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**Prevalence and associates of smoking and smoking cessation six months following a cancer diagnosis: A
population based study**

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Compliance with Ethical Standards

- Conflict of Interest: The authors declare that they have no conflict of interest.
- Ethical approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.”
- Informed consent: Informed consent was obtained from all individual participants included in the study.”

ABSTRACT

Purpose: Limited research has examined smoking amongst recent cancer survivors, or the relative contribution of factors on smoking behaviour. This study aimed to describe amongst recent Australian cancer survivors: (i) prevalence of smoking by cancer type; (ii) characteristics associated with continued smoking following diagnosis; (iii) intention to quit among those who continue to smoke; and (iv) characteristics associated with quitting following diagnosis.

Method: Cross-sectional data were analysed from 1,299 cancer survivors diagnosed with their first primary cancer recruited from two Australian cancer registries in Australia between 2006 and 2008.

Results: 8.6% of participants reported current smoking. Participants who were younger and single or widowed reported higher odds of current smoking. Participants who had a certificate/diploma or tertiary education reported lower odds of smoking. Among current smokers, 53% intended to quit in the future. Lung cancer survivors reported more than four times the odds of quitting smoking since diagnosis compared to other cancer types.

Conclusion: 14% of recent Australian cancer survivors report continued smoking.

Implications for cancer survivors: Smoking following a cancer diagnosis is associated with increased risk of mortality and further morbidity. There is a need to target cessation efforts towards survivors who are younger, without a partner and with a low level of education.

Keywords: smoking, smoking cessation, cancer, survivorship

1. INTRODUCTION

More than 66% of individuals diagnosed with cancer will survive longer than five years after diagnosis[1, 2].

Over the past decade, the health and wellbeing of those living with a history of cancer (i.e. survivors) has emerged as a global public health priority[3]. Due to their important role in the prevention of disease, modifiable health behaviours including physical activity, nutrition, smoking and alcohol consumption have been identified as priority areas for cancer survivors[4].

Individuals who continue to smoke after a diagnosis of cancer are at increased risk of death from smoking related cardiovascular and respiratory complications, as well as higher risk of cancer recurrence, the development of second primary cancers, and complications from treatment[5-7]. Continuing to smoke post-diagnosis has also been found to be associated with overall poorer physical, social and emotional functioning[8-10]. Despite these significant adverse health impacts, comparative to other areas of behavioural research relatively few studies have examined the smoking habits of cancer survivors[11].

Of the few studies conducted in this area, smoking prevalence has been found to vary across cancer type and time since diagnosis. Smoking prevalence ranges from as low as 3% for female breast, colorectal and endometrial cancer survivors an average of 8.5 years post diagnosis[10], to as high as 21.3% for survivors of an unspecified time since diagnosis[12]. The American Cancer Society's Study of Cancer Survivors-II found smoking prevalence's varied from 8.4% for men with prostate cancer to 17.4% for individuals diagnosed with bladder cancer[13].

However, much of this previous research is based on unrepresentative convenience samples which include only a few cancer types[10, 14-17]. Of the population-based studies including heterogeneous samples of cancer survivors[12, 13, 18-21], none have focused on the behaviours of *recent* survivors less than one year post-diagnosis. This is an important group as a recent diagnosis of cancer and the likelihood of needing treatment close to the time of diagnosis may constitute a 'teachable moment' where individuals may be more motivated to make positive changes to their health behaviours. In addition, while the assessment of psychosocial variables such as anxiety, depression and social support have been found to be associated with smoking behaviours in other population groups[22-25], few studies have examined the relative contribution of individual, disease *and* psychosocial factors to smoking behaviour[20, 21]. Understanding the range of factors that contribute to

smoking and smoking cessation among recent cancer survivors will assist in the development of smoking cessation interventions targeted at this group.

Aims

To describe amongst Australian cancer survivors who are six months post-diagnosis:

- i. prevalence of smoking by cancer type;
- ii. demographic, disease, and psychosocial characteristics associated with continued smoking following diagnosis;
- iii. intention to quit among cancer survivors who continue to smoke; and
- iv. demographic, disease and psychosocial characteristics associated with quitting smoking following diagnosis.

