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Review

Health behaviours in childhood cancer survivors: A systematic review

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ABSTRACT

Aim: To review (1) prevalence and predictors of risk behaviours especially smoking and (2) values of interventions to reduce risk behaviours in childhood cancer survivors.
Method: A systematic search of four databases (OVID Medline (1966 to May week 2, 2006), CINAHL, EMBASE, and Pubmed (US Library of Medicine and National Institute of Health)) for articles published between January 1990 and May 2006.
Results: Twenty-three eligible articles. Incidence of risk behaviours are comparable with, or lower than the general population and controls. Socio-demographic (age, socio-economic status, diagnosis, ethnic group) and psychological variables (perceived vulnerability) predict risk behaviour. Improved knowledge and awareness of vulnerability have been found after interventions, but no changes in health behaviours.
Conclusion: This review illustrates an optimistic picture of low participation in substance use amongst survivors, although based mainly on smoking. However, smoking might not be the major problem for survivors and attention must also be directed to other health behaviours including exercise and healthy diet.

1. Introduction

Current estimates suggest 5-year survival following childhood cancers exceeds 70%.[1,2] However, survivors are at increased risks of second malignant tumours,[3–10] impaired reproductive, pulmonary, endocrine and cardiovascular function,[11–13] cognitive dysfunction[14] and psychological and behavioural problems[15] as a result of the primary disease and its treatment. These late-effects leave this population vulnerable to future health problems.[16,17]

It is not clear how far late-effects can be modified by life style behaviours, although there are well-established associations between lifestyle and cancers in the general population.[18,19] Smoking for example, has been identified as the single most important cause of cancer.[20] In this paper, we consider the extent to which survivors engage in lifestyle behaviours such as smoking and drinking that might further aggravate their vulnerability to late-effects.

For cancer survivors, regular tobacco use may exacerbate treatment-related risk of cardiac and pulmonary toxicities,[21,22] and increase risk of lung cancer.[23,24] Similarly, exposure to UV light may further increase skin cancer risks already heightened by radiotherapy.[25–27] Alcohol is associated with the increased risk of several cancers in the general population[28] and may further increase risk of myocardial dysfunction and liver damage following cytotoxic therapy and combined irradiation.[29]

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Conversely, self-care behaviours (diet, exercise) have been associated with reduced risk of cancer and other chronic diseases in the general population[30] and may also contribute to long-term health and well-being of survivors.[31] The cancer experience can disrupt healthy behaviours such as exercise and healthy eating, leaving survivors at further disadvantage.

Given the risks of late-effects, regular follow-up of survivors is generally recommended. The aims are not only to detect recurrence but also to monitor and treat late-effects, and educate survivors about their disease, vulnerability to future health problems and opportunities for self-care.[32,33] Information about self-care and health promotion is considered essential and an integral part of follow-up care[32,34,35] and survivours themselves are often keen to take responsibility for managing their own health.[36] Information about risk may also be important for family members given that relatives can be at increased cancer risk as a consequence of genetic susceptibility and similar lifestyles.[37] For survivors, practical advice and information about the consequences of risk behaviours might lead to reduced organ damage and secondary malignancies.[38]

Thus, this review was prompted by awareness of late-effects in survivors and the contribution of lifestyle behaviours to health.[39] The specific aims were to identify (1) the prevalence and (2) predictors of lifestyle behaviours and (3) approaches to interventions for survivors of childhood cancer.

2. Materials and methods

Using recommended methods[40] we conducted a systematic search using four computerised databases [OVID Medline (1966 to May week 2, 2006), CINAHL, EMBASE, and Pubmed (US Library of Medicine and National Institute of Health)]. Text word and Thesaurus searches were used to maximise identification of relevant articles. The following keywords were searched using Boolean logic:

- *adolescent*,
- *survivor*,
- *child*, *childhood*, *children*, *pediatric*, *paediatric*,
- *cancer*,
- *health*,
- *behaviour*, *behavior.*

Additional references cited in retrieved articles were subsequently obtained.

2.1. Eligibility criteria

Inclusion criteria were articles

1. Published in English in a peer-reviewed journal between January 1990 and May 2006.
2. Included information about
   (a) The incidence or predictors of risky or protective health behaviours.
   (b) A planned psychosocial or educational intervention to promote healthy lifestyle behaviours and/or reduce incidence of risky health behaviours.
   (c) Survivors of childhood cancer over 10 years of age.

