

Health behaviour practices and expectations for a local cancer survivorship programme: a cross-sectional study of survivors of childhood cancer in Hong Kong

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ABSTRACT

Introduction: Lifestyle choices may influence health outcomes in cancer survivors. This study of childhood cancer survivors in Hong Kong investigated factors associated with health-protective and health-damaging behaviours; it also examined expectations of a survivorship programme.

Methods: This cross-sectional study recruited survivors of childhood cancer ≥ 2 years after treatment. Survivors completed a structured questionnaire to report their health practices and the perceived values of survivorship programme components. Multivariable logistic regression analysis was conducted to identify factors associated with health behaviours.

Results: Two hundred survivors were recruited (mean age = 23.4 ± 8.8 years; mean duration since treatment, 13.4 ± 7.6 years). Comparatively few survivors exercised ≥ 4 days/week (16.0%), used sun protection (18.0%), and had a balanced diet (38.5%). Furthermore, comparatively few survivors reported that they had not undergone any immunisation (24.5%) or were unsure (18.5%) about their immunisation history. Most adult survivors were never-drinkers (71.0%) and never-smokers (93.0%). Brain tumour survivors were more likely to have unhealthy eating habits, compared with haematological malignancy survivors (odds ratio [OR] = 2.45; 95% confidence interval [CI] = 1.29-4.68). Lower socioeconomic status was associated with inadequate sun protection (OR = 0.20; 95% CI = 0.05-0.83), smoking (OR = 5.13;

95% CI = 1.48-17.75), and exposure to second-hand smoke (OR = 3.52; 95% CI = 1.42-8.69). Late-effects screening (78.5%) and psychosocial services to address psychological distress (77%) were considered essential components of a survivorship programme.

Conclusions: Despite the low prevalences of health-damaging behaviours, local survivors of childhood cancer are not engaging in health-protective behaviours. A multidisciplinary programme addressing late effects and psychosocial aspects may address the multifaceted needs of this special population.

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New knowledge added by this study

- Despite the low prevalences of health-damaging behaviours, engagement in health-protective behaviours among survivors of childhood cancer in Hong Kong was unsatisfactory, particularly with regard to participation in regular physical activity, consumption of a balanced diet, and the use of sun protection.
- Indicators of lower socioeconomic status (ie, lower education attainment and monthly household income) were collectively identified as predictors of smoking, poor dietary habits, and lack of immunisation.
- Survivors of childhood cancer regarded services concerning health issues (eg, education and screening for late effects) as the most important aspects of survivorship care. They also preferred enrolment into a survivorship programme early in the cancer care continuum.

Implications for clinical practice or policy

- A potential intervention opportunity may involve engaging survivors and families in a structured comprehensive survivorship programme during their transition to survivorship. The centralisation of paediatric oncology services in the new Hong Kong Children's Hospital has provided an unprecedented opportunity for oncologists and allied health professionals to initiate a formal paediatric cancer survivorship programme that is tailored to the healthcare system in Hong Kong.
- A multidisciplinary and interactive programme addressing late effects and psychosocial aspects may help survivors of childhood cancer take age-appropriate ownership of their health and function as active partners with their health providers during the survivorship phase.
- Underserved survivors may require special navigation services and care coordination to promote adherence to surveillance, preventive care, and health-protective behaviours.

本地癌症康復者護理計劃的健康行為實踐和期望：香港兒童癌症康復者橫斷面研究

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引言：生活方式或會影響癌症康復者的健康成效。這項針對香港兒童癌症康復者的研究檢視與健康保護及損害行為相關的因素，並審查對康復護理的期望。

方法：這項橫斷面研究招募接受治療後2年或以上的兒童癌症康復者。康復者完成結構式問卷，以收集他們的健康實踐以及對康復者護理計劃內容的感知價值。進行多變量邏輯迴歸分析以確立與健康行為相關的因素。

結果：招募200名癌症康復者（平均年齡 23.4 ± 8.8 歲；受訪時已完成治療的平均時間為 13.4 ± 7.6 年）。癌症康復者每星期平均運動4天或以上（16.0%）、防曬（18.0%）和均衡飲食（38.5%）的比例均相對較低。另外，相對較少癌症康復者沒有接受任何免疫接種（24.5%）或不確定（18.5%）有關的免疫接種史。大部分成年康復者從不喝酒（71.0%）和從不吸煙（93.0%）。與血液系統惡性腫瘤康復者相比，腦腫瘤康復者較可能有不健康的飲食習慣（優勢比2.45；95%置信區間=1.29-4.68）。較低社會經濟地位與防曬不足（優勢比0.20；95%置信區間=0.05-0.83）、吸煙（優勢比5.13；95%置信區間=1.48-17.75）和接觸二手煙（優勢比3.52；95%置信區間=1.42-8.69）相關。治療後遲發效應篩查（78.5%）和針對心理困擾的社會心理服務（77%）被認為是康復者護理計劃的重要部分。

結論：雖然研究顯示本地兒童癌症康復者出現健康損害行為的發生率較低，但有健康保護行為的比例亦不高。針對治療後遲發效應及社會心理方面的多學科計劃有助解決這個特殊群組的多方面需求。

Introduction

Advancements in diagnostic and treatment strategies have led to substantial improvements in treatment prognoses for children with cancer. The 5-year survival rate of childhood cancers has increased dramatically in high-resource settings, from <50% in the 1970s to >80% in the past decade.¹ Consequently, there has been a global surge in the population of survivors of childhood cancer, especially in developed regions such as Hong Kong. According to the Hospital Authority Cancer Registry, from 2001 to 2017 in Hong Kong, approximately 180 paediatric patients <19 years of age were diagnosed with cancer each year.² It is unquestionably necessary to further improve survival rates, and recent efforts and resources have been dedicated to improving the quality of life and health outcomes of survivors of childhood cancer in Hong Kong.³⁻⁵

Cancer survivors are susceptible to developing a spectrum of late effects because of their previous treatment exposures.^{6,7} Studies have shown that histories of specific treatment exposures, coupled with continued engagement in health-damaging

behaviours during survivorship, may accelerate or exacerbate the development of late effects.^{8,9} The Children's Oncology Group (COG)¹⁰ provide details of common health-damaging behaviours and their potential impacts on various treatment-related chronic conditions.

