Epidemiology of paediatric cancer in Hong Kong, 1982 to 1991. Hong Kong Cancer Registry

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Objective. To review the data of paediatric cancer that had been collected by the Hong Kong Cancer Registry from 1982 through 1991.
Design. Cross-sectional retrospective study.
Setting. Hong Kong.
Patients. Children aged 15 years or younger.
Main outcome measures. The types of cancer were classified into 12 diagnostic groups according to morphology (following the International Classification of Diseases for Oncology M-code). The incidences of the different types of cancer were obtained with reference to the Hong Kong population aged 15 years or younger. Data collected between 1989 and 1991 were checked by paediatric oncologists from the Hong Kong Paediatric Haematology and Oncology Study Group.
Results. A total of 1756 cases of paediatric cancer were registered during the 10-year period. The incidence of cancer was 144.3 new cases per million children. Leukaemia was the most common form of childhood cancer (40.0%), followed by brain tumour (16.3%), and lymphoma (10.8%). The relative frequencies of neuroblastoma (2.4%) and Wilms' tumour (3.5%) were lower than those reported from western countries.
Conclusion. The incidences and types of paediatric cancer in Hong Kong are similar to those in western countries. Collaboration with paediatric oncology groups should provide more accurate information on the incidence and survival rates of children with cancer in Hong Kong.

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Key words: Age factors; Child; Neoplasms/epidemiology; Neoplasms/mortality; Survival rate

Introduction

Since the early 1970s, the Hong Kong Hospital Authority, formerly the Medical and Health Department, has produced annual reports on the new cases of cancer and the number of deaths in Hong Kong due to cancer. The data are collected by the Hong Kong Cancer Registry (HKCR), which was established in 1963. The HKCR obtains information from the following sources: (1) pathology reports from all public hospitals and most hospitals in the private sector; (2) all patient records from the five radiotherapy and oncology departments in Hong Kong; (3) discharge diagnosis reports from public hospitals; (4) death certificates kept by the government Death Registry; and (5) voluntary notification from medical practitioners.

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In a previous report of paediatric cancer in Hong Kong from 1974 to 1979, the incidence of various cancers as well as the overall incidence were shown to be similar to the figures reported from western countries.[1] However, the peak incidence of acute lymphoblastic leukaemia (ALL) that was observed in the 1- to 4-year age-group in western children[1] was not seen in Hong Kong children. From 1982 to 1988, there were 180 to 190 new cases of paediatric cancer per year; the incidence was thus much higher than that reported from other countries and also higher than that previously reported in Hong Kong. Whether there was a genuine increase of paediatric cancer incidence, as observed in the United States, needed to be investigated.[2] A 10-year study would thus reveal more accurate statistics on paediatric cancer.

Comparing survival rates of children with cancer is important to assess the impact of recent developments in medical care. Obtaining survival rates would also be useful for health planning authorities to allocate resources. To study childhood survival, a 5-year follow-up period is the minimal period of study,

because the majority of the cancer relapses and deaths occur within the first 5 years after diagnosis.[3] Therefore, a study period from 1982 through 1991 was chosen—that is, allowing at least 5 years' follow-up from the last year of the study.

Methods

The annual report from the HKCR lists cancers by patient age and type of cancers for the whole population of Hong Kong. The reporting system, however, does not describe paediatric cancers separately. Cancers are classified by the HKCR according to anatomical site (following the International Classification of Diseases for Oncology [ICD-O]). Paediatric cancers, however, can vary greatly in anatomical site, even for the same histological neoplasm—for example, neuroblastoma can affect the adrenal gland, mediastinum, or pelvis. A cancer registry that is based on the Morphology Section of the ICD-O M-code for childhood cancers is widely accepted and has been used in various reports from different countries.[3-5] This report of paediatric cancer in Hong Kong is also classified according to the ICD-O M-code system (ie 12 diagnostic groups); the incidences and survival rates can then be compared with the corresponding figures from other countries.