Articles were excluded if they involved

1. A literature review or case studies.
2. Patients on treatment.
3. Only qualitative data.

We identified 119 articles and obtained abstracts. Based on the defined eligibility criteria, 96 were excluded at this stage. We obtained copies of all remaining papers.

2.2. Review procedure

A summary sheet was developed for extracting data and included

1. Aims.
2. Methodology – sample size, socio-demographic characteristics of sample (age, time since treatment, cancer type), comparison group, design and setting.
3. Theoretical background.
4. Intervention design and targets.
5. Outcome measures.
6. Results.

Both the authors independently reviewed all papers. Discrepancies in coding were resolved through discussion.

3. Results

The 23 articles were conducted in the US ($n = 21$), UK ($n = 1$) and Australia ($n = 1$). Eight of the United States papers described data from the Childhood Cancer Survivor Study (CCSS),[41] of which five[21,42] described the incidence of health behaviours. Three described baseline data[46,47] prior to an intervention.[48]

A further eight US articles[22,23,49–54] described work at St. Jude Children's Research Hospital (SJCRH), Memphis. Of these, four[23,52–54] reported health behaviours, and four[22,49–51] described interventions (assessment of feasibility,[49] and intervention outcomes.[22,50,51])

Of the 23 articles, 17[21,23,38,42–47,52–56,58–60] described the prevalence and/or predictors of health behaviours (Table 1), and six[22,48–51,57] interventions to reduce risky health behaviours (Table 2).

3.1. Prevalence of risk behaviours

Smoking was the most frequently studied risk behaviour ($n = 20$),[21–23,38,45–60] followed by alcohol use ($n = 10$),[23,38,45,47, 51,53,57–60] recreational drug use ($n = 5$),[38,57–60] unsafe sex ($n = 1$),[60] multi-vitamin use ($n = 1$),[47] red meat consumption ($n = 1$),[47] and physical inactivity ($n = 1$).[47]

Protective health behaviours (self-care) were reported in six articles, (self-examination and screening,[42] dental

Table 1 – Prevalence and predictors of health behaviors

Study	Aims	Sample	Measures	Results
Emmons et al.[21] CCSS USA	Determine smoking behaviour and predictors of initiation/cessation	N = 9709 18–47 years *Comparison group* US norms	1. Demographics 2. Medical history 3. Health status 4. Functional status 5. Living status 6. Work history 7. Smoking	1. 28% ever smoked, 17% current smokers (<US norms) 2. Decreased risk of initiation associated with; <10 years at diagnosis pulmonary treatment, CNS radiation, Black ethnic group 3. Low income and less education increased risk of initiation 4. 41.5% had attempted to quit
Yeazel et al.[42] CCSS USA	Determine self-examination and cancer screening	N = 9434 ⩾18 years *Comparison group* N = 2667 siblings	1. Smear (pap) screening 2. Breast/testicle self-examination (SE)	1. Screening practices below recommended levels 2. Survivors report more SE than siblings 3. Females ⩾25 years report more screening than 18–24 years 4. Less concern about health issues – less likely to report screening
Yeazel et al.[43] CCSS USA	Determine dental utilisation practices	As [42]	1. Self-reported dental practices	1. Dental utilisation below recommended levels 2. Minority groups, no health insurance, low income, low educational attainment – less likely to report recent dental visit
Oeffinger et al.[44] CCSS USA	Determine health care utilisation and predictors of medical visits	As [42]	1. Demographics 2. Medical history 3. Health status and concerns for health 4. Utilisation of medical care over 2 year period	1. < 20% seen in cancer centre 2. Medical visit decreased with survivor age and time since diagnosis 3. Lack of medical insurance, ethnic minority, male – less medical contact
Castellino et al.[45] CCSS USA	Compare health behaviours (screening, dental practices, tobacco and alcohol use, exercise) between ethnic groups	N = 8767 N = 443 *Black* N = 503 *Hispanic* N = *7821 White* 18–48 years *No Comparison group*	1. Health status 2. Health practices 3. Health behaviours	1. Compared with White females, Black more likely, and Hispanic survivors less likely, to have smear (pap) screening 2. Compared with Whites, Black and Hispanic survivors report less Smoking and Black less likely to report problem drinking 3. Black survivors less likely to engage in risk behaviours and report better preventative practices
Emmons et al.[46] CCSS USA	Evaluate predictors of tobacco use amongst smokers before the PFH intervention	N = 796 sub sample of current smokers ⩾18 years *No Comparion group*	1. Demographics 2. Tobacco knowledge 3. Perceived vulnerability 4. Psychological symptoms 5. Self-efficacy 6. Smoking status	1. 53.2% nicotine dependent, 58% ⩽1 attempt to quit 2. Older age, less education, and more smokers in social network Predictors of smoking, fewer quit attempts, and nicotine dependence 3. Perceived vulnerability, younger age at diagnosis, belief that cancer Increases health risk and male sex predictors of self-efficacy and readiness to quit