Adult and paediatric oncology research has suggested that cancer survivors and their families are often highly receptive to education regarding optimal lifestyles during the early survivorship period.¹¹ Thus, the COG and other international oncology groups have specified that an ideal cancer survivorship programme should comprise recommended screening/surveillance protocols to detect recurrence and late effects, health promotion activities, specialty referrals, and psychosocial interventions.^{7,12} One systematic review reported that a comprehensive cancer survivorship care programme is associated with positive behavioural change and better health outcomes in survivors.³

In Hong Kong, a recent study by Chan et al¹³ showed that, although the rates of smoking and alcohol consumption were low among local survivors of childhood cancer, survivors were less likely than their healthy siblings to participate in cancer screening. However, the study did not examine frequencies of engagement in other health-protective behaviours, such as participation in physical activity, undergoing immunisation, using sunscreen, and consuming a balanced diet. Furthermore, survivors' expectations of a comprehensive survivorship programme have not been investigated. The identification of predictors of poor health-behaviour practices and elucidation of survivors' needs will presumably assist clinicians in developing targeted interventions to address the needs of this special population.

The primary aim of this study was to identify factors associated with engagement in health-protective and health-damaging behaviours among local survivors of childhood cancer. The secondary aim was to examine cancer survivors' expectations of a comprehensive survivorship programme in Hong Kong.

Methods

Study design and population

This prospective, observational study was conducted at the paediatric oncology/haematology long-term follow-up clinic of the Prince of Wales Hospital, Hong Kong. Eligible participants were recruited through convenience sampling. Between June 2019 and March 2020, the study investigators obtained the list of patients who were scheduled to attend follow-up consultations at the long-term follow-up clinic; this clinic was typically held once per week. Patients were then screened for eligibility using the

in-house electronic patient record system (Clinical Management System). All eligible patients who subsequently attended the long-term follow-up clinic were invited to participate in the study.

The inclusion criteria were as follows: diagnosis with primary cancer before 18 years of age; treatment in any medical institutions in Hong Kong; survival for at least 2 years since the completion of cancer treatment or 5 years since diagnosis; and ability to communicate in Cantonese. A parent was recruited if the survivor was aged ≤ 16 years, or if the survivor was cognitively impaired. Patients were excluded if they were diagnosed with non-cancer conditions (eg, aplastic anaemia, thalassemia), did not understand Cantonese, were still on active treatment, or had incomplete treatment data.

Data collection

Clinical data regarding cancer diagnosis, treatment history, commodities, and relapse status were retrieved from survivors' electronic health records. A 20-minute structured questionnaire was interviewer-administered. Participants self-reported their socioeconomic information (ie, highest education attainment, medical insurance, and monthly family income).

Health behaviours were measured using a version of the 2013 National Youth Risk Behaviour Survey¹⁴ that had been modified and translated into Traditional Chinese. To adapt the survey for use within the study population, questions pertaining to the healthy behaviour practices of young adult cancer survivors were added. These additional questions were developed based on the health behaviours and practices most frequently reported in studies of survivors of childhood cancer in other countries.^{9,15,16} Health-protective behaviours refer to engagement in physical activity, balanced diet, sun protection, and immunisation programmes. Health-damaging practices refer to alcohol consumption, smoking, and exposure to second-hand smoke. Alcohol consumption and smoking practices were evaluated in adult survivors only, as the legal age for purchasing tobacco and alcoholic products is 18 years in Hong Kong.

Participants were asked to rate the perceived values of recommended components of a comprehensive survivorship programme¹² in the categories of health, psychosocial, parenting, and financial issues. Ratings were conducted using a 5-point Likert scale (1=least important, 5=most important). Participants were also asked to report their preferred time of enrolment into a survivorship programme and modes of services.

Sample size

The current analysis is part of a broader study¹⁷ that aimed to evaluate the effect of an educational

intervention on improving awareness of personal health risks among survivors (primary outcome), as well as general health literacy and health behaviours among survivors (auxiliary outcomes). The tailored educational intervention included a review of the survivor's cancer treatment summary and teaching materials that contained simplified health promotion messages derived from the COG Health Links.¹⁰ Sample size was determined based on the primary outcome (awareness of personal health risks). A similar study by Landier et al¹⁸ showed that the proportion of survivors of childhood cancer who adequately understood their health risks (defined as awareness of >75% of treatment-related late effects for which they were at risk) was approximately 55% after two sessions of the tailored intervention (ie, $\theta=0.55$). At $\alpha=0.05$, the required sample size for achieving 80% power to detect a difference in proportion (target $\theta_0=0.45$) between pre- and post-intervention assessments was 195. The current analysis reported the health behavioural practices of participants who provided baseline, pre-intervention assessments.

Statistical analysis

The SAS University Edition (version 2015; SAS Institute Inc, Cary [NC], US) software was used for all statistical analyses. Descriptive statistics were used to summarise participants' demographics, clinical characteristics, and frequencies of health behaviours. Multivariable logistic regression analysis was conducted to identify factors that were associated with health behaviours. Associations were presented using odds ratios (ORs) and 95% confidence intervals (95% CIs). Based on a literature review,^{9,15,19,20} the hypothesised predictors comprised demographics and clinical characteristics (sex, age, cancer diagnosis, and time since diagnosis), as well as socioeconomic status (medical insurance status, monthly household income, and highest education attainment [in adult survivors only]). Finally, descriptive statistics were used to summarise participants' preferences for the components of a comprehensive survivorship programme.

