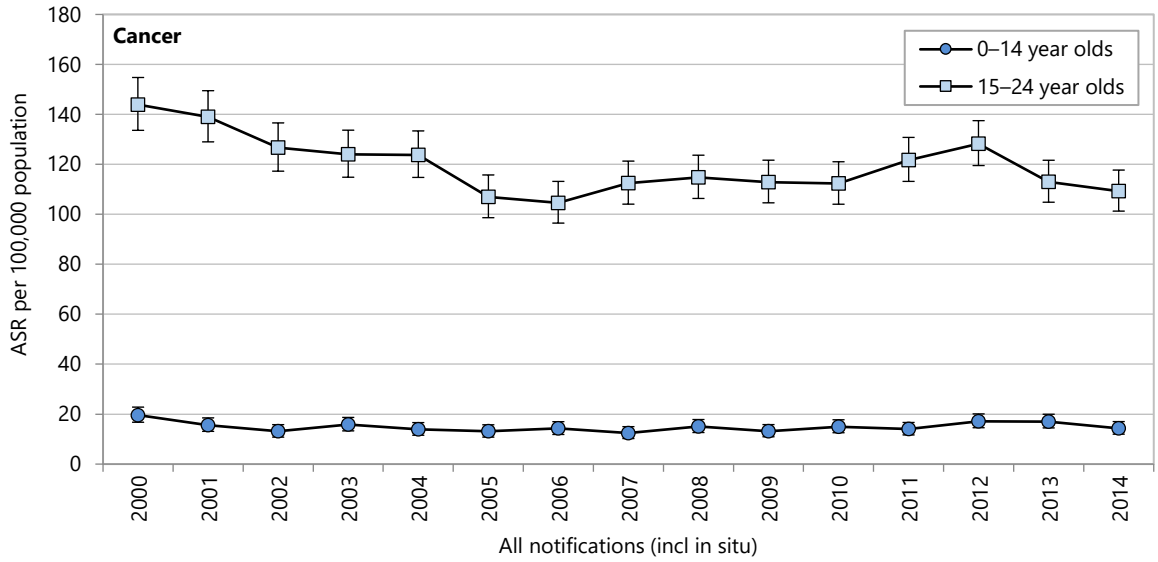
Year is registration year. Age is age at date of diagnosis. Rates are age-standardised, unless stated otherwise.

Included cancers are as defined by the Ministry of Health, and the codes utilised to identify cases are available in Error! Reference source not found.. Unless otherwise stated, cancer notifications exclude in-situ neoplasms.

National trends and distribution

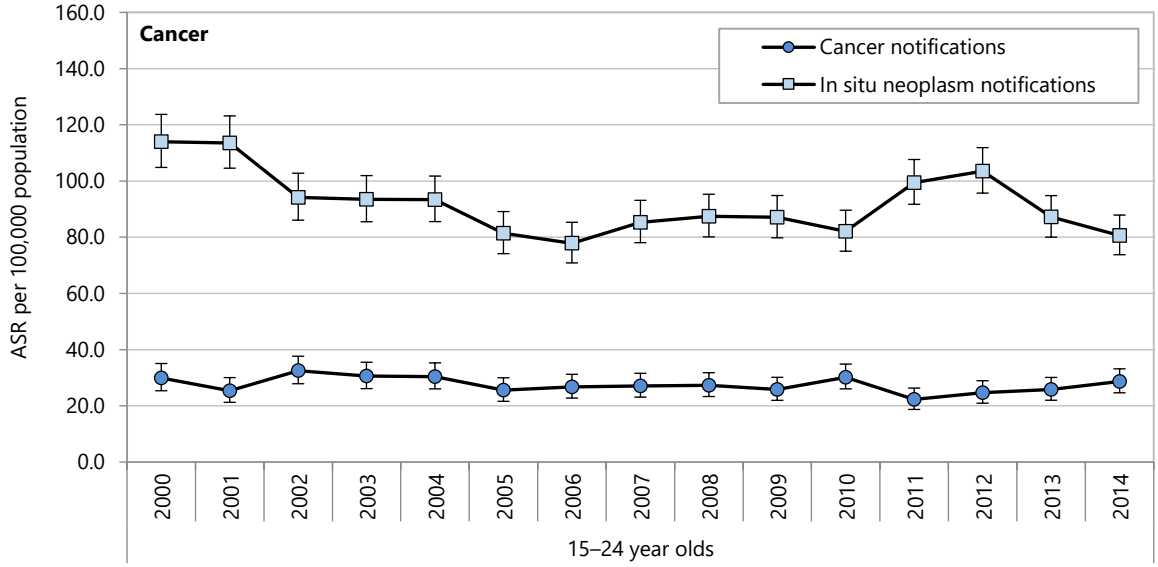
From 2000 to 2014 a total of 12,309 individual 0–24 year olds were diagnosed with cancer, an average of 880 individuals per year. Most of these individuals had one cancer diagnosis. As shown in **Figure 1** there has been a small but statistically significant decline in cancer registration rates for 0–14 and 15–24 year olds over this 15-year time period. In 15–24 year olds the decline is due to a fall in incidence of in-situ neoplasm registrations and cancer registration rates were stable over time (**Figure 2**).

Figure 1. Notifications to NZ Cancer Registry for 0–24 year olds, by age group and year, New Zealand 2000–2014



Numerator: National Cancer Registry, Denominator: Statistics NZ Estimated Resident Population. ASR = Age standardised rate (standardised to 2013 NZ Census population). All notifications (including in-situ)

Figure 2. Notifications to NZ Cancer Registry for 15–24 year olds, by type and year, New Zealand 2000–2014



Numerator: National Cancer Registry, Denominator: Statistics NZ Estimated Resident Population. ASR = Age standardised rate (standardised to 2013 NZ Census population)

Table 1 presents the rate of cancer diagnosis, deaths and hospitalisations by age group and sex during the most recent five-year period which had data available for each measure. The highest rates of new cancer diagnoses and cancer deaths were among 20–24 year olds, followed by 0–4 year olds. The highest hospitalisation rate was for 0–4 year olds. With the exception of 20–24 year olds, cancer incidence was higher in males than females. The death rate was higher for 0–4 and 15–19-year-old males compared to females, with little difference by gender in other age groups. Hospitalisation rates were higher for males compared with females in all age groups.

