Differences in chronic conditions and lifestyle behaviour between people with a history of cancer and matched controls

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Abstract

Objective: To determine whether people with a history of cancer have a higher prevalence of chronic conditions or different lifestyle behaviour compared with controls.

Design, setting and participants: Cross-sectional, self-reported data from a telephone survey conducted between 1 January 2010 and 31 March 2012 of adult residents of South Australia who self-reported a previous cancer diagnosis (cases) and randomly selected age- and sex-matched residents with no cancer diagnosis (controls).

Main outcome measures: Self-reported medically diagnosed cardiovascular disease, hypertension, hyperlipidaemia, diabetes and osteoporosis; lifestyle behaviour (smoking, physical activity and diet); body mass index (BMI); psychological distress and self-reported health.

Results: A total of 2103 cases and 4185 controls were included in the analyses. For men, after adjusting for age, cancer survivors were more likely than controls to have ever had cardiovascular disease ($P < 0.001$), high blood pressure ($P = 0.001$), high cholesterol ($P < 0.001$) and diabetes ($P = 0.04$). These associations remained significant after controlling for socioeconomic status (SES), with the exception of high blood pressure ($P = 0.09$). For women, there was an increased prevalence of high cholesterol ($P = 0.005$), diabetes ($P = 0.02$) and osteoporosis ($P = 0.005$) in cancer cases, but after adjusting for SES, these associations were no longer significant. Women with a previous cancer diagnosis were more likely than controls to have ever smoked, after adjusting for SES ($P = 0.001$). There were no other differences in lifestyle behaviour or BMI between cases and controls for men or women.

Conclusion: Despite similar lifestyle habits and BMI, the prevalence of chronic conditions was significantly higher among people with a history of cancer than among controls without cancer. This supports the importance of chronic disease management as part of health care after a diagnosis of cancer.

Health care of cancer survivors has traditionally focused on detecting cancer recurrence, with less focus on managing chronic diseases. This is despite growing evidence that cancer survivors have a significant burden of non-cancer chronic illness.[1,2] Most of this evidence has come from population-based studies,[3,4] with few case–control studies.[5] An Australian population-based study showed that long-term cancer survivors were more likely than controls to report multiple long-term conditions.[6] Another study found that people with a history of cancer were nearly 50% more likely to die of non-cancer causes than the general population.[7]

Very few studies have looked at the impact of sex on the association between cancer and comorbidity. A Dutch cancer registry study of colon cancer patients showed that comorbidity was more likely in men and in patients with lower socioeconomic status (SES),[8,9] consistent with general patterns of comorbidity in people without cancer.[10] Another study of cancer patients from the Dutch registry also showed a higher likelihood of comorbidity in men and a 50% greater risk of serious comorbidity in those with low SES.[11]

Our aim was to determine whether individuals previously diagnosed with cancer reported a higher prevalence of chronic conditions or different lifestyle behaviour than age- and sex-matched controls. We also examined self-reported health in those with cancer and chronic conditions compared with those with cancer and no chronic conditions.

Methods

Data were collected using the South Australian Monitoring and Surveillance System (SAMSS) from 1 January 2010 to 31 March 2012. SAMSS is a computer-assisted telephone interview survey that monitors self-reported trends in diseases, health problems, risk factors and health service use over time.[12]

This study was approved by the human research ethics committees at the South Australian Department for Health and Ageing and Flinders University, and participants gave verbal informed consent before participating.

Questions relating to cancer diagnosis for participants aged 18 years or over were used to identify those with a previous cancer diagnosis and up to two age- and sex-matched controls per cancer case. We used propensity score matching techniques[13] to probabilistically match about two survey respondents without cancer to each survey respondent with current cancer or a history of cancer. Matching was performed according to 5-year age groups (from 15–20 years to 95–100 years) and sex.

Data items

The questions used are shown in Appendix 1 (online at mja.com.au). Prevalence of chronic conditions was assessed by asking respondents if they had ever been medically diagnosed with cardiovascular disease, high blood pressure, high cholesterol, diabetes and osteoporosis. Self-reported health was determined by respondents rating their health on a five-category scale from excellent to poor. Psychological distress was assessed using the 10-item Kessler

Psychological Distress Scale (K10).[14] Self-reported height and bodyweight were used to calculate body mass index (BMI).

Physical activity was measured using six questions from the Active Australia Survey.[15] Answers to these questions were summed into three categories to establish whether sufficient physical activity was being performed, in accordance with national guidelines.[16]

SES was assessed using the Socio-Economic Indexes for Areas (SEIFA) score.[17] Data were also collected on education, social environment, work status, family structure, income and first language other than English.