The age-group stratification of the current reporting system of the HKCR is at 10-year intervals. For paediatric cancers, however, using 10-year intervals does not optimally reflect the distribution of cancers among the various age-groups. Since children are generally regarded to be younger than 15 years, the 10- to 19-year age-group interval cannot be separated into groups of individuals younger or older than 15 years. Hence, accurate statistics about paediatric cancer cannot be obtained by using this age-group classification. Furthermore, embryonal cancers such as Wilms' tumour, neuroblastoma, retinoblastoma, and hepatoblastoma typically occur in children younger than 5 years. If 10-year intervals are used, the age-specific incidences of the embryonal cancers will be much underestimated. Finally, ALL, which is the most common cancer in children, has a typical peak at age 1 to 5 years in developed countries, whereas the peak is not observed in underdeveloped countries.[6] The age-group interval was thus taken as 5 years in this study.

A cross-sectional descriptive study was performed for a 10-year period (1982-1991) of the newly diagnosed childhood cancers. To assess the 5-year survival, the mortality data were traced up to end of 1996.

Data collection

The HKCR had collected raw data of all cancers in Hong Kong as described in the introduction. The data of children younger than 15 years were extracted from the computer database for further analysis. For the period 1989 through 1991, the data were double-checked by members of the Hong Kong Paediatric Haematology and Oncology Study Group, which comprises paediatric oncologists, pathologists, and surgeons who work for the Hong Kong Hospital Authority; this body is responsible for the care of more than 90% of paediatric patients with cancer in Hong Kong. The population at risk was taken to be the general population aged 0 to 14 years from 1982 through 1991; population figures were obtained from the Hong Kong Census and Statistics Department.

Data analysis

The morphological diagnoses of the cancer cases were grouped into following diagnostic groups according to the ICD-O M-code:

(1) Leukaemia: ALL, other lymphocytic, acute non-lymphocytic, chronic myeloid, other and unspecified;
(2) Lymphomas: Hodgkin's disease, non-Hodgkin's lymphoma (NHL), Burkitt's lymphoma, unspecified lymphoma, other reticuloendothelial;
(3) Brain and spinal: ependymoma, astrocytoma, medulloblastoma, other glioma, other and unspecified;
(4) Sympathetic nervous system: neuroblastoma, other;
(5) Retinoblastoma;
(6) Kidney: Wilms' tumour, renal carcinoma, other and unspecified;
(7) Liver: hepatoblastoma, hepatic carcinoma, other and unspecified;
(8) Bone: osteosarcoma, chondrosarcoma, Ewing's sarcoma, other and unspecified;
(9) Soft tissue sarcoma: rhabdomyosarcoma, fibrosarcoma, other and unspecified;
(10) Germ cell tumour: non-gonadal germ cell, gonadal germ cell, gonadal carcinoma, intracranial germ cell, other and unspecified;
(11) Epithelial neoplasm: adrenocortical carcinoma, thyroid carcinoma, nasopharyngeal carcinoma, melanoma, other carcinoma; and
(12) Others.

The relative frequency was calculated as the percentage contribution of each particular group or subgroup to the total case series. The incidence rate was the number of new cases divided by the population at risk and was expressed as the number per million at

risk each year. The incidence for the period 1982 through 1991 was calculated by dividing the number of cases collected during that period by the total at-risk population during the same period. The paediatric patients were grouped according to sex and age-groups of 0 to 4 years (0 to <5 years), 5 to 9 years (≥5 to <10 years), and 10 to 14 years (≥10 to <15 years). The frequency distribution was calculated by dividing the observed number of patients in the age and sex category concerned by the total number of paediatric patients with cancer (as a percentage). Since the survival data of patients who were diagnosed in the early 1980s could not be traced accurately, children whose deaths had not been reported to the Hong Kong Death Registry by the end of 1996 were regarded as survivors (ie >5 years of survival).

Results

A total of 1756 cases of paediatric cancer were registered by the HKCR during the 10-year study period. There were between 166 and 199 cases from 1982 to 1988 but only 143 to 161 from 1989 to 1991 (Fig 1). The paediatric population also showed a slight decline from 1.28 million to 1.15 million during 1982 to 1991. The incidence varied between 115.2 to 159.6 per million and the overall incidence for the 10-year period was 144.3 per million per year. The incidence from 1982 to 1988 was 146.8 per million, whereas that from 1989 to 1991 was much lower, at 124.7 per million per year (Fig 2). The basis of the diagnoses made since 1987 was increasingly histological; the most recent diagnoses (made in 1991) were nearly all based on histological evidence (Fig 3).