(*continued on next page*)

Table 1 – *continued*

Study	Aims	Sample	Measures	Results
Butterfield et al.[47]CCSS USA	Describe prevalence/ predictors of risky behaviours (red meat, multivitamin, exercise, tobacco and alcohol use) amongst smokers	*N* = 541 of smokers in paper 6 ⩾18 years *No Comparison group*	1. Health behaviour questionnaire	1. 92% of smokers engaged in other health compromising behaviours 2. Most common risk factor was not taking a multivitamin 3. Those engaging in other risky behaviours were most likely to smoke heavily, be nicotine dependent and lower stages of readiness to quit
Mulhern et al.[23]ACT USA	Determine health beliefs and behaviours (tobacco and alcohol use, exercise, diet, sleep, seat belt use, dental practices)	*N* = 40 (⩾18 years) and parents of 11–17 year olds (*N* = 110). ⩾2 years off treatment and ⩾5 years since diagnosis *No Comparison group*	1. Health behaviours (self and parent report) 2. Health Protection beliefs	1. Tobacco and alcohol use for ⩽18 years <10% 2. Tobacco use = 17.5%, alcohol use = 72.5% *but problem drinking infrequently reported* for ⩾18 years 3. Gender, SES, time since treatment finished not associated with health protection beliefs or behaviours
Tyc et al.[52] ACT USA	Determine predictors of future intentions to use tobacco	*N* = 46 (10–18 years) 1–4 years from completion therapy *Excluding CNS tumors* *No Comparison group*	1. Tobacco knowledge 2. Perceived vulnerability 3. Intentions to use tobacco	1. Survivors knowledgeable about risks, perceived themselves vulnerable, and reported low intentions to use tobacco in the future 2. Older age, less knowledge of tobacco risks predict smoking intentions
Tyc et al.[53] ACT USA	Identify prevalence/ predictors of health behaviours (tobacco and alcohol use, diet, sleep, seatbelt use, dental practises, exercise)	As [52] *No Comparison group*	1. Health behaviour 2. Perceived vulnerability 3. Health Protection beliefs 4. Health locus of control	1. Moderately frequent practice of protective health behaviours 2. Alcohol and tobacco use was low 3. Younger age and higher socio-economic status predict healthier behaviour 4. Most perceived greater vulnerability to health problems but this not related to protective behaviour
Tyc et al.[54] ACT USA	Identify predictors of perceived vulnerability and intentions to use tobacco	As [22] (see Table 2) *No Comparison group*	As [22] (see Table 2) plus 1. Self-reported tobacco use	1. Analysis based on non-smokers (*n* = 98) 2. Perceived vulnerability to tobacco risks associated with demographic and medical variables, knowledge, past tobacco use 3. 57% reported intention to use tobacco 4. Perceived positive value of tobacco and past tobacco use predictors of intentions for future tobacco use
Verrill et al.[38] USA	Examine prevalence of anti-social behaviour, tobacco, alcohol, and recreational drug use	*N* = 26 ⩾1year off treatment *Comparison group* 26 controls	1. Demographics 2. IQ test – WISC 3. Child behaviour checklist 4. Anti-social behaviour 5. Drinking and drug history	1. Survivors report significantly less illegal drug use than controls 2. No significant differences in smoking and alcohol use