Statistical analysis

Demographic variables were compared using χ^2 tests. We used conditional logistic regression to assess the association between cancer status and each of the chronic condition prevalence outcomes and whether participants met fruit and vegetable intake recommendations. We used a random-effects ordinal logistic regression model to assess the association between cancer status and self-rated health and sufficiency of exercise. For this, the matched group of participants (ie, one case and two controls) was the random effect. For each analysis, we first adjusted for age. Then, to control for any differences between groups in SES, we adjusted for SEIFA score, with education, social environment, work status, family structure, income and first language other than English also entered into the model as potential confounders. All analyses were stratified by sex.

As a sensitivity analysis, we estimated morbidity effects for cancer cases diagnosed within the previous 5 years compared with those diagnosed more than 5 years previously.

The data were not survey weighted as we used only a subset of the original survey data for this study. All analyses were performed using Stata, version 12.1 (StataCorp). Each analysis was performed as a two-sided hypothesis test with variables considered significant if $P < 0.05$.

Results

From 1 January 2010 to 31 March 2012, 40 528 dwellings in South Australia were selected. Of these, 9711 were out of scope (not eligible or disconnected phone numbers), 5869 residents refused to participate, 2938 could not be contacted, 966 were non-English speakers, and 1536 were unavailable or incapacitated. In total, 19 508 interviews were completed, achieving a response rate of 63% of those in scope. Of these, 2103 respondents were identified as having been diagnosed with cancer (cases) and were age- and sex-matched to 4185 respondents without previous cancer (controls). Although we were able to match 96.3% (2025/2103) of cancer respondents to two controls, suitable matching could not be done for some older respondents (⩾ 90 years of age): 18 cases were unmatched, and 30 were matched with only one control. All matched and unmatched cases were included in the analysis.

In the cancer group, 938 participants (44.6%) were men and 1165 (55.4%) were women; the mean (SD) age was 69.6 (11.6) years for men and 68.0 (12.5) years for women. In the control group, 1860 participants (44.4%) were men and 2325 (55.6%) were women; the mean (SD) age was 69.3 (11.6) years for men and 67.8 (12.5) years for women. There were no significant differences in mean ages between the groups.

The demographic profile of the sample is outlined in Appendix 2 (online at mja.com.au). Compared with controls, a greater proportion of women in the cancer group reported high to very high psychological distress, and greater proportions of both men and women in the cancer group reported poor self-rated health. There were no significant differences between cases and controls for BMI.

Skin cancer (melanoma and non-melanoma) was the most commonly reported cancer (35.7%), followed by breast cancer, male (prostate and testicular) cancer, and gastrointestinal cancer (Appendix 3, online at mja.com.au).

Mean (SD) time since diagnosis for the cancer group was 10.86 (10.38) years, with 5.5% (114/2063) diagnosed less than 1 year before the survey, 28.0% (578/2063) diagnosed 1–4.99 years previously, and 66.5% (1371/2063) diagnosed 5 or more years previously.

For men, when adjusted for age, cancer survivors were significantly more likely than controls to have ever had cardiovascular disease, high blood pressure, high cholesterol and diabetes (Box 1). When adjusted for age and SES, the increased odds remained for all variables except high blood pressure. For women, when adjusted for age, cancer survivors were significantly more likely than controls to have ever had high cholesterol, diabetes and osteoporosis. However, after adjusting for SES, these associations were no longer significant.

In the sensitivity analysis comparing cancer cases diagnosed within the previous 5 years with those diagnosed more than 5 years previously, we found no substantive differences in the results except for the prevalence of hypertension among men diagnosed with cancer more than 5 years ago (significantly increased odds for cancer cases compared with controls in the adjusted model: odds ratio, 1.36; 95% CI, 1.03–1.80; $P = 0.03$).

For men, there were no significant differences between cancer cases and controls for any lifestyle variables (Box 2). For women, there was a significant association between cancer diagnosis and smoking status, which remained significant after being fully adjusted. There was also a significant association with physical activity status in women, which was no longer significant after adjusting for SES.

There was a significant association between self-reported health and the presence of one or more chronic conditions among cancer cases. For men, 35.9% (265/739) of those with cancer and one or more chronic conditions rated their health as fair or poor compared with 19.6% (39/199) of those with cancer alone ($P < 0.001$). For women, these figures were 38.9% (350/900) compared with 19.2% (51/265) ($P < 0.001$). A similar pattern was seen in the control group, with 26.8% (341/1272) of men with one or more chronic conditions reporting fair or poor health compared with 12.4% (73/588) of men with no chronic conditions ($P < 0.001$), and 27.4% (462/1686) compared with 12.8% (82/639) of women ($P < 0.001$).