The types of cancer, classed according to the 12 diagnostic groups of the ICD-O M-code, are listed in Table 1. Leukaemia was the most common type of cancer, constituting 40.0% of all cancers and having an incidence of 57.7 per million. Acute lymphoblastic leukaemia was the most common subtype of leukaemia, comprising 72.1% of all leukaemias; its incidence varied between 25.8 and 49.7 per million and the overall 10-year incidence was 41.6 per million. Brain tumour was the second most common type of cancer, representing 16.3% of all paediatric cancers; its incidence was 23.8 per million. Astrocytoma and medulloblastoma were the two most common subtypes of brain tumour. Hodgkin's disease constituted only 10.0% of all lymphomas,

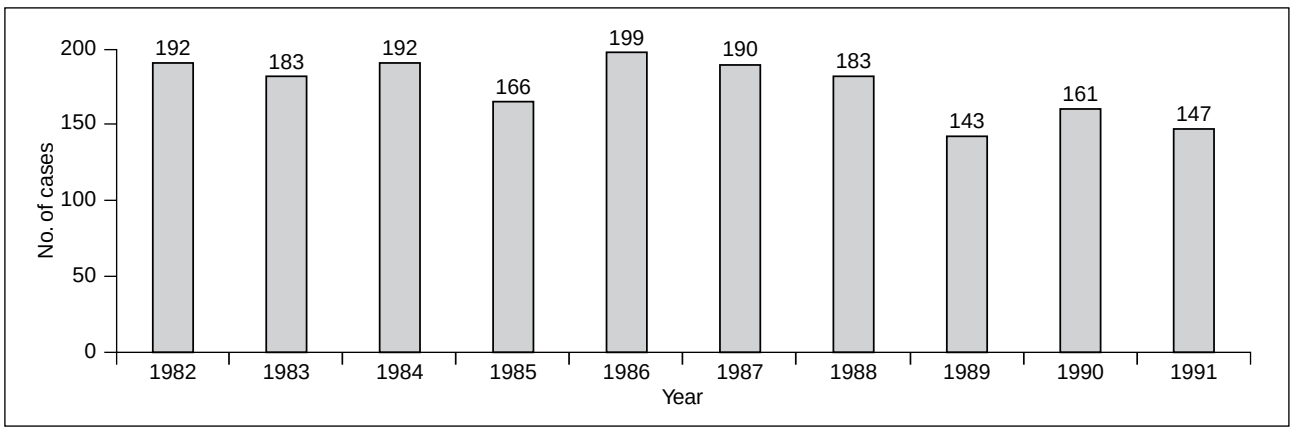

Fig 1. Annual number of new cases of paediatric cancer in Hong Kong

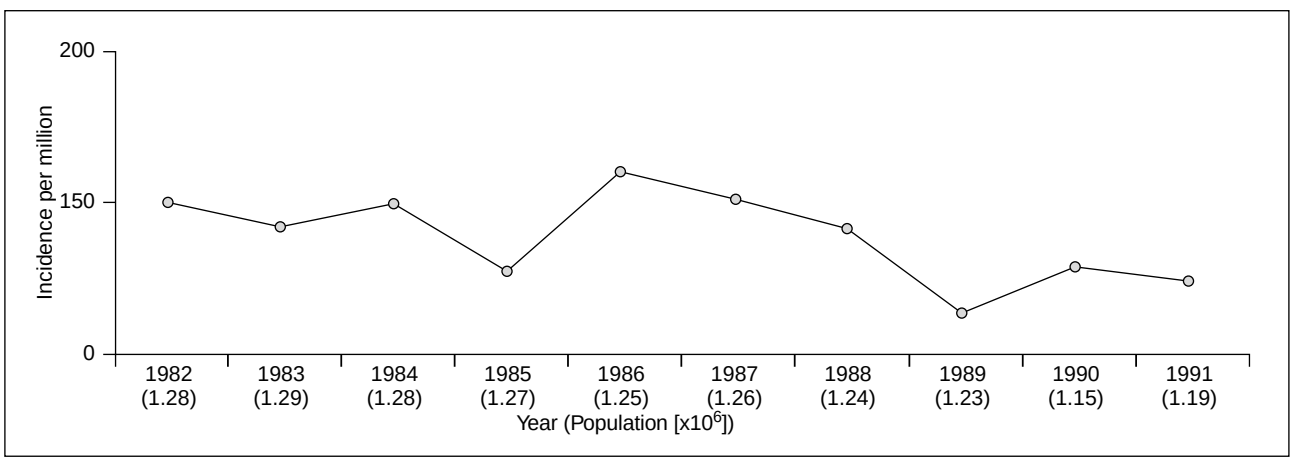

Fig 2. Annual incidence of paediatric cancer in Hong Kong

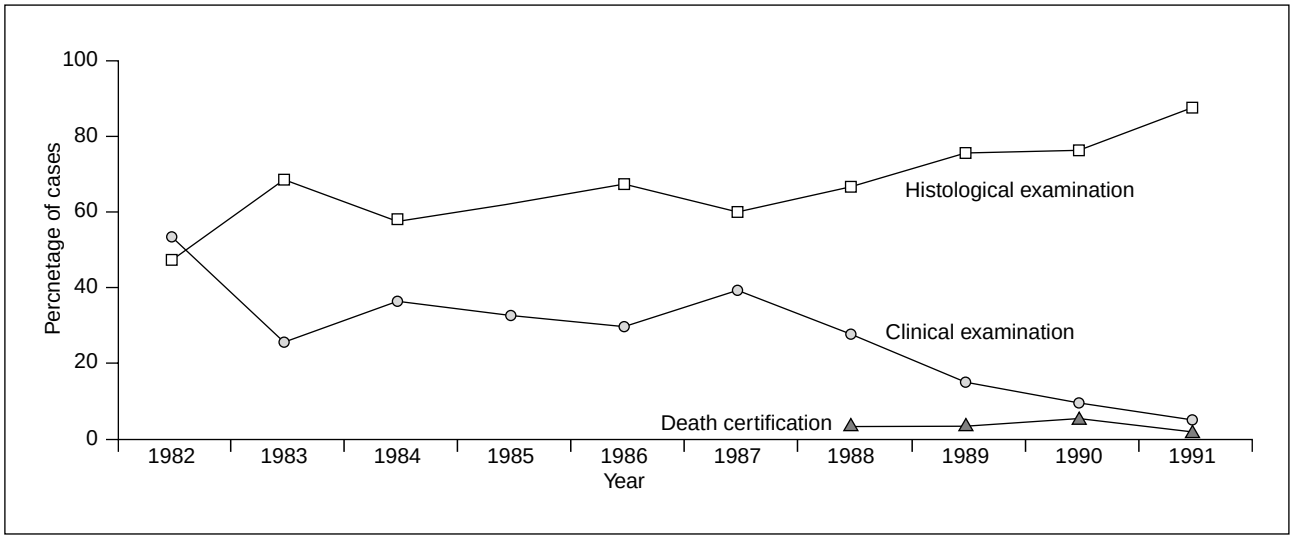

Fig 3. Basis of diagnosis of paediatric cancer in Hong Kong

the majority of which were NHL. The incidence of lymphoma was 15.7 per million. Neuroblastoma and Wilms' tumour constituted only 2.4% and 3.5% of paediatric cancers, respectively; their incidences were 3.5 and 5.3 per million, respectively. Liver tumours constituted 2.5% of paediatric cancers, with an incidence of 3.7 per million. Hepatoblastoma constituted only 24.0% of liver tumours, but hepatocellular carcinoma accounted for a much higher proportion (42.0%). A substantial percentage (7%) of tumours did not fall into the 11 well-defined diagnostic groups.

The age and sex distributions of all paediatric cancer patients and the common types of cancer are shown in Table 2. There was a marked predominance of males with ALL, NHL, or liver tumour. The peak age of 0 to 4 years was observed in the ALL category during the 10-year period; 43.2% of ALL cases occurred in this age-group, with a corresponding incidence of 54.3 per million. Embryonal tumours such as neuroblastoma and Wilms' tumour occurred mainly in the 0- to 4-year age-group. Bone tumours, however, occurred mainly in the adolescent age group (10-14 years).