Table 1. Cancer in 0–24 year olds, by age group and sex, New Zealand

Age (years)	Incidence rate per 100,000 (2010–2014)	Mortality rate per 100,000 (2009–2013)	Hospitalisation rate per 100,000 (2011–2015)
Cancer			
New Zealand			
Total			
0–4	23.16	3.61	188.37
5–9	10.71	1.48	117.71
10–14	12.19	2.06	112.41
15–19	19.77	4.16	113.67
20–24	32.87	4.80	103.14
Males			
0–4	24.66	4.23	215.03
5–9	12.29	1.18	133.09
10–14	13.70	2.07	126.03
15–19	20.37	5.00	130.87
20–24	31.28	4.76	109.43
Females			
0–4	21.59	2.97	160.23
5–9	9.04	1.79	101.58
10–14	10.59	2.05	98.08
15–19	19.14	3.27	95.58
20–24	34.49	4.84	96.71

Numerator(s): *Incidence:* National Cancer Registry; *Mortality:* National Mortality Collection; *Hospitalisations:* National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population. Rates are age-specific rates; Cancer includes all malignant tumours and other neoplasms of uncertain/unknown behaviour; Incidence by new registrations, Mortality by underlying cause of death; Hospitalisation by primary diagnosis; All notifications (including in-situ)

Diagnosis

The most common types of cancer in 0–14 year olds between 2010 and 2014 were tumours of the lymphoid, haematopoietic and related tissue, in particular leukaemia, followed by tumours of the central nervous system (including brain and eye) (**Table 2**). Tumours of the lymphoid, haematopoietic and related tissue were also the most common types of cancer for 15–24 year olds, followed by cancers of the skin and male genital organs (**Table 3**).

Table 2. Cancer notifications for 0–14 year olds, by cancer group, New Zealand 2010–2014

2010–2014	Notifications *(n)*	ASR per 100,000	95% CI
New Zealand			
0–14 year olds			
Cancer notifications			
All cancers	699	15.47	14.34–16.66
Lymphoid, haematopoietic and related tissue	325	7.19	6.43–8.02
Leukaemia	*246*	*5.45*	*4.79–6.17*
Leukaemia: Lymphoid leukaemia	*194*	*4.30*	*3.72–4.95*
Leukaemia: Acute myeloid leukaemia	*20*	*0.44*	*0.27–0.68*
Hodgkin lymphoma	*30*	*0.66*	*0.44–0.94*
Non-Hodgkin lymphoma (except Burkitt lymphoma)	*26*	*0.57*	*0.38–0.84*
Burkitt lymphoma	*12*	*0.27*	*0.14–0.46*
Eye, Brain and other parts of the central nervous system	138	3.06	2.57–3.61
Mesothelial and soft tissue	62	1.38	1.05–1.76
Bones, joints and articular cartilage	47	1.03	0.76–1.37
Thyroid and other endocrine glands	35	0.78	0.54–1.08
Urinary tract	35	0.78	0.54–1.08
Digestive organs	26	0.57	0.38–0.84
Respiratory system and intrathoracic organs	<10	s	s
Lip, oral cavity and pharynx	<10	s	s
Skin	<10	s	s
Female genital organs	<10	s	s
Male genital organs	<10	s	s
Ill-defined, secondary or unspecified sites	<10	s	s

Numerator: National Cancer Registry, Denominator: Statistics NZ Estimated Resident Population. Cancer includes all malignant tumours and other neoplasms of uncertain/unknown behaviour; ASR = Age standardised rate (standardised to 2013 NZ Census population)

Table 3. Cancer notifications and incidence for 15–24 year olds, by cancer group, New Zealand 2010–2014

2010–2014	Notifications *(n)*	ASR per 100,000	95% CI
New Zealand			
15–24 year olds			
Cancer notifications			
All cancers	821	26.34	24.57–28.21
Lymphoid, haematopoietic and related tissue	233	7.47	6.54–8.49
Hodgkin lymphoma	*87*	*2.79*	*2.23–3.44*
Leukaemia	*34*	*1.09*	*0.75–1.52*
Leukaemia: Lymphoid leukaemia	*23*	*0.74*	*0.47–1.10*
Leukaemia: Acute myeloid leukaemia	*99*	*3.17*	*2.58–3.86*
Non-Hodgkin lymphoma	*38*	*1.22*	*0.86–1.67*
Skin	115	3.70	3.05–4.44
Male genital organs*	109	6.89	5.66–8.31
Thyroid and other endocrine glands	67	2.15	1.67–2.73
Digestive organs	57	1.83	1.39–2.37
Eye, Brain and other parts of the central nervous system	51	1.64	1.22–2.15
Bones, joints and articular cartilage	46	1.47	1.08–1.96
Female genital organs*	55	3.60	2.71–4.68
Mesothelial and soft tissue	36	1.15	0.81–1.60
Lip, oral cavity and pharynx	16	0.51	0.29–0.83
Respiratory system and intrathoracic organs	14	0.45	0.25–0.75
Breast*	14	0.92	0.50–1.54
Urinary tract	<10	s	s

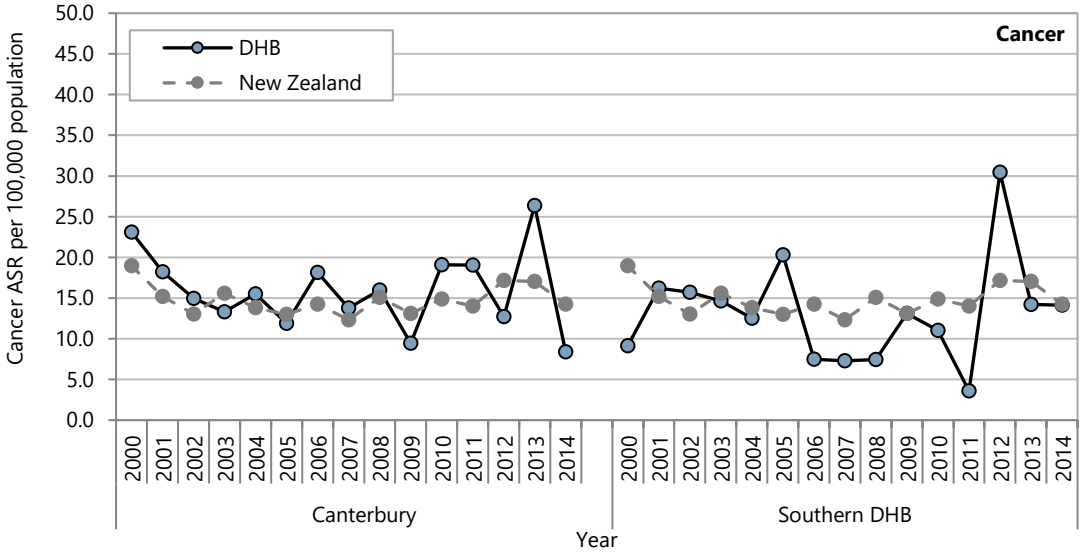
Numerator: National Cancer Registry, Denominator: Statistics NZ Estimated Resident Population. Cancer includes all malignant tumours and other neoplasms of uncertain/unknown behaviour; ASR = Age standardised rate (standardised to 2013 NZ Census population); * = sex-specific rate

Regional trends and distribution

Cancer notification rates have been suppressed in several South Island DHBs due to low numbers. From 2000 to 2014 cancer notification rates showed a similar pattern to the national rate in Canterbury and Southern DHBs for 0–14 and 15–24 year olds, considering that the rates were based on small numbers (**Figure 3**, **Figure 4**). Between 2010 and 2014 the age-standardised notification rate (ASR) was not statistically different from the national rate in any of the South Island DHBs for either age group (**Table 4**, **Table 5**).