Tao et al.[55] USA	Compare prevalence/ predictors of smoking with siblings	$N = 592$ ($\geqslant$18 years) Diagnosed 1970–1987 and $\geqslant$2 years since diagnosis date *Comparison group* 409 siblings ($\geqslant$18 years)	1. Smoking behaviour 2. Profile of mood states (POMS) 3. Self-esteem	1. Significantly fewer survivors (23%) ever smoked compared with siblings (35.7%)
Haupt et al.[56] USA	Determine prevalence/ predictors of smoking	$N = 1289$ ($\geqslant$18 years) Diagnosed 1945–1974 and $\geqslant$5 years since diagnosis date *Comparison group* 1930 siblings ($\geqslant$19 years)	1. Smoking history	1. 57% never smoked, 28.6% current smokers 2. Survivors 8% less likely to currently smoker compared with controls, 13% less likely to have ever smoked, *but* 12% less likely to have quit smoking 3. Survivors were less likely to smoke if diagnosed in recent years (1965–1974) but similar to controls if diagnosed (1945–1954)
Hollen and Hobbie[58] USA	Explore predictors of decision-making and risky health behaviours(tobacco and alcohol use, recreational drugs)	$N = 52$ (14–19 years) and their parents. $\geqslant$2 years off treatment and $\geqslant$5 years disease free *Excluding CNS tumors*	1. Demographics 2. IQ test – WISC 3. Decision-making 4. Periodic assessment of drug use among youth 5. Temperament survey (revised) 6. Resiliency 7. Parents postal survey	1. Non-resiliency and poor decision-making significant predictors of one or more risk behaviours
Larcombe et al.[59] UK	Compare prevalence of health behaviours(tobacco and alcohol use, recreational drugs, exercise, skin protection, diet) with control groups	$N = 178$ (18–30 years) Diagnosed $\geqslant$5 years *Comparison* 67 Siblings 184 age matched controls	1. Risk behaviours 2. Self-esteem scale 3. Health locus of control	1. Survivors reported significantly less alcohol (75%), tobacco (20%) and illegal drug use (13%) than controls and slightly less than siblings 2. Smokers less successful at quitting smoking compared with controls
Bauld et al.[60] Australia	Compare prevalence/ predictors of health Behaviours (tobacco, alcohol and recreational drug use and unsafe sex) with healthy adolescents	$N = 153$(13–24 years) $\geqslant$12 months off treatment *Comparison group* Australia norms	1. Health behaviour questionnaire	1. Survivors reported more pain reliever for non-medical purposes *but* lower binge drinking, alcohol use, cannabis use, other illicit drug use, and smoking than population norms 2. Older survivors reported more alcohol, *but* lower use of cannabis, other illicit drugs, and tobacco 3. Age of onset of tobacco use older for survivors compared with population norms

Table 2 – Interventions

Study	Aims	Sample	Intervention	Theory	Measures	Results
Emmons et al.[48] CCSS USA	Reduce smoking and improve knowledge/self-efficacy.	As study [46] (see Table 1)	*Self-help VS Peer-counselling* – Peer delivered telephone counselling –Targeted materials – Nicotine replacement therapy	1. SCT[a] 2. TTM[b]	Baseline, 8 months, 1 year. As study [46] (see Table 1)	1. Cessation doubled at 8 and 1 year 2. Cessation rate increased with number of counselling calls 3. High self-efficacy at baseline predicted likelihood to quit 4. Incremental cost effectiveness = $5371 per additional quit at 1 year
Tyc et al.[22] ACT USA	Improve knowledge, perceived vulnerability and decrease intentions to use tobacco	$N = 103$ (10–18 years) $\geqslant 1$ year from completion *Excluding CNS tumours*	*Standard care VS Intervention* 1. Late-effects risk counselling 2. Educational video 3.Goal setting 4. Written feedback 5. Follow-up telephone counselling at 1 and 3 months	1. HBM[c]	Baseline, 6, 12 months 1.Tobacco knowledge 2. Perceived vulnerability 3. Intentions to use tobacco 4. Perceived positive effects of tobacco	1. 98 non-smokers 2. No significant differences at 6 months 3. Intervention group: significantly higher knowledge, higher perceived vulnerability and lower intention at 12 months 4. Tobacco knowledge, perceived vulnerability to risks and intentions to use tobacco are modifiable with risk counseling
Hudson et al.[49] ACT USA	Improve knowledge and increase protective behaviours	$N = 266$ (12–18 years) and parents $\geqslant 2$ years off treatment and $\geqslant 5$ years since diagnosis	*Standard care VS Intervention* – Late-effects risk counselling – Clinical summary – Health behaviour training – Commitment to health goal	1. HBM 2. PMT[d]	Baseline, Telephone follow-up at 3 and 6 months. – Knowledge of risks – Health behaviours – Perceived vulnerability, health and severity of risks – Self-efficacy – Benefits/barriers to practice behaviours	Baseline results only 1. Survivors comparable with normal population but lower smoking 2. Poor knowledge about treatment and vulnerability to risks 3. Intervention study to educate survivors about vulnerability is feasible

