Title

Awareness of cancer risk factors and protective factors among Australian adults

Running title

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Conflict of Interest statement

The authors have no conflict of interest to declare.

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Awareness of cancer risk factors and protective factors among Australian adults

Abstract

Issue addressed:

Up to one third of incident cancers in Australia are attributable to modifiable factors. Understanding the general public's awareness of cancer risk and protective factors is important for identifying knowledge gaps and informing the development of effective and targeted health promotion strategies.

Methods:

In a telephone survey of 355 Western Australian adults aged 18-54 years (48% male), with a sample skewed towards low-SES areas, respondents rated the effect on cancer risk of 11 established cancer risk factors and 7 established cancer protective factors.

Results:

Most respondents correctly recognised the increased cancer risk from sun tanning (94%), asbestos (92%), pesticide use (92%), and being overweight or obese (86%), and the protective effect of being physically active (82%). Half (52%) of respondents incorrectly believed red wine decreased or had no effect on cancer risk. One in five respondents (19%) incorrectly believed sunscreen use increased cancer risk. Only 18% of respondents were aware that HPV vaccination confers a protective effect, while 17% believed it increases risk.

Conclusions:

Although the majority of respondents were aware of certain established cancer risk and protective factors, a sizeable proportion held misconceptions about the cancer risk associated with red wine consumption, sunscreen use, and HPV vaccination.

So what?

Health promotion programs designed to educate the public about modifiable cancer risk factors may need to increase public awareness of the safety of preventive factors such as HPV vaccination and sunscreen, and the increased cancer risk from consumption of all alcoholic beverage types, including red wine.

Summary

Surveyed Western Australian adults had high levels of awareness that sun tanning, asbestos, pesticide use, and excess body weight increase cancer risk and that physical activity decreases cancer risk. Public health campaigns may need to address misconceptions about other established risk and protective factors, such as red wine, sunscreen, and HPV vaccination.

Keywords

- Cancer
- Beliefs
- Risk factors
- Protective factors
- Causation

Introduction

Cancer is one of the leading causes of mortality and morbidity in Australia^{1,2}, accounting for more than 800,000 years of life lost in 2015³. Modifiable risk factors, including dietary, lifestyle, environmental, and occupational exposures, contribute to an estimated 44% of the burden of disease from cancers in Australia². One third of incident cancers in Australia are attributable to dietary and lifestyle factors such as tobacco smoke, alcohol consumption, physical inactivity, excess body weight, and inadequate intake of fibre, fruit, and vegetables⁴.

Public recognition of modifiable cancer risk factors varies widely. While the carcinogenic effects of tobacco use and sun exposure are generally well recognised, awareness of other established risk factors among the general population is less consistent⁵⁻¹³. For example, research conducted in the last decade has found that 30–80% of adults are aware that inadequate dietary intake of fruit and vegetables increases cancer risk^{5-8,13}, while 43–81% of adults identify alcohol⁶⁻⁸ and 62–74% of adults identify excess body weight⁶⁻⁸ as cancer risk factors. Few studies have examined public perceptions about occupational cancer risk factors, although a 2007–2008 study reported that 94% of Western Australian adults were aware that asbestos increased cancer risk⁸. Several studies have examined awareness of established reproductive cancer risk factors such as hormone

replacement therapy (HRT)^{14,15} or breastfeeding¹⁶; among these studies awareness varied widely. Awareness of established cancer risk factors may be moderated by demographic factors such as age, gender, marital status, employment, education, socioeconomic status (SES), ethnicity, country of birth or residence, and personal or familial history of cancer^{5-8,10,12,13,17-19}.