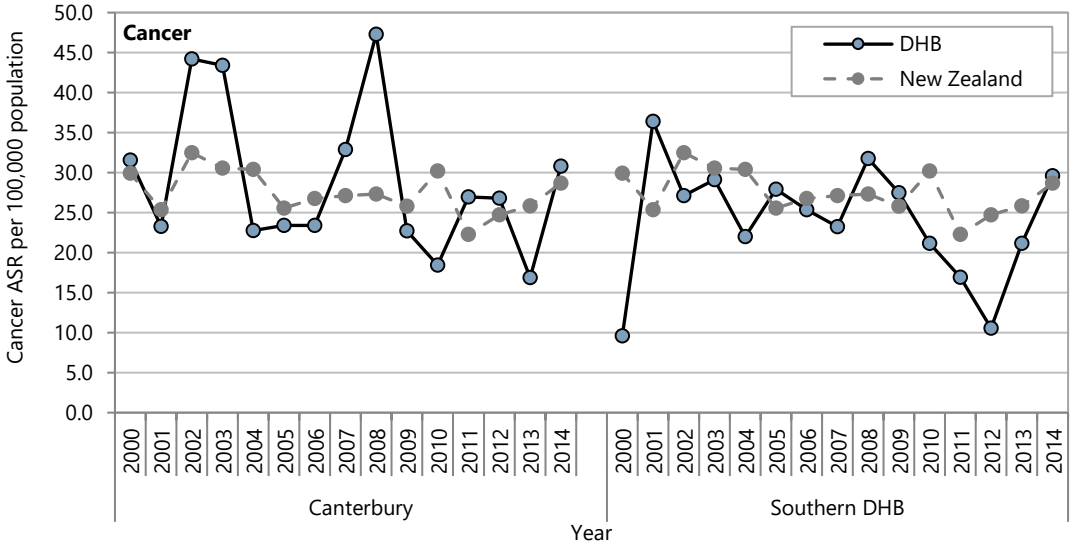
The number of cancer notifications and ASRs in each cancer group are presented in **Table 6** and **Table 7.** These show a similar distribution to New Zealand with tumours of the lymphoid, haematopoietic and related tissue predominant. For 15–24 year olds skin cancer ASRs were as high as lymphoid, haematopoietic and related tissue ASRs in Nelson Marlborough and Canterbury.

Figure 3. Cancer notifications for 0–14 year olds, South Island DHBs vs New Zealand 2000–2014



Numerator: National Cancer Registry; Denominator: Statistics NZ Estimated Resident Population. ASR = Age standardised rate (standardised to 2013 NZ Census population) per 100,000 population; Cancer includes all malignant tumours and other neoplasms of uncertain/unknown behaviour; Caution: DHB ASRs based on small numbers, rates suppressed due to small numbers for Nelson Marlborough, South Canterbury and West Coast DHBs

Figure 4. Cancer notifications for 15–24 year olds, South Island DHBs vs New Zealand 2000–2014



Numerator: National Cancer Registry; Denominator: Statistics NZ Estimated Resident Population. ASR = Age standardised rate (standardised to 2013 NZ Census population per 100,000 population; Cancer includes all malignant tumours and other neoplasms of uncertain/unknown behaviour; Caution: DHB ASRs based on small numbers, rates suppressed due to small numbers for Nelson Marlborough, South Canterbury and West Coast DHBs

Table 4. Cancer notifications and incidence for 0–14 year olds, South Island DHBs vs New Zealand 2010–2014

DHB	Notifications *(n)*	ASR per 100,000	Rate ratio	95% CI
0–14 year olds				
Cancer notifications				
Nelson Marlborough	17	12.69	0.82	0.28–2.40
South Canterbury	<10	s	s	s
Canterbury	81	17.13	1.11	0.66–1.85
West Coast	<10	s	s	s
Southern DHB	41	14.67	0.95	0.47–1.91
New Zealand	699	15.47	1.00	

Numerator: National Cancer Registry, Denominator: Statistics NZ Estimated Resident Population. Cancer includes all malignant tumours and other neoplasms of uncertain/unknown behaviour; ASR = Age standardised rate (standardised to 2013 NZ Census population) per 100,000 population; s = suppressed due to small numbers

Table 5. Cancer notifications and incidence for 15–24 year olds, South Island DHBs vs New Zealand 2010–2014

DHB	Notifications *(n)*	ASR per 100,000	Rate ratio	95% CI
15–24 year olds				
Cancer notifications				
Nelson Marlborough	20	26.59	1.01	0.37–2.72
South Canterbury	<10	s	s	s
Canterbury	85	23.99	0.91	0.55–1.50
West Coast	<10	s	s	s
Southern DHB	47	19.89	0.75	0.39–1.46
New Zealand	821	26.34	1.00	

Numerator: National Cancer Registry, Denominator: Statistics NZ Estimated Resident Population. Cancer includes all malignant tumours and other neoplasms of uncertain/unknown behaviour; ASR = Age standardised rate (standardised to 2013 NZ Census population) per 100,000 population; s = suppressed due to small numbers

Table 6. Cancer notifications for 0–14 year olds, by DHB and cancer group, South Island DHBs 2010–2014

2010–2014	Notifications (*n*)	ASR per 100,000 population	95% CI
Cancer notifications			
0–14 year olds			
Nelson Marlborough			
All cancers	17	12.69	7.39–20.33
Lymphoid, haematopoietic and related tissue	10	7.47	3.58–13.74
Leukaemia	*9*	*6.72*	*3.07–12.76*
South Canterbury			
All cancers	8	15.11	6.51–29.78
Canterbury			
All cancers	81	17.13	13.60–21.29
Lymphoid, haematopoietic and related tissue	42	8.87	6.39–11.99
Leukaemia	*30*	*6.34*	*4.28–9.05*
Hodgkin lymphoma	*5*	*1.05*	*0.34–2.45*
Non-Hodgkin lymphoma	*<5*	*s*	*s*
Mesothelial and soft tissue	10	2.12	1.01–3.90
Thyroid and other endocrine glands	7	1.49	0.60–3.06
West Coast			
All cancers	7	22.03	8.82–45.41
Southern DHB			
All cancers	41	14.67	10.53–19.91
Lymphoid, haematopoietic and related tissue	21	7.52	4.65–11.50
Leukaemia	*18*	*6.46*	*3.82–10.20*
Leukaemia: Lymphoid leukaemia	*12*	*4.31*	*2.22–7.53*
Hodgkin lymphoma	*<5*	*s*	*s*
Non-Hodgkin lymphoma	*<5*	*s*	*s*
Eye, Brain and other parts of the central nervous system	8	2.88	1.24–5.67