Hudson et al.[50] ACT USA	Improve knowledge, health perceptions, and increase health protective behaviours	N = 272 (12–18 years) ⩾2 years off treatment and ⩾5 years since diagnosis	Standard care VS Intervention (as 49)	1. HBM	Baseline, 1 year. As [49]	1. Females in intervention group showed more improved knowledge than males 2. Those with specific health goals showed improved practice
Cox et al.[51] ACT USA	Secondary analysis of study 50. Identify predictors of substance use	As study [50]	As study [50]	1. HBM 2. IMC-HB[e]	Same as 50 *plus* annual questionnaire from medical records – Medical history – Symptoms – Worry and concerns about cancer/treatment	1. Baseline; higher grade, greater perceived susceptibility, greater worry predicted increased substance use 2. 1 year follow-up: school grade and worry increased substance use: desire to change behaviour and being female decreased substance use
Hollen et al.[57] USA	Improve health decisions	N = 64(13–21 years) ⩾2 years off treatment and ⩾5 years since diagnosis *Excluding CNS tumors.*	*Camp VS Camp and intervention* 1. 1-day educational workshop 2. Overnight social component	1. CMDM[f]	Baseline, 1, 6, 12 months, 1. Semi-structured interview 2. Decision-making Quality 3. Risk-motivation questionnaire 4. Periodic assessment of drug use among youth	1. Improved decision-making significant at 1 and 12 months 2. No effect on smoking motivation/ use or alcohol use 3. Illegal drug use and unprotected sex too infrequent for analysis

a Social Cognitive Theory.
b Trans-theoretical model.
c Health belief model.
d Protection motivation theory.
e Interaction model of client health behaviour.
f Conflict model of decision-making.

care,[23,43,53] follow-up attendance,[44] exercise,[23,53,59] healthy diet,[23,53,59] sleep,[23,53] seat belt use,[23,53] and sun protection.[59])

3.1.1. *Smoking*

Apart from one study[38] the incidence of smoking in survivors was described as lower[21,23,49,53,60] than the general population. Survivors smoked less than siblings[55] and healthy aged-matched controls,[59] but smoking was not lower amongst survivors at specific risk of cardio- or pulmonary dysfunction.[21] Health risk behaviours clustered together: 92% of smokers engaged in other health compromising behaviours. Furthermore, those who smoked heavily were nicotine dependent, less ready to quit, and most likely to engage in other risky behaviours.[47]

Although survivors were older than the general population at smoking onset,[60] they made fewer attempts to quit[21] and were less successful at quitting compared to siblings.[55,56,59] Cessation rates were only moderately higher than the general population.[21] Amongst non-smokers, 57% of younger survivors (aged 10–18 years old) were uncertain about whether they would abstain from future tobacco use.[54] Those with less knowledge of tobacco related health risks expressed greater intentions to smoke in the future.[52]

3.1.2. *Alcohol use*

Approximately 75% reported some alcohol use,[23,59] and this was lower[53,60] or comparable with matched control groups.[38] The incidence of binge drinking (12.5%), heavy drinking (2.5%), and drinking and driving (0%) were low among adult survivors.

3.1.3. *Recreational drug use*

Cancer survivors were less likely to report using illegal drugs compared with matched controls[38,60] or siblings[59] although they were more likely to report using pain relief for non-medical purposes.[60] In two studies, where the aim was to describe recreational drug use, incidence was too low for analysis[57] or not reported.[58]

3.1.4. *Unsafe sex*

Survivors engaged less in unprotected sex compared to healthy adolescents.[60]

3.1.5. *Self-care*

Based on an overall score including various protective health behaviours, survivors engaged in self-care moderately frequently,[53,59] and practiced healthier behaviour than controls or siblings.[59] However, cancer screening, dental practices, and utilisation of specialist follow-up care were below optimal.[23,42–44] In one study almost a quarter of survivors also reported infrequently eating balanced meals or wearing seatbelts, and exercising less than 1 hour a week. Over half reported sleeping less than 8 hours a night.[23]

3.2. *Predictors of risky/healthy behaviours*

3.2.1. *Clinical and demographic variables*

There is little consistent evidence for gender differences in health behaviours but males were less likely to report a recent dental visit than females[43] and more ready to quit smoking than females.[46]