Table 1. Paediatric cancer statistics in Hong Kong, the United States, and France

Cancer*	Hong Kong		United States		France	
	1982-1991 Frequency (%)	1982-1991 Incidence†	1984-1991[3] Frequency (%)	1974-1989[9] Incidence†	1984-1991[5] Frequency (%)	1984-1991[5] Incidence†
(1) Leukaemia	40.0	57.7	31.4	36.5	29.7	41.10
acute lymphoblastic leukaemia	72.0	41.6	75.0	30.9	82.0	-
other and unspecified	28.0	-	25.0	-	18.0	-
(2) Brain tumour	16.3	23.8	17.6	27.6	20.6	28.50
astrocytoma	30.0	-	54.0	-	-	-
medulloblastoma	12.7	-	24.0	-	-	-
(3) Lymphoma	10.8	15.7	12.4	15.0	12.8	22.80
Hodgkin's disease	10.0	-	41.0	-	24.0	-
non-Hodgkin's lymphoma	90.0	-	-	-	-	-
(4) Sympathetic nervous system (neuroblastoma)	2.4	3.5	8.1	9.7	9.0	16.50
(5) Retinoblastoma	2.5	3.6	2.9	3.9	2.1	4.80
(6) Wilms' tumour	3.5	5.3	6.3	8.1	4.8	5.30
(7) Liver tumours	2.5	3.7	1.3	-	0.45	1.20
hepatoblastoma	24.0	-	69.0	-	-	-
hepatocellular carcinoma	42.0					
(8) Bone tumour	4.2	6.1	5.0	6.2	5.9	5.50
osteosarcoma	54.0	-	52.0	-	-	-
Ewing's sarcoma	8.0	-	40.0	-	-	-
(9) Soft tissue sarcoma	2.9	4.2	7.1	4.5	7.4	11.40
(10) Germ cell tumour	4.1	5.9	3.2	-	3.3	2.75
(11) Epithelial tumours	3.3	4.8	4.0	-	3.8	4.10
(12) Others	7.0	-	0.5	-	0.2	0.25
Total	n=1756	144.3	n=9308	133.3	n=875	144.40

* Relative frequencies of cancer subtypes are shown as percentages of the cases in the 12 main categories
† Per million children aged 15 years or younger

Table 2. Age and sex distribution (%) of paediatric patients with cancer

Cancer	Age (years)			Sex	
	0-4	5-9	10-14	Male	Female
Acute lymphoblastic leukaemia	43.2	33.5	23.3	62.5	37.5
Acute myeloid leukaemia	32.6	29.8	37.6	48.2	51.8
Brain tumour	29.7	38.6	31.5	53.5	46.5
Non-Hodgkin's lymphoma	38.6	28.6	32.9	67.7	32.3
Neuroblastoma	74.5	20.2	5.3	45.5	54.5
Wilms' tumour	69.4	21.0	9.7	56.5	43.5
Liver tumour	37.5	27.5	35.4	72.9	27.1
Bone tumour	11.4	19.3	69.3	55.7	44.3

Table 3. Survival rates (%) [>5 years] of paediatric patients with cancer

Cancer	1982	1983	1984	1985	1986	1987	1988	1989	1982-1989
Acute lymphoblastic leukaemia	80.8	75.8	82.1	71.2	71.6	76.8	83.0	78.1	74.9
Brain tumour	58.3	43.4	62.0	46.4	63.6	43.4	51.5	50.0	52.1
Non-Hodgkin's lymphoma	57.9	66.6	72.2	63.6	82.4	78.9	86.6	87.5	74.0
All cancers	63.3	65.0	74.3	62.8	66.8	65.6	69.1	72.7	67.4

The survival rates (>5 years) of paediatric patients with cancer are shown in Table 3. The overall survival rate was 67.4%.

Discussion

Childhood cancer is the second most common cause of death of children aged 1 to 14 years in Hong Kong. This study analysed data from the HKCR and computed them into formats that were comparable to other reported series. The incidence of paediatric cancer from 1982 through 1991 was quite similar to that found in western countries. However, there was a marked difference in incidence between two periods—namely, from 1982 to 1988 and 1989 to 1991. The data for the latter period had been double-checked by paediatric oncologists from the Hong Kong Paediatric Haematology and Oncology Study Group. Some cases of childhood cancer between 1989 and 1991 had been reported more than once due to patient name-changing following diagnosis (name-changing is common in Hong Kong after an unfortunate life event), writing errors, or the same patient having two different diagnoses. There were also cases that were wrongly coded as cancer, such as ALL, by junior doctors. It is likely that such errors also occurred in the earlier period, from 1982 to 1988, especially since clinical diagnosis reports were the major source of information during that period. The true annual incidence of childhood cancer in Hong Kong is thus probably approximately 125 rather than 144 per million. Cancer incidences calculated after 1989 should be more accurate, however, because the birth certificate or identity card number had since then been included in all pathology request forms and because data had been thoroughly checked. The accurate collection of data is very important when monitoring any change in the incidence of individual cancers since the information is needed to formulate cancer prevention strategies. The recent publication from Taiwan of the reduced incidence hepatocellular carcinoma in children after routine vaccination of hepatitis B illustrates the importance of accurate data collection.[7]