Numerator: National Cancer Registry, Denominator: Statistics NZ Estimated Resident Population. Cancer includes all malignant tumours and other neoplasms of uncertain/unknown behaviour; ASR = Age standardised rate (standardised to 2013 NZ Census population) per 100,000 population; s = suppressed due to small numbers; Not all cancers are presented in table

Table 7. Cancer notifications for 15–24 year olds, by DHB and cancer group, South Island DHBs 2010–2014

2010–2014	Notifications (*n*)	ASR per 100,000 population	95% CI
Cancer notifications			
15–24 year olds			
Nelson Marlborough			
All cancers	20	26.59	16.23–41.07
Lymphoid, haematopoietic and related tissue	7	9.29	3.72–19.14
Skin	6	7.98	2.91–17.38
South Canterbury			
All cancers	9	28.08	12.81–53.31
Canterbury			
All cancers	85	23.99	19.16–29.66
Lymphoid, haematopoietic and related tissue	19	5.35	3.22–8.36
Leukaemia	*6*	*1.69*	*0.62–3.67*
Hodgkin lymphoma	*6*	*1.69*	*0.62–3.67*
Non-Hodgkin lymphoma	*6*	*1.69*	*0.62–3.69*
Skin	22	6.22	3.90–9.41
Digestive organs	9	2.54	1.16–4.82
Male genital organs*	7	3.75	1.50–7.72
Thyroid and other endocrine glands	7	1.98	0.79–4.08
Female genital organs*	6	3.59	1.31–7.82
Mesothelial and soft tissue	5	1.40	0.45–3.27
West Coast			
All cancers	7	38.55	15.44–79.43
Southern DHB			
All cancers	47	19.89	14.61–26.45
Lymphoid, haematopoietic and related tissue	15	6.35	3.55–10.47
Leukaemia	*5*	*2.11*	*0.68–4.94*
Hodgkin lymphoma	*9*	*3.81*	*1.74–7.23*
Skin	7	2.96	1.19–6.11
Male genital organs*	5	4.27	1.38–9.96
Female genital organs*	5	4.20	1.35–9.79

Numerator: National Cancer Registry, Denominator: Statistics NZ Estimated Resident Population. Cancer includes all malignant tumours and other neoplasms of uncertain/unknown behaviour; ASR = Age standardised rate (standardised to 2013 NZ Census population) per 100,000 population; * = Sex specific rates; Not all cancers are presented in table

Evidence for good practice

Possibilities for prevention

Unlike adult cancers, very few childhood cancers have known preventable causes.[6] One of the few preventable causes is exposure to ionising radiation in utero from diagnostic radiography.[6] Since this association was recognised in the 1950s, health services have been careful to minimise women's radiation exposure during pregnancy.[6]

While childhood cancers are largely not preventable, there are important preventive measures that children and young people can take to reduce their risks of getting cancer later in life. Getting sunburnt in childhood is associated with an increased risk of developing melanoma skin cancer in adulthood.[7] There has been little research on sun protection specifically for children but evidence from studies in adults suggests that the following measures are effective: avoiding sun exposure when sun is at its highest; avoiding the use of artificial UV sources such as sun beds; wearing sun-protective clothing, wide-brimmed hats and sunglasses; and liberal use of sunscreen products on all exposed skin.[8]

Infection with human papilloma virus is the main cause of cervical cancer and it is also a significant cause of vaginal, vulvar, penile, anal and oropharyngeal cancers.[9] Vaccination against HPV (for both girls and boys)

offers protection against HPV-related cancers.[9] Vaccination against hepatitis B reduces the incidence of hepatocellular carcinoma (a type of liver cancer), which is associated with chronic hepatitis B infection.[10]

Smoking is a cause of many types of cancer in adults: lung, larynx, oral cavity, pharynx, oesophagus, pancreas, bladder, kidney, cervix, and stomach, and acute myeloid leukaemia.[11] Since most adult smokers started smoking as teenagers or young adults, discouraging young people from taking up smoking is a very effective way to prevent cancers caused by smoking.[12]

Evidence-based health care for children and young people with cancer

Treatment for child cancer is complex, involving multiple types of treatment (chemotherapy, radiotherapy, surgery) that are delivered over several years by multidisciplinary teams.[13] There is evidence that better treatment outcomes for child cancer are achieved by high (vs. low) volume hospitals, high (vs. low) volume providers, and specialised (vs. non-specialised) hospitals, although the differences are relatively small.[14] Suggested explanations for this include 'practice makes perfect' and 'selective referral' (hospitals or physicians with good reputations receive more referrals).[15] These factors have not been explored in relation to child cancer treatment specifically and it is likely that both play a part.[14]

New Zealand's small population makes it challenging to provide high quality child cancer services nationwide. New Zealand currently has two specialist child cancer services, located in Auckland and Christchurch. These have shared care arrangements with the other DHBs so that a specialist paediatric oncology service is responsible for advising on and coordinating the initial diagnostic work-up, the provision of intensive therapy, and overall management of a child's care but once the child is stabilised, some components of treatment can be provided closer to the child's home.[13]

In developed countries, including New Zealand, children with cancer are generally treated according to protocols developed through international collaborative research studies.[16] Since the early 2000s, the rate of decrease in child cancer mortality has slowed considerably and it is probable that optimisation of currently available anti-cancer treatments has been achieved.[16] New therapies are being developed which target the molecular biomarkers associated with particular sub-types of cancer[17] but so far targeted drugs have been of benefit to only a very small proportion of child cancer patients.[18] (Biomarkers are substances, mostly proteins, that are produced by cancer cells or by other body cells in response to cancer, and that can be detected and measured in tissues or body fluids.[19])

Treatment for child cancer has both short term and long term adverse effects. Commonly experienced short term effects include fatigue, lack of energy, pain, anaemia, infection, lack of appetite, hair loss, bruising, nausea, vomiting, diarrhoea, and mucositis (painful mouth ulcers due to inflammation and ulceration of the lining of the digestive tract).[20] In the long term child cancer survivors are at lifelong risk of developing a subsequent primary cancer and of having multiple physical and psychosocial health problems including cardiovascular disease, cardiomyopathy, pulmonary fibrosis, renal dysfunction, obesity, mental health problems, and endocrinopathies (e.g. premature gonadal failure, thyroid disease, and osteoporosis).[21] Most of the serious health problems do not become apparent until decades after cancer treatment has ended.[22] Lifelong follow-up of survivors is therefore regarded as best practise.[23,24]

These national and international guidelines, systematic reviews, other publications and websites relevant to the prevention and management of cancer are suggested for further reading.