Results

Participant characteristics

In total, 252 survivors were screened for eligibility; 39 were excluded for <2 years since treatment or <5 years since diagnosis, the presence of non-cancer diagnoses (eg, benign ovarian teratoma), inability to understand Chinese, or treatment performed outside of Hong Kong. Subsequently, 213 eligible participants were approached. Eight survivors declined to participate, while the remaining 205 eligible survivors provided informed consent and completed the study. Five participants were

subsequently excluded because of incomplete treatment records. Finally, data from 200 participants were analysed (response rate 93.9%) [Fig 1].

The mean (\pm standard deviation) ages at interview were 26.9 ± 6.4 years and 11.1 ± 3.6 years among adult and paediatric survivors, respectively (Table 1). The mean age at cancer diagnosis was 7.3 ± 5.2 years. The mean time since treatment completion was 13.4 ± 7.6 years; 41.0% (n=82) of survivors were within 10 years after treatment. The most common diagnoses were leukaemia (n=78, 39.0%), lymphoma (n=28, 14.0%), and bone tumour (n=18, 9.0%). In total, 185 survivors (92.5%) had undergone chemotherapy, 130 survivors (65.0%) had received radiation, and 85 survivors (42.5%) had undergone surgery. Only 30 survivors (15.0%) had received hematopoietic stem cell transplantation.

All paediatric survivors were students. Among adult survivors, 107 (69.0%) had completed post-secondary education. Only 32 survivors (16.0%) reported a monthly household income of less than HKD\$15 000, and 86 survivors (43.0%) had private medical insurance.

Interviews for paediatric survivors (n=45) were completed by parents (Table 1). The mean age of parents was 43.4 ± 7.7 years, and 43 (95.6%) parents had completed secondary school or higher education.

Health behaviour practices

The health-protective and health-damaging behaviours of survivors are summarised in Table 2. The least frequently practised health-

protective behaviour was physical activity. Only 16 survivors (8%) met the World Health Organisation recommendation of engagement in 20 minutes of aerobic physical activity for ≥ 4 days per week. Of the survivors, 104 (52.0%) reported that they exercised rarely (≤ 1 day per week) and 135 (67.5%) applied sunscreen rarely. Fewer than 40% of survivors “always” and “frequently” had a balanced diet. In terms of immunisation practice, 49 (24.5%) survivors reported that they did not undergo any immunisation and 37 (18.5%) were unsure about their immunisation history.

Among 155 adult survivors, 110 (71.0%) were never-drinkers, whereas 45 (29.0%) identified themselves as social drinkers. These social drinkers met the “moderate” and “low-risk” drinker definitions established by the National Institute on Alcohol Abuse and Alcoholism.²¹ Of the 155 adult survivors, 144 (92.9%) were never-smokers and three (1.9%) were ever-smokers. Only eight survivors (5.2%) were current smokers; they smoked a median of 7.5 cigarettes per day (interquartile range=5-10). Of the survivors, 85 (42.5%) were exposed to second-hand smoke; 41 (20.5%) from family members and 29 (14.5%) from colleagues.

Factors associated with health behaviours

Compared with survivors of central nervous system (CNS) tumours, survivors who had been diagnosed with haematological malignancies were more likely to adopt a balanced diet (OR=2.45; 95% CI=1.29-4.68). Younger age at interview was also a significant predictor of adoption of a balanced diet (OR=0.95; 95% CI=0.91-0.99) [Table 3].

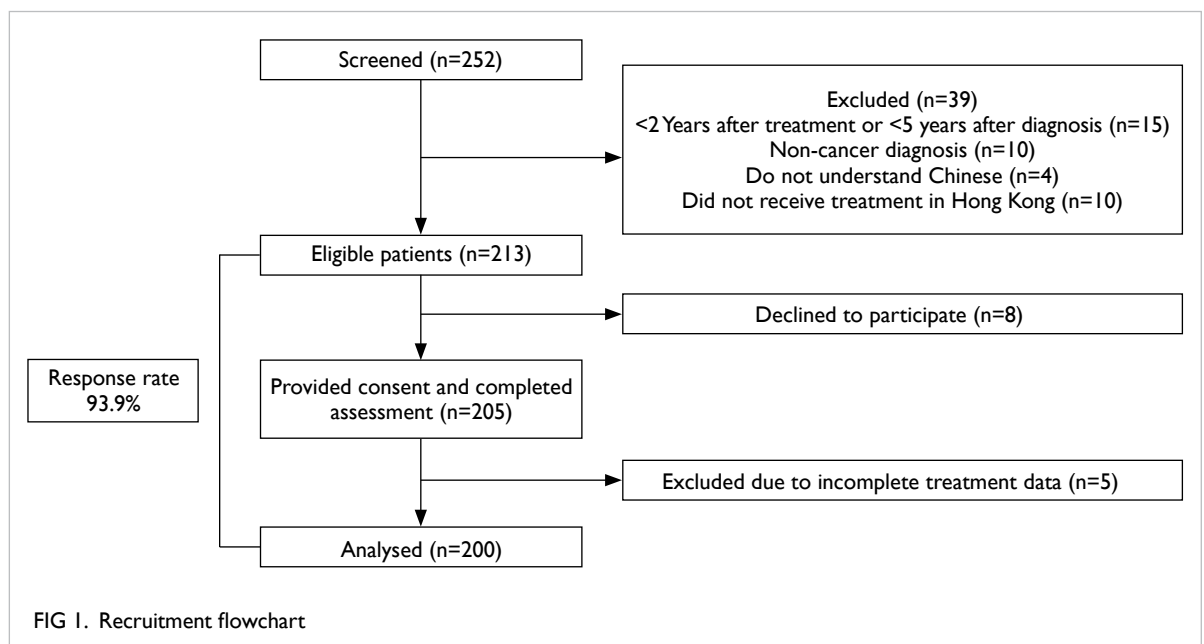


TABLE I. Characteristics of study population of survivors of childhood cancer (n=200)*