Evidence relating to age is equivocal. Older females (>25 years) were more likely to conduct breast self-examination (BSE) compared with younger survivors,[42] and among older Australian survivors adverse health behaviours (cannabis, illicit drug and tobacco use) were less than for younger survivors.[60] Older age has also been associated with increased tobacco[46] and alcohol use[60] but younger age predicts more frequent engagement in self-protective behaviours.[53]

Survivors aged 10 years or younger at diagnosis were less likely to smoke than those diagnosed later[21] and younger age at diagnosis was a consistent predictor of self-efficacy and readiness to quit amongst those who smoked.[46]

As with the general population, higher socio-economic status predicted healthier behaviour.[53] Those with lower income or educational attainment were least likely to report a recent dental visit,[43] and the likelihood of smoking initiation, current smoking, nicotine dependence and fewer quit attempts increased with lower income and education.[21]

Survivors treated with cranial irradiation or pulmonary-toxic treatments were less likely to start smoking.[21] Black survivors were less likely to engage in risk behaviours (smoking, alcohol use) and more likely to report preventative practices (dental care, screening, physical activity) than White survivors. Black female survivors were more likely to have had a recent pap smear compared with White female survivors, while Hispanic females were least likely.[45] Black survivors reported less problem drinking[45] and Black and Hispanic survivors reported less smoking compared with White survivors.[21]

3.2.2. *Psychological variables*

Perceived vulnerability, concern about health and understanding of the association between cancer and health were consistent predictors of self-efficacy and readiness to quit smoking[46] and perform self-care.[42,23] Those with poor decision-making skills were most likely to engage in one or more risk behaviours.[58]

3.3. *Interventions*

Of the six interventions identified, four involved randomised controlled trials (RCTs) at SJCRH.[22,49–51] These interventions were based on two models of behaviour change [the Health Belief Model[61] and Protection Motivation Theory.[62]] Tyc et al. described the efficacy of a 12 month intervention including risk counselling, educational video, goal setting, written feedback, and follow-up telephone counselling at 1 and 3 months. Participation in the intervention was associated with improved knowledge, higher perceived vulnerability, and lower intention to engage in smoking.[22]

Hudson et al. aimed to test the feasibility of an educational intervention to improve knowledge of treatment and risks of late-effects and increase health protective behaviours over a 1 year period.[49] Patients were randomised to receive regular care or regular care plus late-effects risk counselling, health behaviour training, goal setting, and telephone follow-ups. At baseline, survivors showed deficits in knowledge about treatment, increased vulnerability to future risks and prac-

ticed behaviours that may adversely affect their health. Outcomes for the intervention were not reported.

The two remaining papers[50,51] report primary and secondary analysis of an intervention to improve knowledge, health perceptions and behaviours. Intervention conditions replicate those described above[49] with additional measures of cancer worries and medical history. There was no improvement in protective behaviour or reduction in risk behaviour following intervention. Females however showed greater improvement in knowledge.

The PFH intervention[48] was built on two earlier reports,[46,47] which describe baseline incidence data. This randomised trial was designed to evaluate the effect of a peer-counselling intervention among smokers. The intervention draws on concepts from Social Cognitive[63] and Transtheoretical models.[64] Survivors were assigned to either a peer-delivered telephone counselling programme, tailored and targeted intervention materials and nicotine replacement therapy, or a self-help group in which they received a letter highlighting the importance of smoking cessation to reduce the risk of secondary cancer and a manual to quit. Smoking cessation doubled at 8 months and 1 year and increased with the number of phone calls.

'Camp good days and special times' was based on a decision-making model.[65] Outcomes were assessed at baseline, 1, 6 and 12 months and showed improved decision-making at 1 and 12 months. There was no significant improvement in smoking, alcohol or illegal drug use or unprotected sex.[57]

4. Discussion

Current evidence suggests that survivors are less, or equally, likely to engage in risk behaviour compared with peers or siblings. Consistent predictors of alcohol and tobacco use in the general population are socio-demographic variables[66–69] and these variables also predict risk behaviours in survivors.[21,53] Survivors experience threats to long-term future health, and, despite risk-counselling, anxiety about cancer is associated with increased substance use[51]. Over and above these risk factors, survivors may be more likely to engage in risky health behaviours because they are at higher risk of physical, psychological and behavioural difficulties and may have poorer decision-making skills.[70]