Ministry of Health Publications and web pages

- Ministry of Health. 2015. HPV immunisation programme. http://www.health.govt.nz/our-work/preventative-health-wellness/immunisation/hpv-immunisation-programme
- Ministry of Health. 2014. New Zealand Cancer Plan: Better, faster cancer care 2015–2018. Wellington: Ministry of Health. http://www.health.govt.nz/publication/new-zealand-cancer-plan-better-faster-cancer-care-2015-2018
- Ministry of Health. 2012. Guidance for integrated paediatric palliative care services in New Zealand. Wellington: Ministry of Health. http://www.health.govt.nz/publication/guidance-integrated-paediatric-palliative-care-services-new-zealand
- Ministry of Health. 2012. Protecting Children with Cancer from Measles. Wellington: Ministry of Health. http://www.moh.govt.nz/notebook/nbbooks.nsf/0/4CC384531E1E23C8CC257A5B0080638C/$file/protecting-children-with-cancer-from-measles.pdf

- Ministry of Health. 2010. National Plan for Child Cancer Services in New Zealand. Wellington: Ministry of Health. http://www.health.govt.nz/publication/national-plan-child-cancer-services-new-zealand

New Zealand Guidelines

- National Child Cancer Network[NZ]. National guidelines for the care of childhood cancer in specialist child cancer and shared care centres. https://www.starship.org.nz/for-health-professionals/national-guidelines-paediatric-oncology-and-haematology/#All
- New Zealand Gynaecological Cancer Group. 2015. Gynaecologic Cancer Follow-up: New Zealand Gynaecological Cancer Group guidelines. http://www.health.govt.nz/publication/gynaecologic-cancer-follow-new-zealand-gynaecological-cancer-group-guidelines
- New Zealand Gynaecologic Cancer Group. 2014. Gestational Trophoblastic Disease: New Zealand Gynaecologic Cancer Group Guidelines. Wellington: Ministry of Health. http://www.health.govt.nz/publication/gestational-trophoblastic-disease-new-zealand-gynaecologic-cancer-group-guidelines
- Special Issue: Australian and New Zealand Consensus Guidelines for the Use of Antifungal Agents in the Haematology / Oncology Setting, 2014 Update. *Internal Medicine Journal*, 44(12b), 1267–397. http://onlinelibrary.wiley.com/doi/10.1111/imj.2014.44.issue-12b/issuetoc
- New Zealand Guidelines Group. 2012. Guidance on Surveillance for People at Increased Risk of Colorectal Cancer. http://www.health.govt.nz/system/files/documents/publications/colorectal-cancer-surveillance-guidance.pdf
- New Zealand Guidelines Group (NZGG). 2009. Suspected Cancer in Primary Care: Guidelines for investigation, referral and reducing ethnic disparities. Wellington: New Zealand Guidelines Group. http://www.health.govt.nz/publication/suspected-cancer-primary-care-guidelines-investigation-referral-and-reducing-ethnic-disparities
- National Screening Unit. 2008. Guidelines for Cervical Screening in New Zealand. Wellington: National Screening Unit, Ministry of Health. https://www.nsu.govt.nz/system/files/resources/guidelines_for_cervical_screening_in_new_zealand.pdf

International guidelines relevant to cancer prevention

- Dickinson J, Tsakonas E, Conner Gorber S, et al. 2013. Recommendations on screening for cervical cancer. *Canadian Medical Association Journal*, 185(1), 35-45. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3537778/
- World Health Organization. 2013. WHO guidelines for screening and treatment of precancerous lesions for cervical cancer prevention. Geneva: World Health Organization. http://www.who.int/reproductivehealth/publications/cancers/screening_and_treatment_of_precancerous_lesions/en/
- Moyer VA. 2012. Screening for cervical cancer: U.S. Preventive Services Task Force recommendation statement. *Annals of Internal Medicine*, 156(12), 880-91, w312. http://www.uspreventiveservicestaskforce.org/Page/Document/UpdateSummaryFinal/cervical-cancer-screening?ds=1&s=screening%20cervical%20cancer
- Moyer VA. 2012. Behavioral counseling to prevent skin cancer: U.S. Preventive Services Task Force recommendation statement. *Annals of Internal Medicine*, 157(1), 59-65. http://www.uspreventiveservicestaskforce.org/Page/Document/UpdateSummaryFinal/skin-cancer-counseling

International guidelines relevant to the supportive care of children and young people with cancer

- Flank J, Robinson PD, Holdsworth M, et al. 2016. Guideline for the treatment of breakthrough and the prevention of refractory chemotherapy-induced nausea and vomiting in children with cancer. *Pediatric Blood & Cancer*, 63(7), 1144-51. http://dx.doi.org/10.1002/pbc.25955
- National Collaborating Centre for Cancer. 2015. Suspected cancer: recognition and referral. London: National Institute for Health and Care Excellence. https://www.nice.org.uk/guidance/NG12 (full guideline with evidence: https://www.nice.org.uk/guidance/ng12/evidence)
- Smith TJ, Bohlke K, Lyman GH, et al. 2015. Recommendations for the Use of WBC Growth Factors: American Society of Clinical Oncology Clinical Practice Guideline Update. *Journal of Clinical Oncology*, 33(28), 3199-212.