	All survivors (n=200)	Adult survivors (n=155)	Paediatric survivors (n=45)	Parents
Sex				
Male	110 (55.0%)	86 (55.5%)	24 (53.3%)	14 (31.1%)
Female	90 (45.0%)	69 (44.5%)	21 (46.7%)	31 (68.9%)
Age at interview, y [†]	23.4 ± 8.8	26.9 ± 6.4	11.1 ± 3.6	NA
Age at diagnosis, y [†]	7.3 ± 5.2	8.61 ± 4.9	2.8 ± 2.5	NA
Time since treatment completion, y [†]	13.4 ± 7.6	15.4 ± 7.3	6.8 ± 3.4	NA
Education level				
Secondary school and below				
Kindergarten	3 (1.5%)	1 (0.6%)	2 (4.4%)	0
Primary school	30 (15.0%)	0	30 (66.7%)	2 (4.4%)
Secondary school	59 (29.5%)	47 (30.3%)	12 (26.7%)	27 (60.0%)
Post-secondary school				
Higher diploma	41 (20.5%)	41 (26.5%)	0	3 (6.7%)
Bachelor's degree	60 (30.0%)	60 (38.7%)	0	7 (15.6%)
Master's or above	6 (3.0%)	6 (3.9%)	0	6 (13.3%)
Special education	1 (0.5%)	0	1 (2.2%)	0
Employment status				
Student	88 (44.0%)	43 (27.7%)	45 (100%)	0
Full-time employment	86 (43.0%)	86 (55.5%)	0	25 (55.6%)
Part-time employment	13 (6.5%)	13 (8.4%)	0	8 (17.8%)
Homemaker	11 (5.5%)	11 (7.1%)	0	1 (2.2%)
Unemployed or in job transition	0	0	0	0
Retired	2 (1.0%)	2 (1.3%)	0	11 (24.4%)
Private medical insurance				
Yes	86 (43.0%)	63 (40.6%)	23 (51.1%)	NA
No	113 (56.5%)	91 (58.7%)	22 (48.9%)	
Missing response	1 (0.5%)	1 (0.6%)	0	
Monthly household income (HKD)				
<\$15 000	32 (16.0%)	20 (12.9%)		12 (26.7%)
\$15 001-\$30 000	58 (29.0%)	46 (29.7%)		12 (26.7%)
\$30 001-\$50 000	42 (21.0%)	33 (21.3%)		9 (20.0%)
>\$50 000	60 (30.0%)	49 (31.6%)		11 (24.4%)
Missing response	8 (4.0%)	7 (4.5%)		1 (2.2%)
Housing				
Public housing	71 (35.5%)	51 (32.9%)		20 (44.4%)
Subsidised home ownership housing	32 (16.0%)	27 (17.4%)		5 (11.1%)
Private housing	78 (39.0%)	63 (40.6%)		15 (33.3%)
Others	18 (9.0%)	12 (7.7%)		5 (11.1%)
Missing response	1 (0.5%)	1 (0.6%)		0
Diagnosis[‡]				
				NA
Haematological malignancy				
Leukaemia	78 (39.0%)	64 (41.3%)	14 (31.1%)	
Lymphoma	28 (14.0%)	24 (15.5%)	4 (8.9%)	
CNS tumour	14 (7.0%)	11 (7.1%)	3 (6.7%)	
Non-CNS solid tumour				
Neuroblastoma	13 (6.5%)	6 (3.9%)	7 (15.6%)	
Retinoblastoma	2 (1.0%)	2 (1.3%)	0	
Renal tumour	10 (5.0%)	8 (5.2%)	2 (4.4%)	
Hepatic tumour	7 (3.5%)	2 (1.3%)	5 (11.1%)	
Bone tumour	18 (9.0%)	16 (10.3%)	2 (4.4%)	
Soft tissue sarcoma	14 (7.0%)	9 (5.8%)	5 (11.1%)	
Germ cell tumour	11 (5.5%)	8 (5.2%)	3 (6.7%)	
Others [§]	5 (2.5%)	5 (3.2%)	0	
Treatment				
				NA
Chemotherapy	185 (92.5%)	145 (93.5%)	40 (88.9%)	
Radiation	130 (65.0%)	94 (60.6%)	36 (80.0%)	
Surgery	85 (42.5%)	62 (40.0%)	23 (51.1%)	
HSCT	30 (15.0%)	22 (14.2%)	8 (17.8%)	
History of cancer relapse	31 (15.5%)	26 (16.8%)	5 (11.1%)	NA

Abbreviations: CNS = central nervous system; HSCT = hematopoietic stem cell transplant; NA = not applicable

* Data are shown as No. (%) or mean ± standard deviation

† Parents completed the questionnaire on behalf of paediatric survivors (age ≤16 years)

‡ Classified according to International Classification of Childhood Cancer

§ Other cancer types included adrenal gland carcinoma, nasopharyngeal carcinoma, primary adnexal carcinoma, mucoepidermoid carcinoma, and adrenocortical carcinoma

TABLE 2. Engagement in health-protective and health-damaging behaviours among survivors of childhood cancer (n=200)*