The timing of health promotion is paramount, and interventions to reduce smoking *initiation* as well as cessation are required.[21] Only one study has attempted to reduce initiation.[22] Special consideration must be given to younger patients to influence beliefs about smoking and intentions to use tobacco prior to peak age of initiation.[53] Typically, this occurs while children undergo active treatment when smoking is typically very low (2%), perhaps a consequence of treatment side-effects, and practical constraints (in-patient care).[71] Opportunities for health promotion among those undergoing treatment must not be overlooked, and should be the focus of future research. Interventions must also target the most vulnerable populations. Despite the relatively low incidence of smoking in survivors it remains unacceptably high given treatment-related damage to cardio- pulmonary systems.[21,58]

In considering how to reduce smoking initiation for survivors, it is sensible to draw on the extensive literature addressing why young people smoke and the most successful methods of intervention. Existing school-based interventions require modification to include information about late-effects and heightened vulnerability for survivors compared with peers.[72,73] Survivors need personalised information including treatment history, awareness of the benefits of health protective behaviours and follow-up counselling.[73] Interventions might also include teaching new coping skills to manage anxiety about future health.

Randomised controlled trials are the gold standard for evaluation of any intervention but the obstacles are considerable.[74] Tercyak et al. report that among 244 eligible survivors only 31% were ultimately randomised (13% were not eligible, 33% refused to cooperate and 22% did not respond to mailings or phone calls). Reasons for trial refusal included lack of interest (28%) and lack of time (23%). We must acknowledge that this is highly mobile population, very busy, and often with little awareness of why they should be interested in health promotion.

4.1. *Limitations of the current literature*

Most studies rely on self-reported behaviour that may be subject to bias, as survivors may over or under estimate drug use. Under-reporting may also occur from parents, since they may be unaware of their child's substance use.[23] Ideally, smoking status should be confirmed with biochemical assays. The bogus pipeline technique[48] could improve accuracy of recall and provides a potentially cheaper alternative.

Smoking has been the main research focus and there has been relatively little investigation into other risk behaviours. In practice, behavioural risk factors cluster together. Smokers, who have poorer diets, are less physically active and consume more alcohol than the general population.[75] Adolescent smokers engage in riskier sexual behaviour[76] and greater substance use[77] than non-smokers. The adverse health effects of these factors combined may be higher than for individuals engaging in only one risk behaviour but critically, effective education about prevention and management must involve an integrated approach to address all issues.

Few studies have focussed on protective health behaviours and those that have examined self-care have tended to report total behaviour indices rather than incidence of specific behaviours.[23,59] Research on skin protection, sun bathing and sun-bed use amongst survivors are especially important given the increased risk of skin cancer, and would inform future interventions targeting self-care as well as reduction of risk behaviour.

All but two studies were conducted in the United States. It is vital that related work is conducted in Europe to account for differences in incidence and attitudes to smoking. Prevalence rates in southern Europe, for example, are higher than in the US or northern Europe.[78] Assuming that survivors experience similar pressure to smoke as the normal population, survivours in southern Europe may be much more likely to smoke and are at higher risk of compromised health.

Sampling bias includes under-representation of ethnic minorities[22,23,50–53,55] and exclusion of CNS tumour

survivors.[22,58,57] Most studies include survivors of different cancers so it is unclear if those at greatest risk adopt healthier lifestyles.

The cost and effectiveness of intervention also require consideration.[34] Delivery costs and financial estimates in relation to cost per year of life saved are rarely reported. Exceptionally, one study[48] calculated the total delivery cost of their intervention as 298.17 US dollars for the intervention group and 2.25 US dollars for the self-help control group, resulting in an incremental cost-effectiveness of the intervention as 5.371 US dollars per additional quit at 12 months.

Statistical difficulties are also apparent although partly reflect the low incidence of substance use.[38] Similarly, analyses of risk amongst ethnic minorities are based on far smaller sample sizes than White survivors.

Notwithstanding methodological limitations of research, this review illustrates an optimistic picture of low participation in substance use amongst survivors. Even so, given concerns about the heightened vulnerability of survivors, there is no room for complacency. In clinical practice, increasing awareness of vulnerability is essential. From this perspective, recent publications aimed at survivors that include specific lifestyle and health promotion advice are welcome.[79] This heightened awareness needs to be followed up by more comprehensive intervention packages. More intensive packages are necessary for the relatively small number of survivors who smoke. However, our review suggests that smoking might not be the major problem for survivors and attention must also be directed to other health behaviours including exercise and healthy diet.

Conflict of interest statement

None.

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