- Influenza immunization for adult and pediatric patients undergoing cancer treatment. 2015. Edmonton, Alberta: Alberta Health Services. http://www.albertahealthservices.ca/assets/info/hp/cancer/if-hp-cancer-guide-supp002-vaccination.pdf
- Science M, Robinson PD, MacDonald T, et al. 2014. Guideline for primary antifungal prophylaxis for pediatric patients with cancer or hematopoietic stem cell transplant recipients. *Pediatric Blood & Cancer*, 61(3), 393–400. http://dx.doi.org/10.1002/pbc.24847
- Dupuis LL, Robinson PD, Boodhan S, et al. 2014. Guideline for the prevention and treatment of anticipatory nausea and vomiting due to chemotherapy in pediatric cancer patients. *Pediatric Blood & Cancer*, 61(8), 1506-12. http://onlinelibrary.wiley.com/doi/10.1002/pbc.25063/abstract
- Jakes AD, Marec-Berard P, Phillips RS, et al. 2014. Critical Review of Clinical Practice Guidelines for Fertility Preservation in Teenagers and Young Adults with Cancer. *Journal of Adolescent and Young Adult Oncology*, 3(4), 144-52. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4270154/
- Schiffer CA, Mangu PB, Wade JC, et al. 2013. Central venous catheter care for the patient with cancer: American Society of Clinical Oncology clinical practice guideline. *Journal of Clinical Oncology*, 31(10), 1357-70. http://jco.ascopubs.org/content/31/10/1357.long
- Loren AW, Mangu PB, Beck LN, et al. 2013. Fertility preservation for patients with cancer: American Society of Clinical Oncology clinical practice guideline update. *Journal of Clinical Oncology*, 31(19), 2500-10.
- Dupuis LL, Boodhan S, Holdsworth M, et al. 2013. Guideline for the prevention of acute nausea and vomiting due to antineoplastic medication in pediatric cancer patients. *Pediatric Blood & Cancer*, 60(7), 1073-82. http://onlinelibrary.wiley.com/doi/10.1002/pbc.24508/abstract
- Koren G, Carey N, Gagnon R, et al. 2013. Cancer chemotherapy and pregnancy. *Journal of Obstetrics and Gynaecology Canada*, 35(3), 263-80. http://sogc.org/wp-content/uploads/2013/04/gui288CPG1303E.pdf
- Patel A, Schwarz EB. 2012. Cancer and contraception. Release date May 2012. SFP Guideline #20121. *Contraception*, 86(3), 191-8.
- National Institute for Health and Clinical Excellence. 2012. Neutropenic sepsis: prevention and management in people with cancer. London: National Institute for Health and Clinical Excellence. https://www.nice.org.uk/guidance/cg151 (full guideline with evidence: https://www.nice.org.uk/guidance/cg151/evidence)
- Note: the National Guideline Clearinghouse has noted that this guideline references a class of drugs for which important revised regulatory and/or warning information has been released by the FDA, see May 12, 2016 – Fluoroquinolone Antibacterial Drugs
- Lehrnbecher T, Phillips R, Alexander S, et al. 2012. Guideline for the management of fever and neutropenia in children with cancer and/or undergoing hematopoietic stem-cell transplantation. *Journal of Clinical Oncology*, 30(35), 4427-38. http://jco.ascopubs.org/content/30/35/4427.long
- Monagle P, Chan AKC, Goldenberg NA, et al. 2012. Antithrombotic therapy in neonates and children: Antithrombotic therapy and prevention of thrombosis, 9th ed: American College of Chest Physicians evidence-based clinical practice guidelines. *Chest*, 141(2_suppl), e737S-e801S. http://dx.doi.org/10.1378/chest.11–2308
- Basch E, Prestrud AA, Hesketh PJ, et al. 2011. Antiemetics: American Society of Clinical Oncology clinical practice guideline update (Erratum in *Journal of Clinical Oncology*. 2014 Jun 1;32(19):2117. Dosage error in article text.). *Journal of Clinical Oncology*, 29(31), 4189-98. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4876353/

International guidelines relevant to the psychosocial care of children and young people with cancer

- Standards for Psychosocial Care for Children with Cancer and Their Families [Special Issue]. 2015. *Pediatric Blood & Cancer*, 62(S5), S419–S895. http://onlinelibrary.wiley.com/doi/10.1002/pbc.v62.S5/issuetoc
- Cincinnati Children's Hospital Medical Center. 2012. Best Evidence Statement. Psycho-social interventions for primary caregivers of newly diagnosed pediatric oncology patients. Cincinnati, OH: Cincinnati Children's Hospital Medical Center. https://www.cincinnatichildrens.org/WorkArea/DownloadAsset.aspx?id=102118

International guidelines relevant to the long term care of child and young adult cancer survivors

- Children's Oncology Group. 2013. Long-term follow-up guidelines for survivors of childhood, adolescent and young adult cancer. Monrovia, CA: Children's Oncology Group. http://www.survivorshipguidelines.org/pdf/LTFUGuidelines_40.pdf
- Scottish Intercollegiate Guidelines Network. 2013. Long term follow up of survivors of childhood cancer. Edinburgh: Scottish Intercollegiate Guidelines Network. http://www.sign.ac.uk/guidelines/fulltext/132/index.html

Evidence-based medicine reviews relevant to cancer prevention

Publications relevant to discouraging young people from starting smoking and encouraging young smokers to quit can be found in the previous report in this series: *The determinants of health for children and young people* (2014) http://hdl.handle.net/10523/6383.

- Wu YP, Aspinwall LG, Conn BM, et al. 2016. A systematic review of interventions to improve adherence to melanoma preventive behaviors for individuals at elevated risk. *Preventive Medicine*, 88, 153-67.
- Walling EB, Benzoni N, Dornfeld J, et al. 2016. Interventions to Improve HPV Vaccine Uptake: A Systematic Review. *Pediatrics*, 138(1). http://pediatrics.aappublications.org/content/138/1/e20153863.long
- Pink J, Parker B, Petrou S. 2016. Cost Effectiveness of HPV Vaccination: A Systematic Review of Modelling Approaches. *Pharmacoeconomics*. http://dx.doi.org/10.1007/s40273-016-0407-y
- Garland SM, Kjaer SK, Munoz N, et al. 2016. Impact and Effectiveness of the Quadrivalent Human Papillomavirus Vaccine: A Systematic Review of 10 Years of Real-world Experience. *Clinical Infectious Diseases*, ciw354.
- Schmeler KM, Sturgis EM. Expanding the benefits of HPV vaccination to boys and men. *The Lancet*, 387(10030), 1798-99.
- Stillo M, Carrillo Santisteve P, Lopalco PL. 2015. Safety of human papillomavirus vaccines: a review. *Expert Opinion on Drug Safety*, 14(5), 697-712. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4667712/
- Drolet M, Benard E, Boily MC, et al. 2015. Population-level impact and herd effects following human papillomavirus vaccination programmes: a systematic review and meta-analysis. *The Lancet Infectious Diseases*, 15(5), 565-80.
- Albrow R, Blomberg K, Kitchener H, et al. 2014. Interventions to improve cervical cancer screening uptake amongst young women: a systematic review. *Acta Oncologica*, 53(4), 445-51.
- Crosignani P, De Stefani A, Fara GM, et al. 2013. Towards the eradication of HPV infection through universal specific vaccination. *BMC Public Health*, 13, 642. http://bmcpublichealth.biomedcentral.com/articles/10.1186/1471–2458-13-642
- Hendry M, Lewis R, Clements A, et al. 2013. "HPV? Never heard of it!": a systematic review of girls' and parents' information needs, views and preferences about human papillomavirus vaccination. *Vaccine*, 31(45), 5152-67.
  (CRD summary: http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0059867/)
- Grimes RM, Benjamins LJ, Williams KL. 2013. Counseling about the HPV vaccine: desexualize, educate, and advocate. *Journal of Pediatric & Adolescent Gynecology*, 26(4), 243-8.
- Nahar VK. 2013. Skin cancer prevention among school children: a brief review. Central European Journal of Public Health, 21(4), 227-32. http://apps.szu.cz/svi/cejph/show_en.php?kat=archiv/2013–4-10

Evidence-based medicine reviews relevant to the supportive care of children and young people with cancer

- Robinson PD, Dupuis LL, Tomlinson G, et al. 2016. Strategies facilitating practice change in pediatric cancer: a systematic review. *International Journal for Quality in Health Care*.
  DOI: http://dx.doi.org/10.1093/intqhc/mzw052
- Kirch R, Reaman G, Feudtner C, et al. 2016. Advancing a comprehensive cancer care agenda for children and their families: Institute of Medicine Workshop highlights and next steps. *CA: Cancer Journal for Clinicians*. http://onlinelibrary.wiley.com/doi/10.3322/caac.21347/abstract
- Kortmann RD, Freeman C, Marcus K, et al. 2016. Paediatric radiation oncology in the care of childhood cancer: A position paper by the International Paediatric Radiation Oncology Society (PROS). *Radiotherapy and Oncology*, 119(2), 357-60.