	No. (%) of survivors
Health-protective behaviour	
Physical activity†	
Frequency‡	
Rarely	104 (52.0%)
Sometimes	64 (32.0%)
Frequently	16 (8.0%)
Always	16 (8.0%)
Balanced diet	
Frequency‡	
Rarely	64 (32.0%)
Sometimes	59 (29.5%)
Frequently	57 (28.5%)
Always	20 (10.0%)
Sun protection	
Frequency‡	
Rarely	135 (67.5%)
Sometimes	29 (14.5%)
Frequently	12 (6.0%)
Always	24 (12.0%)
Immunisation	
No	49 (24.5%)
Unsure	37 (18.5%)
Yes	114 (57.0%)
Human papillomavirus (only available to adult female survivors, n=69)	16 (23.2%)
Hepatitis B	78 (39.0%)
Influenza (in the past 1 year)	67 (33.5%)
Pneumococcal	29 (14.5%)
Health-damaging behaviour	
Alcohol consumption (adult survivors only, n=155)	
Current drinker§	45 (29.0%)
Never-drinker	110 (71.0%)
Smoking (adult survivors only, n=155)	
Current smoker	8 (5.2%)
No. of cigarette/day, median (interquartile range)	7.5 (5-10)
Ever-smoker	3 (1.9%)
Never-smoker	144 (92.9%)
Exposure to second-hand smoking	
No	115 (57.5%)
Yes	85 (42.5%)
Family (residing in the same household)	41 (20.5%)
Friends	27 (13.5%)
Colleagues	29 (14.5%)
Others	11 (5.5%)

* Data are shown as No. (%), unless otherwise specified

† The World Health Organization recommends 150 minutes of moderate-intensity aerobic physical activity per week; survivors were asked to report number of days per week they engaged in 20 minutes of aerobic physical activity

‡ Rarely: 0-1 day per week; Sometimes: 2-3 days per week; Frequently: 4-5 days per week; Always: 6-7 days per week

§ All survivors were identified as moderate drinkers according to definitions by the National Institute on Alcohol Abuse and Alcoholism. Moderate drinking is defined as ≤ 1 drink/day for women and ≤ 2 drinks/day for men

Female survivors had more than fivefold greater odds of regular sunscreen use, compared with male survivors (OR=5.66; 95% CI=2.40-13.34). Lower education level in adult survivors (OR=0.20; 95% CI=0.05-0.83) and lower monthly household income (OR=0.35; 95% CI=0.15-0.84) were associated with inadequate sun protection (Table 3).

Older survivors were less likely than younger survivors to participate in immunisation programmes (OR=0.76; 95% CI=0.53-0.97). Although the difference was not statistically significant (P=0.051), immunisation practices tended to be less common in survivors who did not have private medical insurance, compared with survivors who did (OR=0.78; 95% CI=0.45-1.06).

In terms of health-damaging behaviours (Table 4), compared with survivors who had completed education to a higher level than secondary school, adult survivors with a lower education level had greater odds of being current or ever-smokers (OR=5.13; 95% CI=1.48-17.75) and of being exposed to second-hand smoke (OR=3.52; 95% CI=1.42-8.69).

Expectations of a survivorship programme

Nearly all participants stated that the provision of survivorship education (n=168, 84%) and late-effects screening services (n=157, 78.5%) would be the most important components of a survivorship programme (Fig 2). Moreover, helping survivors to understand and confront the fear of relapse (n=161, 80.5%) and addressing psychological distress (n=154, 77%) were the most popular psychosocial services. Among parents (n=45), learning how to parent a child with cancer (n=36, 80%) and psychosocial support for parents (n=33, 73.3%) were regarded as essential components.

Most participants (n=81, 40.5%) stated that their preferred enrolment time into a survivorship programme would be at the initiation of cancer treatment; some participants (n=58, 29.0%) stated that their preferred enrolment time would be during the transition from active treatment to follow-up (Table 5). In terms of modes of services, most respondents preferred dialogue sessions with healthcare professionals (n=156, 78.0%), interactive platforms (n=100, 50.0%), and support groups (n=101, 50.5%) [Table 5].

Discussion

Health-protective behaviours

There is growing evidence that physical activity is a therapeutic strategy that may reduce the risks of systemic recurrence and mortality in cancer survivors.²² Similar to findings from other countries, we found that physical inactivity was highly prevalent among survivors of childhood cancer.^{9,23} This observation was not surprising, considering

TABLE 3. Factors associated with engagement in protective health behaviours among survivors of childhood cancer

	Physical activity*		Balanced diet*		Sun protection by sunscreen*		Any immunisation	
	OR (95% CI)	P value	OR (95% CI)	P value	OR (95% CI)	P value	OR (95% CI)	P value
Age at interview	0.99 (0.95-1.04)	0.72	0.95 (0.91-0.99)	0.009	1.03 (0.98-1.08)	0.27	0.76 (0.53-0.97)	0.048
Age at diagnosis	0.94 (0.86-1.02)	0.14	1.00 (0.94-1.07)	0.97	1.05 (0.97-1.14)	0.26	1.00 (0.93-1.07)	0.920
Sex								
Female	0.84 (0.39-1.83)	0.67	1.03 (0.57-1.85)	0.924	5.66 (2.40-13.34)	<0.001	1.22 (0.61-2.43)	0.57
Male	Ref		Ref		Ref		Ref	
Clinical diagnosis†								
Haematological malignancies	2.16 (0.90-5.18)	0.085	2.45 (1.29-4.68)	0.006	0.68 (0.30-1.54)	0.34	1.67 (0.80-3.48)	0.16
CNS malignancies	1.63 (0.30-8.82)	0.57	0.44 (0.09-2.19)	0.31	1.19 (0.28-5.11)	0.81	1.38 (0.32-6.01)	0.66
Other solid malignancies	Ref		Ref		Ref		Ref	
Socioeconomic variables								
Education level†‡								
Secondary school or below	0.52 (0.15-1.85)	0.31	0.42 (0.16-1.11)	0.078	0.20 (0.05-0.83)	0.026	1.60 (0.58-4.45)	0.36
Above secondary school	Ref		Ref		Ref		Ref	
Private medical insurance†								
No	0.70 (0.32-1.54)	0.37	0.85 (0.47-1.54)	0.60	0.52 (0.24-1.15)	0.10	0.78 (0.45-1.06)	0.051
Yes	Ref		Ref		Ref		Ref	
Monthly household income (HKD)†								
≤\$30 000	1.07 (0.49-2.33)	0.87	1.09 (0.60-1.97)	0.78	0.35 (0.15-0.84)	0.018	1.11 (0.62-1.99)	0.73
>\$30 000	Ref		Ref		Ref		Ref	