Miller et al[3] have reported an increasing trend of paediatric cancer during the past two decades in the United States. Such a trend was not detected in this study, but errors of data collection in the earlier period may have affected this result. A peak incidence at age 0 to 4 years was observed in this study for ALL—a result not observed in the mid-1970s. The peak age-group of ALL is mainly due to the preponderance of the 'common ALL' subtype, which is regarded as a disease of developed countries. The aetiology of ALL is still unknown, but population mixing may be an important factor in Hong Kong.[8]

The incidences and relative frequencies of various cancers were compared with western data.[3,5,9] This study detected a higher incidence of leukaemia than did the western studies. The distribution of types of leukaemia was similar, however, and ALL constituted approximately 75% of cases. Whether the higher incidence of leukaemia was due to overreporting warrants further study. Hodgkin's disease is uncommon in Hong Kong, representing only 10% of all lymphomas, which is much lower than the corresponding western figure, as well as that from Shanghai (30.7%).[10] The incidences of neuroblastoma and Wilms' tumour among Hong Kong children are much lower than the incidences in western populations. The diagnosis of these two tumours is straightforward; hence, the

possibility of underdiagnosis is low. Hepatocellular carcinoma was the more common type of liver tumour, an observation which reflects the high prevalence of hepatitis B infection in this region. Hepatitis B vaccination in Taiwan has been shown to be associated with a marked reduction of the incidence of hepatocellular carcinoma after 8 years of initiating the vaccination programme—from 0.52 to 0.13 per 100 000 children.[7] Population-based hepatitis vaccination in Hong Kong was initiated in 1988, and hence the incidence of hepatocellular carcinoma in children would have been expected to fall since then. However, the influx of immigrant children from mainland China, where hepatitis B vaccination is not given nationally, may have affected the figures.

The quality of data collection has improved significantly since 1987. More than 95% of diagnoses are now based on histological evidence, which makes the diagnosis more well defined. Consequently, the number of childhood cancers in the 'others' category has decreased from 29 cases per year in 1982 to only three cases per year in 1991. The extensive range of available immunohistological markers and detailed cytogenetic study have contributed to the substantial reduction of unspecified subtypes of various cancers. The improvement in diagnostic methods, however, may not have affected the overall incidence of paediatric cancer, because the diagnosis of 'cancer' is seldom missed in children. Some small round-cell tumours might not have been classified in the past but now can be diagnosed accurately—for example, Ewing's sarcoma. Nevertheless, Ewing's sarcoma had a very low incidence in this study and among other Oriental populations.[1]

This study showed a trend of increasing survival rate over the study period. This result must be interpreted with caution since it was based on the number of patients who were not reported to have died. In western countries, ALL and NHL are very chemosensitive cancers and have been shown to have marked increase in cure rate over the past two decades.[11,12] The survival rate in this study, however, did not reflect the cure rate and hence a corresponding conclusion cannot be drawn. Some relapsed cancers are now 'salvaged' with intensive treatment, such as bone marrow transplant; consequently, some patients survive for more than 5 years despite multiple relapses.[13] Some patients may experience late relapses, even up to 10 years after the initial diagnosis.[14] The efficacy of treatment should be determined by finding the disease-free survival rate and using a much longer follow-up period. The 5-year survival rate for 1989 of 72.7% will not be the long-term disease-free survival rate, as more relapses are expected to occur during a longer follow-up. Another reason for a falsely high survival rate may be due to unreported deaths—for example, some patients might emigrate or some patients might not have cancer labelled as the cause of death.

In conclusion, the overall incidence and distribution of the types of cancer among Hong Kong children is quite similar to those among western children. The quality of data collection showed a marked improvement in recent years, which made the information more accurate and reliable. This trend, and the collaboration of clinicians who take care of children with cancer should help yield more accurate survival data in the future.

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