2. METHODS

This paper is based on data collected as part of the *Cancer Survival Study*, a population-based longitudinal study examining the physical and psychosocial well-being of cancer survivors over the five years following diagnosis[26-31]. This paper reports findings from the first survey administered to survivors six months following diagnosis. Study methodology has been reported elsewhere[26].

Eligibility

Eligible individuals were: diagnosed with their first primary cancer in the preceding six months, which included one of the following: prostate, colorectal, female breast, lung, melanoma, non-Hodgkin's lymphoma, leukaemia, head and neck; aged between 18 and 80 years at time of diagnosis; living in the state of New South Wales (NSW) or Victoria (VIC), Australia, at the time of diagnosis; and judged by their physician to be aware of their diagnosis, physically and mentally capable of participating and sufficiently proficient in English to complete a questionnaire.

Recruitment

Participants were sampled from the state-based Cancer Registries of NSW and VIC. Individuals whose physician had given consent for contact about the study were mailed a study information package by the cancer registry. Individuals who agreed to their contact details being passed to the research team were then mailed a

self-administered, pen-and-paper survey. A second questionnaire package was sent to non-responders after three weeks and reminder telephone calls made after a further three weeks. Consent was implied through the return of the survey. The study was approved by the University of Newcastle Human Research Ethics Committee (H-199-1101), the Cancer Institute New South Wales, and Cancer Council Victoria.

Measures

The survey included items related to treatment, psychosocial wellbeing, and lifestyle behaviours. Data from the following measures are reported in this paper:

Outcomes

Smoking and smoking cessation. Using standard self-report items[32], participants indicated whether they currently smoked tobacco (no, never smoker; no, ex-smoker; daily; at least once a week; less often than once a week) and whether they had quit smoking in the last six months (yes; no; don't know). Those who reported being a never or ex-smoker were categorised as non-smokers. Those who reported smoking daily, at least once a week or less than once a week were categorised as smokers. Ex-smokers were asked when they had quit (after being diagnosed; in the 12 months before cancer diagnosis; more than 12 months before cancer diagnosis). Current smokers were asked their intention to quit smoking in the future. Studies examining the accuracy of self-reported smoking among newly diagnosed cancer patients have found low rates of misclassification among current smokers, non-smokers, and those who had quit smoking more than one year ago[33].

Study factors

Demographic characteristics. Participants self-reported current marital status, highest completed level of education, health insurance coverage, and current employment. Age at diagnosis, sex and postcode were obtained from the cancer registries.

Disease characteristics. Participants self-reported the cancer treatments they had received in the last six months (surgery, chemotherapy, radiotherapy, hormone therapy, other) and current remission status. Primary cancer type was obtained from the cancer registries.

Social support. Participants completed the Medical Outcome Study Social Support Survey (MOS – SSS), which measures the availability of: emotional/informational; tangible; affectionate; and positive social interaction[34]. Raw subscale scores were standardised from 0 to 100. Respondents scoring in the bottom one-third of each distribution were classified as having ‘low’ availability of that particular type of social support, while respondents scoring in the top two-thirds were classified as having ‘some’ availability of that type of social support (Sherbourne, personal communication).

Anxiety and depression. Participants completed the 14-item Hospital Anxiety and Depression Scale (HADS), which measures symptoms of anxiety and depression within the last week [35]. A score of 8 or greater on both sub-scales was used to classify respondents as having high levels of anxiety or depression [36].

Statistical analysis

Due to small numbers, data from non-Hodgkin’s lymphoma and leukaemia survivors were combined into one ‘haematological’ category. Participant characteristics and outcomes are presented as counts and percentages, with 95% Confidence Intervals (CIs) reported for outcomes of interest. Chi-square tests were used to compare differences in smoking status by cancer type.