Abbreviations: CI = confidence interval; CNS = central nervous system; OR = odds ratio; Ref = reference group

* Outcomes refer to frequent engagement in each specific health behaviour. "Frequent" is defined as more than ≥4 days per week

† All models were adjusted for demographics variables (age at interview, age at diagnosis, and sex)

‡ Analyses were conducted among adult survivors only (n=155)

that the rate of physical activity is low among the general population in Hong Kong; only 40% to 46% of children and youth met physical activity guidelines for a mean duration of 60 minutes of moderate-to-vigorous physical activity per day.²⁴ Although we did not identify any significant predictors of physical inactivity, this large proportion of inactive survivors indicates the need to further explore the reasons for this phenomenon and devise interventions to address them. For example, interventions targeting the survivor–parent dyad may promote common lifestyle behaviours within the families of survivors.²⁵ Moreover, local adventure-based training and experiential learning programmes may enhance self-efficacy in survivors, thereby empowering them to initiate and maintain a physically active lifestyle.^{26,27}

Our study found that only 38% of survivors reported frequently consuming a balanced diet. For example, survivors of CNS tumours were more likely to have poor dietary habits, compared with survivors of non-CNS malignancies. This is concerning because patients with CNS tumours are more vulnerable to developing metabolic syndromes

related to complications associated with cranial radiation and neurosurgery. Poor dietary habits may further exacerbate the disease course of these late effects.²⁸ This finding suggests that dietitians should give advice regarding stricter dietary control to optimise the health of CNS cancer survivors in Hong Kong.

Despite the extensive promotion of the seasonal influenza vaccination programme by the Hong Kong Special Administrative Region Government,²⁹ only 30% of survivors indicated that they had received the influenza vaccine in the past year. Younger survivors were more likely to have participated in vaccination programmes, probably because school-age children are generally enrolled into the government immunisation programme that provides the hepatitis B, pneumococcal, and annual influenza vaccines, as well as the recently added human papillomavirus (HPV) vaccine.³⁰ We acknowledge that our findings must be interpreted with caution because survivors might inaccurately recall or report their vaccination histories. However, these results have two important implications that warrant attention from the

TABLE 4. Factors associated with engagement in health-damaging behaviours among survivors of childhood cancer

	Current alcohol consumption* †		Current and ever-smokers* †		Second-hand smoke exposure	
	OR (95% CI)	P value	OR (95% CI)	P value	OR (95% CI)	P value
Demographic variables						
Age at interview	0.98 (0.93-1.04)	0.484	1.04 (0.95-1.13)	0.426	1.02 (0.98-1.06)	0.28
Age at diagnosis	1.06 (0.98-1.14)	0.131	0.97 (0.87-1.09)	0.634	1.00 (0.94-1.06)	0.94
Sex						
Female	0.32 (0.15-0.67)	0.003	0.48 (0.14-1.62)	0.236	1.07 (0.60-1.88)	0.82
Male	Ref		Ref		Ref	
Clinical diagnosis [‡]						
Haematological malignancies	0.76 (0.36-1.62)	0.481	0.53 (0.16-1.79)	0.304	0.83 (0.45-1.51)	0.53
CNS malignancies	2.33 (0.59-9.22)	0.229	1.90 (0.32-11.40)	0.485	1.20 (0.38-3.78)	0.76
Other solid malignancies	Ref		Ref		Ref	
Socioeconomic variables						
Education level [‡]						
Secondary school or below	0.98 (0.39-2.46)	0.969	5.13 (1.48-17.75)	0.010	3.52 (1.42-8.69)	0.006
Above secondary school	Ref		Ref		Ref	
Private medical insurance [‡]						
No	0.42 (0.20-0.85)	0.017	0.31 (0.10-1.01)	0.053	0.50 (0.28-0.89)	0.018
Yes	Ref		Ref		Ref	
Monthly household income (HKD) [‡]						
≤\$30 000	0.51 (0.25-1.07)	0.076	0.38 (0.09-1.54)	0.175	0.96 (0.54-1.72)	0.89
>\$30 000	1.00		1.00		1.00	

Abbreviations: CI = confidence interval; CNS = central nervous system; OR = odds ratio; Ref = reference group

* Outcomes refer to engagement in health-damaging behaviour

† Analyses were conducted among adult survivors only (n=155)

‡ All models were adjusted for demographic variables (age at interview, age at diagnosis, and sex)

medical community. First, there is a need to educate survivors regarding the role of vaccination in preventing severe complications from infection (eg, influenza and pneumococcal vaccines for preventing seasonal flu and pneumonia, respectively) and other malignancies (eg, HPV vaccine for preventing cervical cancer). In particular, collaborations among schools and community physicians may help promote the uptake of HPV vaccines among adolescent female survivors.^{31,32} Second, children treated with chemotherapy for childhood malignancies reportedly may develop acquired immunological defects in both cell-mediated and humoral immunity, resulting in the loss of protection conferred by prior vaccinations.³³ Future work should involve the development of clinical consensus guidelines regarding vaccination administration schedules for non-transplant survivors of childhood cancer, particularly survivors who have received intensive chemotherapy treatment.

Health-damaging behaviours

Similar to the findings of Chan et al,¹³ we found that health-damaging practices are uncommon among local survivors. Both drinking and smoking rates were lower in this study than in studies from other developed countries.^{9,19,34} However, the reported rate (20.5%) of exposure to second-hand smoke in the home was surprisingly high. We speculate that this high rate is because the smoking rates of individuals above the age of 40 years remain relatively high in the general population (16.9% to 26.2% in men and 1.3% to 5.1% in women).³⁵ Older family members, particularly men, might remain the main source of second-hand smoke for survivors. This observation underscores the need for continual efforts to encourage survivors to abstain from harmful health practices (particularly during the early survivorship phase) and the need for smoking cessation interventions to be provided for the comparatively few survivors and family members who are current smokers.