Previous research suggests that awareness of cancer risk factors may be associated with adherence to health guidelines and engagement in cancer protective behaviours such as maintaining a healthy body weight, exercising, limiting alcohol consumption, and eating recommended amounts of fruit and vegetables^{5,13}. Nearly two thirds of Australians are overweight and almost one third are insufficiently active²⁰, with 17% of Australians consuming alcohol at levels exceeding lifetime risk guidelines²¹ and 93% consuming inadequate amounts of vegetables²². Given the substantial proportion of cancers in Australia that are attributable to such factors, the ongoing monitoring of public awareness of modifiable cancer risk factors is important for appropriately targeting health promotion campaigns. Although several recent studies have reported public awareness of cancer risk factors in the United Kingdom^{6,13}, Scandinavia⁷, and New Zealand²³, few studies have described awareness of multiple risk or protective factors for cancer among the Australian population in the last decade. Kippen et al reported awareness among New South Wales adults of seven cancer risk factors from a 2013 survey and measured the association between risk factor awareness and cancer protective behaviours; the authors reported that only 40–60% of adults were aware that excess body weight, alcohol consumption, inadequate fruit intake, and inadequate vegetable intake increased cancer risk⁵. MacTiernan et al described Western Australian (WA) adults' beliefs in 2007–2008 about established and unestablished risk and protective factors for cancer, and found that while more than 90% of Western Australians could identify smoking, passive smoking, asbestos, and solariums as risk factors, only 57% were aware that alcohol increased cancer risk⁸. The aim of the present study was to measure current awareness among WA adults of both risk and protective factors for cancer.

Methods

Study population

Telephone surveys were conducted from August to December 2017 using computer-assisted telephone interview. Respondents were WA adults aged 18–54 years who were randomly recruited via the White Pages electronic database. The upper age limit of 54 years was chosen in accordance with previous research indicating that midlife is a critical period for the accumulation of lifestyle and environmental cancer risk factors²⁴. Quotas were set to achieve approximately equal representation of males and females and a ratio of 70%:30% metropolitan to regional residents. Recruitment was skewed towards socioeconomically disadvantaged areas, as Australian adults from these areas have higher levels of cancer incidence and mortality¹.

Survey participation

Ethical approval to conduct the study was obtained from the Curtin University Human Research Ethics Committee, approval #RD-19-14. A sample of 304 non-smoking adults (response rate: 33.2%) rated cancer risk and protective factors prior to responding to a survey about tobacco control policy. A sample of 51 adults who were regular smokers (response rate: 14.5%) rated cancer risk and protective factors after responding to a tobacco control survey that included questions about tobacco use, quitting intentions, and perceptions of an anti-tobacco media campaign.

Beliefs about cancer risk

Respondents reported their beliefs about the effect of 43 specified factors on cancer risk (Supplementary Table 1), which included 11 cancer risk factors and 7 cancer protective factors (Table 2). The majority of risk and protective factors were chosen for inclusion in the survey as they had previously been used in a study of WA adults' perceptions of cancer risk factors⁸ and in a breast cancer case-control study¹⁷. Additional factors were modified from these previous surveys or added in accordance with changing evidence and health policies. Established risk factors were classified as such if they were deemed by the International Agency for Research on Cancer (IARC) to be Group 1 or Group 2A carcinogenic agents, or if IARC reported sufficient evidence for their association with cancer²⁵⁻²⁷. Protective dietary factors were those deemed by the World Cancer Research Fund/American Institute for Cancer Research as having strong evidence for a protective effect on cancer risk, as outlined in the 2018 Continuous Update Project Third Expert Report²⁸. Protective lifestyle factors were those described by IARC or the World Health Organization as reducing cancer risk^{26,29}. Tobacco smoking was deliberately omitted from the survey as it was deemed likely that responses for this risk factor would have been biased for the respondents who completed a tobacco control survey prior to rating cancer risk and protective factors.

For lifestyle and environmental factors, respondents were asked "Which of the following do you think increase, decrease or have no effect on the risk of cancer of any type?". For dietary factors, respondents were asked "Do you think eating any of the following types of food on a regular basis increases, decreases or has no effect on the risk of cancer of any type?". For each factor, respondents could select from five responses: "Decrease a lot", "Decrease a little", "No effect", "Increase a little", and "Increase a lot". Respondents who did not correctly identify established risk and protective factors were not given educational information about these as it was not feasible to do so within a telephone survey.

Statistical analysis

Responses for "Decrease a lot" and "Decrease a little" were grouped together for analysis, as were responses for "Increase a little" and "Increase a lot", resulting in four response categories: "Decrease", "No effect", "Increase", and "Don't know". Percentages across all respondents for these four response categories are reported in Table 2. Responses for awareness of the effect of breastfeeding and HRT are presented for female respondents only, as only females would be directly exposed to these factors.