- Corbett M, Heirs M, Rose M, et al. 2015. The delivery of chemotherapy at home: an evidence synthesis. *Health Services and Delivery Research*, 3(14). http://www.journalslibrary.nihr.ac.uk/hsdr/volume-3/issue-14#
- National Cancer Policy Forum, Board on Health Care Services, Institute of Medicine, et al. 2015. Comprehensive Cancer Care for Children and Their Families: Summary of a Joint Workshop by the Institute of Medicine and the American Cancer Society. Washington (DC): National Academies Press. http://www.ncbi.nlm.nih.gov/books/NBK305219/
- Nass SJ, Beaupin LK, Demark-Wahnefried W, et al. 2015. Identifying and addressing the needs of adolescents and young adults with cancer: summary of an Institute of Medicine workshop. *Oncologist*, 20(2), 186-95. http://theoncologist.alphamedpress.org/content/20/2/186.long
- Mercadante S, Giarratano A. 2014. Pharmacological management of cancer pain in children. *Critical Reviews in Oncology/Hematology*, 91(1), 93-7.
- Levine D, Lam CG, Cunningham MJ, et al. 2013. Best practices for pediatric palliative cancer care: a primer for clinical providers. *The Journal of Supportive Oncology*, 11(3), 114-25.
- Bradley NM, Robinson PD, Greenberg ML, et al. 2013. Measuring the quality of a childhood cancer care delivery system: quality indicator development. *Value Health*, 16(4), 647-54. http://www.sciencedirect.com/science/article/pii/S1098301513017002
- Waldman E, Wolfe J. 2013. Palliative care for children with cancer. *Nature Reviews Clinical Oncology*, 10(2), 100-7.
- Knops RR, van Dalen EC, Mulder RL, et al. 2013. The volume effect in paediatric oncology: a systematic review. *Annals of Oncology*, 24(7), 1749-53. http://annonc.oxfordjournals.org/content/24/7/1749.long
- Qutob AF, Gue S, Revesz T, et al. 2013. Prevention of oral mucositis in children receiving cancer therapy: a systematic review and evidence-based analysis. *Oral Oncology*, 49(2), 102-7.

Evidence-based medicine reviews relevant to psychosocial care of children and young people with cancer

- Weaver MS, Heinze KE, Bell CJ, et al. 2016. Establishing psychosocial palliative care standards for children and adolescents with cancer and their families: An integrative review. *Palliative Medicine*, 30(3), 212-23. http://www.ncbi.nlm.nih.gov/pmc/articles/pmid/25921709/
- Lopes-Junior LC, Bomfim EO, Nascimento LC, et al. 2015. Non-pharmacological interventions to manage fatigue and psychological stress in children and adolescents with cancer: an integrative review. *European Journal of Cancer Care* (Engl). Sep 16. http://dx.doi.org/10.1111/ecc.12381
- Robb SL, Hanson-Abromeit D. 2014. A review of supportive care interventions to manage distress in young children with cancer and parents. *Cancer Nursing*, 37(4), E1–26.
- Valdez-Martinez E, Noyes J, Bedolla M. 2014. When to stop? Decision-making when children's cancer treatment is no longer curative: a mixed-method systematic review. *BMC Pediatrics*, 14, 124. http://bmcpediatr.biomedcentral.com/articles/10.1186/1471–2431-14-124
- Chang CW, Mu PF, Jou ST, et al. 2013. Systematic review and meta-analysis of nonpharmacological interventions for fatigue in children and adolescents with cancer. *Worldviews on Evidence-Based Nursing*, 10(4), 208-17.

Evidence-based medicine reviews relevant to the long term care of child and young adult cancer survivors

- Chow EJ, Anderson L, Baker KS, et al. 2016. Late Effects Surveillance Recommendations among Survivors of Childhood Hematopoietic Cell Transplantation: A Children's Oncology Group Report. *Biology of Blood and Marrow Transplantation*, 22(5), 782-95.
- Armenian SH, Kremer LC, Sklar C. 2015. Approaches to reduce the long-term burden of treatment-related complications in survivors of childhood cancer. *American Society of Clinical Oncology Educational Book*, 196-204. http://meetinglibrary.asco.org/content/115000196-156
- Brier MJ, Schwartz LA, Kazak AE. 2015. Psychosocial, health-promotion, and neurocognitive interventions for survivors of childhood cancer: a systematic review. *Health Psychology*, 34(2), 130–48.
- Oeffinger KC, Argenbright KE, Levitt GA, et al. 2014. Models of cancer survivorship health care: moving forward. *American Society of Clinical Oncology Educational Book*, 205-13. http://meetinglibrary.asco.org/content/114000205–144

- Singer S, Gianinazzi ME, Hohn A, et al. 2013. General practitioner involvement in follow-up of childhood cancer survivors: a systematic review. *Pediatric Blood & Cancer*, 60(10), 1565-73.
- Heirs M, Suekarran S, Slack R, et al. 2013. A systematic review of models of care for the follow-up of childhood cancer survivors. *Pediatric Blood & Cancer*, 60(3), 351-6.

Other relevant New Zealand publications

- Sullivan M, Ballantine K. 2014. The incidence of childhood cancer in childhood cancer in New Zealand. Auckland: National Child Cancer Network. http://childcancernetwork.cp-design.co.nz/wp-content/uploads/2015/10/Childhood-Cancer-Incidence-in-New-Zealand-2000-2009-1.pdf
- Sullivan M, Ballantine K. 2014. Child cancer survival in New Zealand 2000–2009: The first outcome analysis of the New Zealand children's cancer registry. Auckland: National Child Cancer Network. http://childcancernetwork.cp-design.co.nz/wp-content/uploads/2015/10/Childhood-Cancer-Survival-in-New-Zealand-2000-2009-1.pdf
- Ballantine K, Sullivan M. 2013. Adolescent and young adult cancer incidence and survival in New Zealand 2000-2009. Auckland: National Child Cancer Network. http://ayacancernetwork.org.nz/wp-content/uploads/2014/03/FINAL-AYA-cancer-incidence-and-survival-2000-2009.pdf
- Dodgshun AJ, De Silva MP, Bradbeer P, et al. 2014. Enrollment in clinical cancer trials: how are we doing and what are the obstacles to improving enrollment rates? A 2-year retrospective review of pediatric cancer trial enrollment in New Zealand. *Journal of Pediatric Hematology/Oncology*, 36(8), 630–4.
- Yallop K, McDowell H, Koziol-McLain J, et al. 2013. Self-reported psychosocial wellbeing of adolescent childhood cancer survivors. *European Journal of Oncology Nursing*, 17(6), 711-9.
- Wynn B, Frost A, Pawson P. 2012. Adventure therapy proves successful for adolescent survivors of childhood cancers. *Nursing New Zealand*, 18(1), 28-30.
- Palliative Care Council of New Zealand. 2011. National health needs assessment for palliative care. https://www.health.govt.nz/system/files/documents/publications/national-health-needs-assessment-for-palliative-care-jun11.pdf