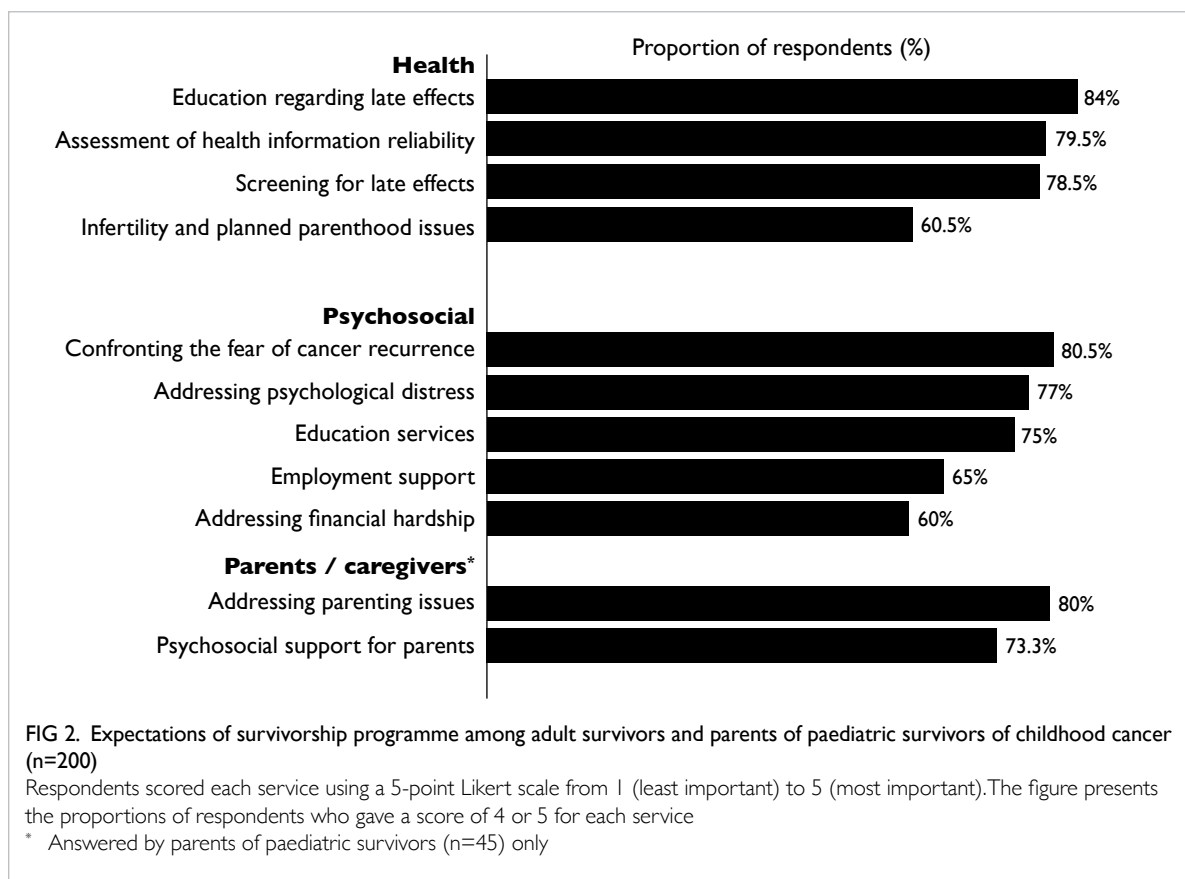


TABLE 5. Preferred mode of services and preferred enrolment time for survivorship programme*

	All survivors (n=200)	Adult survivors (n=155)	Parents† (n=45)
Mode of services†			
Face-to-face conversation with healthcare professionals	156 (78.0%)	122 (78.7%)	34 (75.6%)
Support groups	101 (50.5%)	80 (51.6%)	21 (46.7%)
Mobile applications with interactive components and latest information	100 (50.0%)	78 (50.3%)	22 (48.9%)
Educational talks	67 (33.5%)	45 (29.0%)	22 (48.9%)
Online talks/online educational videos	36 (18.0%)	30 (19.4%)	6 (13.3%)
Short-term vacations	31 (15.5%)	24 (15.5%)	7 (15.6%)
Newsletter by mail	19 (9.5%)	12 (7.7%)	7 (15.6%)
Others	2 (1.0%)	2 (1.3%)	0
Preferred enrolment time for survivorship programme			
At the initiation of cancer treatment	81 (40.5%)	58 (37.4%)	23 (51.1%)
At the last expected month of treatment	29 (14.5%)	26 (16.8%)	3 (6.7%)
During transition from active treatment to follow-up	58 (29.0%)	47 (30.3%)	11 (24.4%)
2 Years post-treatment	25 (12.5%)	18 (11.6%)	7 (15.6%)
Others	7 (3.5%)	6 (3.9%)	1 (2.2%)

* Data are shown as No. (%)

† Each respondent could only choose a maximum of four modes

‡ Parents completed the questionnaire on behalf of paediatric survivors

Socioeconomic factors

In this study, lower socioeconomic status was significantly associated with poor health practices. The association between possession of private medical insurance and immunisation practice was close to statistically significant, further suggesting that socioeconomic disparities hinder access to preventive care among cancer survivors. Underserved survivors may require special navigation services to support their adherence to surveillance, preventive care, and health-protective behaviours.³⁶ Considering that only half of the survivors had private health insurance, collaborations between clinicians and policymakers could enable the establishment of a universal vaccination and late-effects screening programme for cancer survivors. Local research is needed to identify barriers to—and facilitators of—quality care and effective methods of outreach to underserved survivors.