3. To examine the characteristics associated with smoking and smoking cessation following a cancer diagnosis, separate multiple logistic regression analyses were undertaken for each outcome with independent variables of interest. The following independent variables were initially examined with each outcome using Chi-squared tests: age at diagnosis (≤ 49 , 50-59, 60-69, ≥ 70); sex (Male, Female); marital status (Married or defacto, Single or Widowed); geographical location (Major city, Inner regional/Outer regional/Remote); highest level of education (Primary/secondary school, Certificate/Diploma/degree); current employment situation (Retired, Paid employment, Not working or unpaid work); primary cancer type (Prostate, Melanoma, Breast, Haematological, Colorectal, Lung, Head & neck); whether the cancer was in remission (In remission, No/Don’t know); treatment in the last six months (Surgery, Chemotherapy, Radiotherapy, Hormone therapy, Other); social support (Emotional/informational, Tangible, Affectionate, Positive social interaction); anxiety (Low,

High); and depression (Low, High). Variables with a p-value of <0.2 from the Chi-square analysis were included in multiple logistic regression analyses. Variables with a p-value ≤ 0.05 on the Wald statistic were considered statistically significant. Adjusted odds ratios and 95% CIs are reported for the final models.

RESULTS

Sample

Of 3,315 cancer survivors deemed eligible, 1,691 agreed to participate and 1,360 returned the first questionnaire (41% response rate). The 1,299 participants who returned their questionnaire less than nine months post-diagnosis and reported their smoking status were included in analyses.

Participant demographic and disease characteristics

Demographic characteristics of the sample are reported in Table 1. Disease, treatment and psychosocial characteristics are reported in Table 2. More than half of participants were male (59%), and over one-third lived in a regional or remote location (36%). The most common cancer type was prostate cancer (26%). At least three quarters of participants reported low levels of anxiety and depression.

Smoking status

As shown in Table 3, 8.6% (95% CI 7.2 to 10.3) of survivors were current smokers. Almost half were never smokers (45% (95% CI 42 to 47)). The proportion of survivors reporting never smoking was significantly lower among lung cancer survivors (16% (95% CI 10 to 23)) than survivors of other cancer types ($p < 0.0001$).

Characteristics associated with current smoking

The results of the multiple logistic regression examining characteristics associated with current smoking are reported in Table 4. The odds of survivors being a current smoker increased with decreasing age. Participants who were single or widowed reported significantly higher odds of being a current smoker. Those with a certificate/diploma or degree level education reported significantly lower odds of being a current smoker.

Intention to quit smoking

Among the 106 survivors who continued to smoke six months following their diagnosis who reported on their intention to quit, 25% (95% CI 18 to 35) intended to quit in the next month, 17% (95% CI 10 to 26) in the next six months, and 11% (95% CI 6 to 19) reported that they may quit, but not in the next six months. Fourteen

percent (95% CI 8 to 22) of participants reported that they never expected to quit smoking and 32% (95% CI 23 to 42) reported they did not know if they would quit smoking.

Smoking cessation following a cancer diagnosis

Among the 178 survivors who were current smokers at the time of diagnosis, 66 (37%, 95% CI 30 to 45)) reported quitting smoking six months following diagnosis. The results from the multiple logistic regression examining characteristics associated with smoking cessation are reported in Table 5. Survivors diagnosed with lung cancer reported over four times the odds of quitting smoking in the six months since diagnosis compared with survivors of other cancer types.

4. DISCUSSION

In this population based study of recent cancer survivors, 8.6% reported current smoking six months after diagnosis. While smoking rates of between 3% and 8% have been reported in samples primarily consisting of breast, colorectal and prostate cancer survivors recruited in the United States [10, 17, 37], the current findings are at the lower end of the range reported by studies of survivors with a different cancer case mix [12, 18, 20]. The prevalence of smoking found is less than half that of the Australian general population prevalence of 19.4%[38] at the time data were collected, however is consistent with results from the population-based American Cancer Society's Study of Cancer Survivors-II which found a lower smoking prevalence amongst cancer survivors (8.4-11.9%) compared to the general population (20.5%)[13]. This difference may reflect a high rate of smoking cessation at the onset of cancer symptoms, or at the time of diagnosis or treatment. Nevertheless, that the majority of survivors are complying with recommendations regarding smoking is encouraging.