Discussion

We found that individuals with a history of cancer had a higher prevalence of chronic conditions, compared with

age- and sex-matched controls. Men with a history of cancer had increased odds of ever having had cardiovascular disease, high blood pressure, high cholesterol and diabetes, which remained significant after adjusting for SES. Among women, the apparent relationship between cancer status and self-reported high cholesterol, diabetes and osteoporosis was largely explained by SES, with the association weakening after adjusting for SES factors. These results support previous research findings that cancer survivors are more likely to report having other long-term comorbidities,[5,6] with men more at risk than women.[8]

We observed these differences in chronic disease prevalence between cancer survivors and controls despite similar lifestyle behaviour between the groups, including diet and physical activity, and similar levels of overweight or obesity. These findings are similar to those of another Australian study, which showed that women with a history of cancer were more likely to be smokers but there were no differences in physical activity or fruit and vegetable consumption between cancer patients and controls.[18] Such observations support an association between cancer and chronic disease, although the underlying mechanisms and causal direction are unknown.

It is possible that chronic illness itself may predispose to cancer. Increased risk of cancer has been reported in patients with diabetes,[19] and cardiovascular disease and osteoporosis share the common aetiological factors of inactivity and obesity with cancer. Likewise,

1 Odds ratios (ORs) for self-reported chronic conditions among men and women, for cancer cases versus matched controls

Chronic condition*	Controls	Cancer cases	Age-adjusted OR (95% CI)	*P*	Adjusted OR† (95% CI)	*P*
Men	*n* = 1860	*n* = 938				
Cardiovascular disease						
Yes	443 (23.8%)	281 (30.0%)	1.39 (1.16–1.67)	< 0.001	1.48 (1.15–1.90)	0.002
No	1417 (76.2%)	657 (70.0%)	1.00		1.00	
High blood pressure						
Yes	901 (48.4%)	515 (54.9%)	1.30 (1.11–1.53)	0.001	1.19 (0.97–1.47)	0.09
No/don't know	959 (51.6%)	423 (45.1%)	1.00		1.00	
High cholesterol						
Yes	752 (40.4%)	448 (47.8%)	1.35 (1.15–1.59)	< 0.001	1.43 (1.16–1.76)	0.001
No/don't know	1108 (59.6%)	490 (52.2%)	1.00		1.00	
Diabetes						
Yes	300 (16.1%)	180 (19.2%)	1.24 (1.01–1.52)	0.04	1.47 (1.11–1.94)	0.007
No/don't know	1554 (83.6%)	756 (80.6%)				
Missing	6 (0.3%)	2 (0.2%)				
Osteoporosis						
Yes	85 (4.6%)	50 (5.3%)	1.18 (0.82–1.70)	0.38	1.11 (0.67–1.85)	0.69
No	1763 (94.8%)	879 (93.7%)				
Missing	12 (0.6%)	9 (1.0%)				
Women	*n* = 2325	*n* = 1165				
Cardiovascular disease						
Yes	328 (14.1%)	183 (15.7%)	1.11 (0.91–1.37)	0.30	1.17 (0.86–1.58)	0.31
No	1997 (85.9%)	982 (84.3%)	1.00		1.00	
High blood pressure						
Yes	1192 (51.3%)	605 (51.9%)	1.02 (0.88–1.19)	0.76	0.94 (0.77–1.16)	0.58
No/don't know	1133 (48.7%)	560 (48.1%)	1.00		1.00	
High cholesterol						
Yes	997 (42.9%)	557 (47.8%)	1.23 (1.07–1.43)	0.005	1.04 (0.85–1.30)	0.67
No/don't know	1328 (57.1%)	608 (52.2%)	1.00		1.00	
Diabetes						
Yes	260 (11.2%)	164 (14.1%)	1.28 (1.04–1.58)	0.02	1.19 (0.88–1.62)	0.26
No	2062 (88.7%)	998 (85.7%)				
Missing	3 (0.1%)	3 (0.2%)				
Osteoporosis						
Yes	359 (15.4%)	226 (19.4%)	1.31 (1.08–1.58)	0.005	1.24 (0.94–1.65)	0.12
No	1942 (83.5%)	930 (79.8%)				
Missing	24 (1.0%)	9 (0.8%)				