Survivorship care

Most survivors indicated that they would prefer to be enrolled into a survivorship programme early in the cancer care continuum. This is a promising prospect because survivors who had early access to structured survivorship programmes reportedly were more aware of their late effects, visited emergency departments less frequently, had higher cancer-specific health literacy, and tended to experience less emotional stress.³ Therefore, a structured survivorship programme is recommended to include cancer and late-effects screening, a specialist referral network, and psychosocial services for survivors and caregivers (Fig 3).^{4,12} In Hong Kong, the five major

institutions that provide paediatric oncology care typically include these core services in their long-term follow-up programmes, although the specific services offered may differ among institutions. Overall, the centralisation of paediatric oncology services in the new Hong Kong Children’s Hospital has provided an unprecedented opportunity for oncologists and allied health professionals to initiate a formal paediatric cancer survivorship programme in Hong Kong. This will facilitate the development of a survivorship care model that is tailored to the healthcare system in Hong Kong.

Our participants regarded services concerning health issues (eg, education and screening for late effects) as the most important aspects of survivorship care. The COG has developed a set of “risk-based” guidelines, which refer to a personalised systematic plan of regular screening, surveillance, and prevention strategies based on a patient’s treatment, cancer experience, and personal factors.^{5,10} In an effort to improve the awareness of health issues in Chinese cancer survivors, we collaborated with the COG and launched a Chinese version of the Health Links patient education materials in May 2020.¹⁰ To our knowledge, this is the first set of publicly available authoritative resources regarding late effects that is written in a native Chinese language. Such initiatives are anticipated to assist survivors in taking age-appropriate ownership of their health and engaging as active partners with their health providers during the survivorship phase.

Limitations

Our findings should be considered in the context of the following limitations. First, this single-centre study comprised a moderately small sample of survivors who were recruited through a convenience sampling approach. Moreover, eligible participants were identified from a long-term follow-up clinic that had a mean loss to follow-up rate of 15% to 20%. This is a recognised challenge in survivorship research because this population is often lost to follow-up from primary paediatric clinics as a result of their growing independence and mobility during advancement into adulthood.³⁷ These study limitations may have introduced sampling bias because our participants may have been more likely to be health conscious than non-participants and survivors who had been lost to follow-up. Hence, the true uptake of health-protective behaviours among local survivors may be lower than the rates reported in this study, and our findings might not be generalisable to other survivors of childhood cancer in Hong Kong. Second, social desirability and recall bias may have affected the accuracy of the self-reported results. Future studies should adopt validated and more sensitive instruments to achieve a more objective evaluation of health behaviour.

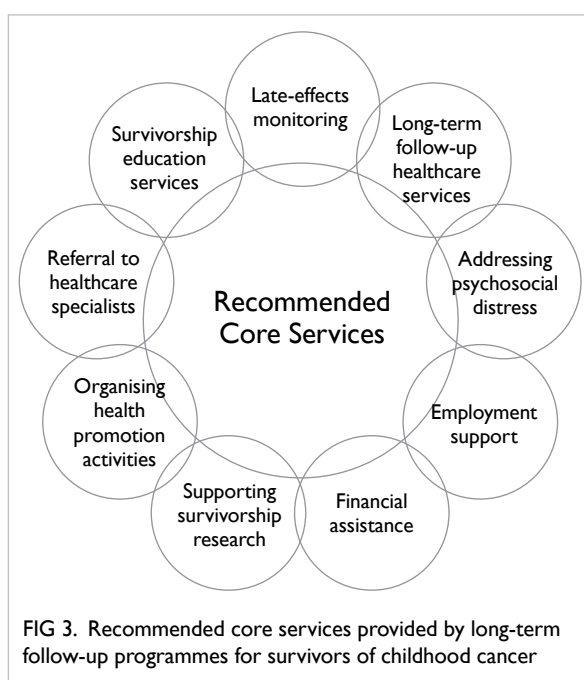


FIG 3. Recommended core services provided by long-term follow-up programmes for survivors of childhood cancer

For example, physical activity and sleep can be better measured with actigraphy studies. Finally, the multiple predictors and covariates analysed in this study may have increased the risk of a Type I error. However, lifestyle itself is a complex phenotype that is likely to be influenced by intrinsic and extrinsic factors. Our findings should be validated using a larger-scale study that involves the prospective collection of outcome data to better reflect the trajectory of health behaviour changes and correlate these findings with the results in local cancer survivors.

Conclusion

Despite the low prevalences of health-damaging behaviours, the frequencies with which Hong Kong survivors of childhood cancer engaged in health-protective behaviours were unsatisfactory. These findings highlight the need to empower survivors to adopt health-protective behaviours. A potential intervention opportunity may involve engaging survivors and families in a structured comprehensive survivorship programme during their transition to survivorship. A multidisciplinary and interactive programme addressing late effects and psychosocial aspects may address the multifaceted needs of Hong Kong survivors of childhood cancer. Future work should aim to improve preventive care for underserved groups through advocacy and care coordination.

Author contributions

Concept or design: All authors.

Acquisition of data: YT Cheung, LS Yang, JCT Ma, PHK Woo, TCH Chan, SMS Luk.

Analysis or interpretation of data: YT Cheung, LS Yang, JCT Ma, PHK Woo, TCH Chan, SMS Luk.

Drafting of the manuscript: YT Cheung, TCH Chan, SMS Luk.

Critical revision of the manuscript for important intellectual content: All authors.

All authors had full access to the data, contributed to the study, approved the final version for publication, and take responsibility for its accuracy and integrity.

Conflicts of interest

All authors have disclosed no conflicts of interest.

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Declaration

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Ethics approval

The study protocol was approved by The Joint Chinese University of Hong Kong–New Territories East Cluster Clinical Research Ethics Committee (Ref: 2018.338). Written informed consent was obtained from all participants.

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