Socio-economic disadvantage was calculated from the Australian Bureau of Statistics' Socio-Economic Indexes for Areas (SEIFA)³⁰ using respondents' self-reported residential postcode. Correct identification of risk and protective factors by demographic characteristics was measured using chi-square tests for binary variables (gender, metropolitan/regional location, and tertiary education) and simple logistic regression models for continuous variables (age, SES). All demographic tests used a Bonferroni-corrected level of significance ($P < 0.003$) to control for the familywise error rate.

Results

Respondents

Respondents were generally representative of the WA population in terms of gender (48% males in the sample vs 50% in the WA general population³¹). More than half of respondents (56%) were from the two least advantaged SEIFA quintiles (Table 1), in accordance with the deliberate oversampling of low SES areas. Respondents were not generally representative of the WA population in terms of age due to deliberate sampling of adults aged 18-54 (10% of the sample aged 18-24 vs 9% of the WA population; 19% of the sample aged 25-34 vs 16% of the WA population; 33% of the sample aged 35-44 vs 14% of the WA population, 38% of the sample aged 45-54 years vs 13% of the WA population³²).

Awareness of established cancer risk factors

Of the 11 established risk factors, 8 (sun tanning, asbestos, pesticides, being overweight or obese, alcohol, diesel exhaust, beer, and cured meat) were correctly identified by a majority of respondents as increasing cancer risk (Table 2). A minority of respondents were aware of the increased cancer risk associated with red meat and red wine. Notably, among those respondents who recognised alcohol as a risk factor, 23% reported that red wine had no effect on cancer risk and 25% believed that it decreased risk (Supplementary Table 2). Less than half of female respondents were aware of the increased cancer risk from HRT.

Awareness of established cancer protective factors

Five of the 8 established protective factors (being physically active, vegetables, fruit, high fibre food, sunscreen, and, among women, breastfeeding) were correctly identified as such by a majority of respondents (Table 2). Although more than half of respondents were aware that sunscreen decreased cancer risk, one in five incorrectly believed that it increased risk (Table 2). A minority of respondents (18%) were aware that human papillomavirus (HPV) vaccination conferred a protective effect on cancer risk, with more than twice as many respondents reporting that it increased or had no effect on risk. Awareness of the protective effect of breastfeeding was recognised by approximately half of women, with 41% stating that it had no effect on cancer risk.

Differences in awareness by age and demographic factors

A significant gender difference was observed for only 2 of the 18 risk and protective factors. Males were significantly more likely than females to be aware that diesel exhaust increased cancer risk ($P<0.001$, 85% of males vs 68% of females), while females were more likely than males to identify HRT as increasing risk ($P=0.001$, 32% of males vs 49% of females). Awareness of risk and protective factors differed by age for one factor only; older adults were less likely than younger adults to correctly identify red wine as increasing cancer risk (OR=0.96, 95% CI=0.94-0.98, for each year increase in age). There were no significant differences by metropolitan/regional location, SES, or tertiary education for any of the 18 factors.

Discussion

This study demonstrates that recognition among Western Australian adults of established cancer risk and protective factors varies widely. The vast majority of respondents were aware of certain cancer risk factors such as sun tanning and exposure to asbestos and pesticides, and most respondents identified physical activity as decreasing cancer risk. However, fewer respondents were aware of other established risk and protective factors such as red wine, sunscreen, and HPV vaccination.

The majority of respondents in the present study were aware of the increased cancer risk from alcohol consumption, and these results accord with previous studies in Australia and other OECD countries that have reported levels of awareness of 43–81% among adults^{6-8,11}. Despite the fact that alcohol was recognised as a risk factor by most respondents in the present study, awareness of the increased cancer risk from red wine was low, which is consistent with previous studies in Australia^{8,17,33} and internationally¹⁶. It is plausible that the discrepancies between beliefs about alcohol and specific alcoholic beverage types such as red wine are attributable to misinformation disseminated by the alcohol industry about the cardiovascular and other health benefits of alcohol consumption³⁴⁻³⁶. Recent evidence suggests that the alcohol industry has routinely employed tactics to obfuscate the association between alcohol and cancer risk, including downplaying or denying the association between alcohol and cancer, and claiming that alcohol may confer a protective effect on cancer risk³⁴. The representation of alcohol in popular media may also play a role in informing public awareness of alcohol as a cancer risk factor; a recent study of Australian newspaper coverage of the link between alcohol and cancer reported that red wine was the most frequently cited beverage type among articles claiming that alcohol prevents or does not cause cancer³⁷.