Websites

- National Child Cancer Network^{NZ}. http://childcancernetwork.org.nz/
- National Institute for Health and Care Excellence. 2014. Cancer services for children and young people NICE quality standard [QS55]. https://www.nice.org.uk/guidance/qs55
- The Cochrane Library. Childhood cancers. http://www.cochranelibrary.com/topic/Cancer/Childhood%20cancers/?per-page=50
- National Cancer Institute. Sun safety intervention programs. http://rtips.cancer.gov/rtips/topicPrograms.do?topicId=102269&choice=default

References

1. National Cancer Institute. 2015. Children with cancer: A guide for parents. US Department of Health and Human Services, National Institutes of Health. http://www.cancer.gov/publications/patient-education/children-with-cancer.pdf
2. Sullivan M, Ballantine K. 2014. Child cancer survival in New Zealand 2000–2009: The first outcome analysis of the New Zealand Children's Cancer Registry http://childcancernetwork.cp-design.co.nz/wp-content/uploads/2015/10/Childhood-Cancer-Survival-in-New-Zealand-2000-2009-1.pdf accessed September, 2016
3. Sullivan M, Ballantine K. 2014. The incidence of childhood cancer in New Zealand http://childcancernetwork.cp-design.co.nz/wp-content/uploads/2015/10/Childhood-Cancer-Incidence-in-New-Zealand-2000-2009-1.pdf accessed September, 2016
4. Ballantine K, Sullivan M. 2013. Adolescent and young adult cancer incidence and survival in New Zealand 2000-2009 http://ayacancernetwork.org.nz/wp-content/uploads/2014/03/FINAL-AYA-cancer-incidence-and-survival-2000-2009.pdf accessed September, 2016
5. McDonald GK, Healey MD, Hii J, et al. 2015. NZ Child and Youth Mortality Review Committee 11th Data Report 2010 – 2014 http://www.hqsc.govt.nz/assets/CYMRC/Publications/eleventh-data-report-2010-2014.pdf accessed September, 2016
6. Ward E, DeSantis C, Robbins A, et al. 2014. Childhood and adolescent cancer statistics, 2014. *CA: A Cancer Journal for Clinicians*, 64(2) 83-103. http://dx.doi.org/10.3322/caac.21219

7. Oliveria SA, Saraiya M, Geller AC, et al. 2006. Sun exposure and risk of melanoma. *Archives of Disease in Childhood*, 91(2) 131-8. http://dx.doi.org/10.1136/adc.2005.086918
8. Berneburg M, Surber C. 2009. Children and sun protection. *The British Journal of Dermatology*, 161 Suppl 3 33-9. http://dx.doi.org/10.1111/j.1365-2133.2009.09447.x
9. Centers for Disease Control and Prevention. 2015. Cancer prevention starts in childhood http://www.cdc.gov/cancer/dcpc/resources/features/cancerandchildren/ accessed July, 2016.
10. Chang MH, You SL, Chen CJ, et al. 2009. Decreased incidence of hepatocellular carcinoma in hepatitis B vaccinees: a 20-year follow-up study. *Journal of the National Cancer Institute*, 101(19) 1348-55. http://dx.doi.org/10.1093/jnci/djp288
11. US Department of Health and Human Services. 2004. The health consequences of smoking: A report of the Surgeon General. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health. http://www.ncbi.nlm.nih.gov/pubmed/20669512
12. US Department of Health and Human Services. 2012. Preventing tobacco use among youth and young adults: A report of the Surgeon General. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health. http://www.surgeongeneral.gov/library/reports/preventing-youth-tobacco-use/exec-summary.pdf
13. Ministry of Health. 2010. National plan for child cancer services in New Zealand. Wellington: Ministry of Health. https://www.health.govt.nz/system/files/documents/publications/national-plan-child-cancer-services-nz-dec11.pdf
14. Knops RR, van Dalen EC, Mulder RL, et al. 2013. The volume effect in paediatric oncology: a systematic review. *Annals of Oncology*, 24(7) 1749-53. http://dx.doi.org/10.1093/annonc/mds656
15. Luft HS, Hunt SS, Maerki SC. 1987. The volume-outcome relationship: practice-makes-perfect or selective-referral patterns? *Health Services Research*, 22(2) 157-82. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1065430/
16. Pritchard-Jones K, Pieters R, Reaman GH, et al. 2013. Sustaining innovation and improvement in the treatment of childhood cancer: lessons from high-income countries. *The Lancet Oncology*, 14(3) e95-e103. http://dx.doi.org/10.1016/S1470-2045(13)70010-X
17. Saletta F, Wadham C, Ziegler DS, et al. 2014. Molecular profiling of childhood cancer: Biomarkers and novel therapies. *BBA clinical*, 1 59-77. http://dx.doi.org/10.1016/j.bbacli.2014.06.003
18. Adamson PC. 2015. Improving the outcome for children with cancer: Development of targeted new agents. *CA: A Cancer Journal for Clinicians*, 65(3) 212-20. http://dx.doi.org/10.3322/caac.21273
19. Mishra A, Verma M. 2010. Cancer biomarkers: are we ready for the prime time? *Cancers (Basel)*, 2(1) 190-208. http://dx.doi.org/10.3390/cancers2010190
20. American Cancer Society. 2016. Chemotherapy side effects http://www.cancer.org/treatment/treatmentsandsideeffects/physicalsideeffects/chemotherapyeffects/index accessed August, 2016.
21. Oeffinger KC, Mertens AC, Sklar CA, et al. 2006. Chronic health conditions in adult survivors of childhood cancer. *The New England Journal of Medicine*, 355(15) 1572-82. http://dx.doi.org/10.1056/NEJMsa060185
22. Armstrong GT, Kawashima T, Leisenring W, et al. 2014. Aging and risk of severe, disabling, life-threatening, and fatal events in the childhood cancer survivor study. *Journal of Clinical Oncology* 32(12) 1218-27. http://dx.doi.org/10.1200/jco.2013.51.1055
23. Children's Oncology Group. 2013. Long-term follow-up guidelines for survivors of childhood, adolescent and young adult cancer. Monrovia, CA: Children's Oncology Group. http://www.survivorshipguidelines.org/pdf/LTFUGuidelines_40.pdf
24. Scottish Intercollegiate Guidelines Network. 2013. Long term follow up of survivors of childhood cancer. Edinburgh: Scottish Intercollegiate Guidelines Network. http://www.sign.ac.uk/guidelines/fulltext/132/index.html