Another encouraging finding was that 37% of participants who were smoking at the time of their cancer diagnosis reported having quit six months later, which is comparable to smoking cessation rates found in effective smoking cessation interventions for cancer survivors[39]. This supports the suggestion that a diagnosis of cancer may be a "teachable moment" and that recent cancer survivors are receptive to behaviour change. Survivors diagnosed with lung cancer had higher odds of quitting, which may reflect the strong association between tobacco use and lung cancer[40] or the provision of additional healthcare provider intervention and support for smoking cessation given the potential for lung cancer treatment to be less effective for continuing

smokers[41]. Lack of associations for other cancer types may be due to limited power. In contrast to a previous study of behaviour change in cancer survivors[42], we did not find any associations between smoking cessation and age at diagnosis.

Of particular concern were the higher odds of continued smoking among survivors who were younger, without a partner, and with a lower level of education. The increased odds of smoking with lower education is consistent with socio-demographic trends in the general Australian population[43]. The finding that younger survivors are more likely to continue to smoke is consistent with one Australian[12] and two American population based studies[20, 21]. Additional support may be required to assist these sub-groups of survivors in quitting after their diagnosis. Surprisingly, no psychological or social support variables were associated with continued smoking.

Of those who continued to smoke six months after diagnosis, more than half expressed an intention to quit sometime in the future. This high level of motivation for cessation is consistent with findings from a study of 1,825 mostly long term cancer survivors which found 64.7% of those who smoked reported a desire to quit[18]. Only 14% of survivors reported never intending to quit smoking. Given that successful quitting is strongly related to initiating quit attempts, these survivors may represent a difficult to reach, unmotivated group for whom additional support for smoking cessation is required.

While survivors who continue to smoke after a cancer diagnosis are likely to require intensive support to quit smoking, two systematic reviews have shown that existing cessation interventions have little impact[39, 44]. Additional work to identify the most effective strategies to assist recent cancer survivors to quit is needed. This may include examining the timing of provision of the intervention; whether single or multiple health risk behaviours are targeted; the healthcare provider who delivers the intervention; and mode of delivery. Work undertaken with a subsample of participants in the *Cancer Survival Study* revealed that most survivors expressed a preference for lifestyle behaviour interventions to be provided in formats other than telephone, and at multiple time points[45]. These findings should be used to inform development of relevant smoking cessation intervention strategies.

Strengths and limitations

This is the first large population-based study to examine smoking within a heterogeneous sample of recent cancer survivors. Although participants were recruited from state-based cancer registries, smoking status is not available from registry records. Therefore, while a standardised approach to assessing self-reported smoking was used, it is possible that some participants may have failed to disclose their smoking which may have led to under-reporting of smoking prevalence. The small number of survivors who reported being current smokers at diagnosis may reduce power and increase the standard error of estimates in the multiple logistic regression analysis. While the response rate of 41% was lower than desired, this is a conservative estimate as it assumes that survivors whose physician was uncontactable or refused, and survivors who were uncontactable or non-responders, were eligible. Even without deducting these survivors of unknown eligibility, the response rate exceeds the adjusted recruitment rate achieved by the American Cancer Society's Study of Cancer Survivors-II (32.7%), which used a similar registry-based method of recruitment[13]. It is possible that some of the non-responders were also smokers, resulting in under-reporting of smoking prevalence. While the association between a number of sociodemographic, disease and psychosocial factors was examined in relation to smoking behaviour, other relevant factors such as smoking history of the household, recommendations to quit smoking and participation in smoking cessation were not assessed.

Conclusions

Less than 10% of recent Australian cancer survivors report continued smoking six months following a cancer diagnosis. Survivors who continue to smoke after a cancer diagnosis may represent a difficult to reach, unmotivated group for whom additional support for smoking cessation is required.

Conflict of interest statement: The authors declare that there are no conflicts of interest.

Ethical approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.”

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