Sun tanning was the most highly ranked cancer risk factor among the WA adults surveyed in this study. These results accord with other studies in Australia and internationally which have reported high levels of awareness among the general population for the increased cancer risk from sun exposure^{5,6,9,11} and solariums^{7,8,38}. Despite the high levels of awareness about the risk of sun exposure among adults surveyed in the present study, just over half of respondents perceived that sunscreen would confer a protective effect against cancer. These results differ from a 2007–2008 survey reported by MacTiernan et al, in which 73% of WA adults believed that

sunscreen would decrease cancer risk⁸. This discrepancy between awareness of the protective effect of sunscreen on cancer risk and perceptions about the health risks associated with sunscreen may be related to popular media reports about the negative health effects of nanoparticles and other ingredients in sunscreen³⁹⁻⁴². In a recent survey of Australian adults, 17% of respondents were concerned that sunscreen contained ingredients that were “bad for [one’s] health”⁴³. To date, the Therapeutic Goods Administration reports no evidence of harm or toxicity from titanium dioxide or zinc dioxide nanoparticles when used in sunscreens⁴⁴ and has approved a range of other sunscreen ingredients⁴⁵. The results of the present study therefore suggest that while future Australian sun protection campaigns should continue to educate the public about the risk of sun exposure to maintain high levels of awareness of this risk factor, these campaigns may also need to address public misconceptions about the safety of sunscreen, as some cancer prevention organisations have begun to do by providing information online⁴⁶⁻⁴⁸.

Notably, the majority of respondents in the present study were unaware that HPV vaccination decreases cancer risk. The observed awareness of the protective effect of HPV vaccination was markedly lower than that reported in an evaluation of HPV knowledge in which 62–63% of Australian adults in 2011 were aware that “HPV vaccines offer protection against most cervical cancers”⁴⁹. Nearly one in five respondents in the present study believed that HPV vaccination would increase cancer risk, which may be indicative of public concerns about the safety of vaccines and myths about their effect on cancer⁵⁰. These results therefore indicate a need for education campaigns to increase public awareness of the safety of HPV vaccination and the evidence for its protective effect on cancer risk.

Awareness of cancer risk was generally low for factors to which women are exclusively exposed, with only half of female respondents aware that HRT increases risk and that breastfeeding confers a protective effect. It is possible that neither factor was a salient issue for many female respondents and this may have influenced awareness of their effects on cancer risk; previous research has shown that beliefs about the effect of breastfeeding and HRT on breast cancer risk are associated with parity and age, respectively⁵¹. However, insufficient breastfeeding and use of HRT are established modifiable risk factors, and the present study therefore demonstrates the importance of healthcare professionals providing women with accurate information about these factors so that they may make appropriately informed choices.

The disparity between scientific evidence and beliefs held by survey respondents about certain risk and protective factors for cancer may be symptomatic of the complex science of establishing carcinogenicity. For example, IARC classifies exposures on an ordinal scale (Group 1–Carcinogenic; Group 2A–Probably carcinogenic; Group 2B–Possibly carcinogenic; Group 3–Unclassifiable; and Group 4–Probably not carcinogenic), rather than as binary categories of cancer-causing or preventing agents. Similarly, the World Cancer Research Fund’s Continuous Update Project designates dietary and physical activity preventive factors as having strong or limited evidence for decreased or increased cancer risk, with categories that include convincing, probable, limited–suggestive, limited–no conclusion, and “substantial effect on risk unlikely”²⁸. Given the complex process of establishing and communicating carcinogenicity, it is perhaps unsurprising that

the present study found numerous misconceptions about cancer risk and protective factors among respondents. Popular media may also play a role in perpetuating such misunderstandings, particularly where media stories present non-evidence-based claims about established cancer risk factors or preventive behaviours^{37,52}, or use single or laboratory-based studies to make claims about the general population^{53,54}. It therefore remains an important challenge for public health organisations to distil the available evidence for cancer risk and protective factors into clear messages that can be readily comprehended and accessed by the general public.

Study limitations

Although recruitment was from various age groups and from both metropolitan and regional locations, there were a disproportionately high number of respondents from less advantaged socioeconomic areas due to a deliberate oversampling of individuals from those areas. Consequently, the results may only be generalisable to Western Australian adults from socioeconomically disadvantaged areas. However, cancer incidence and mortality in Australia are inversely related to socioeconomic advantage¹, and it is therefore important to establish awareness of preventable risk factors among disadvantaged populations.

Additionally, although the White Pages electronic database from which respondents were recruited includes both landline and mobile telephone numbers, mobile numbers are listed in the database only at the owner's request. As such, the study sample excluded mobile-only households with an unlisted mobile number and households with an unlisted landline. Previous research has shown that having an unlisted landline number or residing in a mobile-only household may be associated with sociodemographic factors such as age, country of birth, and socioeconomic status^{55,56}, and these sociodemographic factors may in turn influence awareness of cancer risk factors^{5-8,10,12,13}.

The present study was also limited by the way in which smokers and non-smokers rated cancer risk items in different survey streams, as non-smokers rated cancer risk and protective factors prior to responding to a tobacco control survey, and smokers completed a tobacco control survey prior to rating cancer risk and protective factors. It is possible that completing a tobacco control survey prior to rating risk and protective factors could have primed smokers' responses; however, respondents were specifically advised that questions about cancer risk related to cancer of any type. Finally, tobacco smoking is the leading cause of preventable death in Australia and this study was limited by the deliberate omission of this cancer risk factor. However, previous research has demonstrated high levels of awareness among the Australian general public of the increased cancer risk from smoking^{5,8}, and as such, it is not expected that results pertaining to awareness of the cancer risk from tobacco smoking would have made a unique contribution to the literature.

Conclusion

This survey of WA adults found high levels of awareness for certain established cancer risk and protective factors such as sun tanning, asbestos, pesticide use, being overweight or obese, and being physically active.

Although the majority of respondents were aware of the increased cancer risk from alcohol consumption, half of respondents believed that red wine decreased or had no effect on cancer risk. Similar misconceptions were pervasive among many respondents with respect to sunscreen and HPV vaccination, with nearly one in five respondents incorrectly believing that each of these established protective factors increased cancer risk. The findings of this study demonstrate that public health campaigns aiming to educate the public about modifiable cancer risk and protective factors may also need to focus on dispelling myths about those same factors.

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Tables

Table 1: Demographic characteristics of survey respondents (n=355)

	Survey respondents	
	n	%
Gender		
Male	170	47.9
Female	185	52.1
Age group		
18-24	36	10.1
25-34	66	18.6
35-44	118	33.2
45-54	135	38.0
Location		
Perth metropolitan area	244	68.7
Regional WA	111	31.3
SEIFA quintile		
1 (Least advantaged)	39	11.0
2	160	45.1
3	72	20.3
4	38	10.7
5 (Most advantaged)	41	11.5
Refused	5	1.4
Bachelor degree or higher education		
No	233	65.6
Yes	118	33.2
Refused	4	1.1

Table 2: Respondents' beliefs about established cancer risk and protective factors

	Decrease	No effect	Increase	Don't know
	%	%	%	%
Risk factors				
Sun tanning	1.1	2.5	94.4	2.0
Asbestos	0.3	3.9	92.4	3.4
Pesticides	1.1	3.1	92.4	3.4
Being overweight or obese	1.1	9.3	86.5	3.1

Alcohol	1.7	13.2	80.3	4.8
Diesel exhaust	0.6	13.0	76.1	10.4
Beer	3.7	21.7	66.8	7.9
Cured meat like ham, bacon and salami	2.0	24.2	63.4	10.4
Red meat	12.7	38.3	41.7	7.3
Hormone replacement therapy*	1.6	18.9	48.6	30.8
Red wine	23.9	27.9	36.6	11.5
Protective factors				
Being physically active	82.0	14.9	1.7	1.4
Vegetables	72.4	22.8	2.0	2.8
Fruit	61.1	31.5	3.4	3.9
High fibre food	57.5	29.0	5.1	8.5
Sunscreen	56.1	17.7	19.2	7.0
Breastfeeding one's child*	51.4	40.5	3.2	4.9
HPV vaccination	18.3	27.3	17.2	37.2

* Female respondents only

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