* Respondents were asked if they had ever been medically diagnosed with each condition. † Adjusted for age, Socio-Economic Indexes for Areas score, education, social environment, work status, family structure, income and first language other than English. ORs were obtained using conditional logistic regression. ◆

cancer or cancer treatment may predispose to chronic disease. Endothelial dysfunction, platelet activation and upregulation of prothrombotic factors as a result of anticancer therapy have been postulated, but other mechanisms, yet to be defined, could be involved.[20] Similar associations between therapy and development of chronic disease have been observed in the treatment of HIV, where chronic inflammation and disruption of normal immunity have been proposed as an aetiological mechanism.[21]

Our findings indicate that men with cancer are more likely to report chronic illness, consistent with other studies.[8] This may be due to different types of cancers observed in men, different cancer treatments used or a general greater predisposition to chronic illness in men.[10] It is possible that the association is due to men being more likely to have undiagnosed chronic disease because they have fewer interactions with health and medical services. As diagnosis and treatment of cancer brings men under the surveillance of health and medical services, where other chronic conditions are more likely to be identified, the difference between male cancer survivors and controls may be a result of underdiagnosis of chronic conditions in the controls.

For women, the association of cancer with chronic illness was no longer significant after adjusting for SES. It is unclear why the association between cancer and chronic illness differs between men and women, and may reflect differences in cancer type, health

2 Odds ratios (ORs) for lifestyle behaviour among men and women, for cancer cases versus matched controls

Lifestyle behaviour	Controls	Cancer cases	Age-adjusted OR (95% CI)	*P*	Adjusted OR* (95% CI)	*P*
Men	*n* = 1860	*n* = 938				
Ever smoked						
Yes	1282 (68.9%)	675 (72.0%)	1.16 (0.97–1.38)	0.10	1.05 (0.84–1.32)	0.65
No	577 (31.0%)	263 (28.0%)				
Missing	1 (0.1%)	0				
Physical activity						
Sufficient	817 (43.9%)	412 (43.9%)	1.01 (0.87–1.17)	0.93	0.95 (0.79–1.13)	0.55
Active but not sufficient	537 (28.9%)	269 (28.7%)				
Not active	461 (24.8%)	234 (24.9%)				
Missing	45 (2.4%)	23 (2.5%)				
Recommended fruit intake (2 servings/day)						
Yes	780 (41.9%)	410 (43.7%)	1.08 (0.92–1.27)	0.35	1.14 (0.95–1.38)	0.16
No	1074 (57.7%)	524 (55.9%)	1.00		1.00	
Missing	6 (0.3%)	4 (0.4%)				
Recommended vegetable intake (5 servings/day)						
Yes	195 (10.5%)	112 (11.9%)	1.16 (0.91–1.49)	0.24	1.11 (0.83–1.50)	0.47
No	1631 (87.7%)	808 (86.1%)	1.00		1.00	
Missing	34 (1.8%)	18 (1.9%)				
Women	*n* = 2325	*n* = 1165				
Ever smoked						
Yes	1071 (46.1%)	589 (50.6%)	1.19 (1.03–1.37)	0.015	1.42 (1.17–1.73)	0.001
No	1253 (53.9%)	576 (49.4%)				
Missing	1 (0.04%)	0				
Physical activity						
Sufficient	886 (38.1%)	409 (35.1%)	1.19 (1.04–1.36)	0.01	1.16 (0.99–1.37)	0.07
Active but not sufficient	756 (32.5%)	368 (31.6%)				
Not active	629 (27.1%)	364 (31.2%)				
Missing	54 (2.3%)	24 (2.1%)				
Recommended fruit intake (2 servings/day)						
Yes	1284 (55.2%)	670 (57.5%)	1.10 (0.95–1.27)	0.20	1.10 (0.91–1.31)	0.99
No	1038 (44.7%)	494 (42.4%)	1.00		1.00	
Missing	3 (0.1%)	1 (0.1%)				
Recommended vegetable intake (5 servings/day)						
Yes	326 (14.0%)	167 (14.3%)	1.03 (0.84–1.26)	0.76	1.18 (0.92–1.51)	0.19
No	1985 (85.4%)	986 (84.6%)	1.00		1.00	
Missing	14 (0.6%)	12 (1.0%)				

*Adjusted for age, Socio-Economic Indexes for Areas score, education, social environment, work status, family structure, income, and language other than English. ORs were obtained using conditional logistic regression for fruit and vegetable intake, and random-effects ordinal logistic regression for smoking status and physical activity. ◆

utilisation or other factors that warrant further study. Our observation underscores the importance of SES in the overall disease burden after a diagnosis of cancer, especially for women. Low SES has been associated with worse cancer outcomes[22] and with higher rates of chronic disease.[23]

Our study indicates that those with a history of cancer face an additional burden of chronic illness, which may contribute to increased distress and a perception of poor health. In our study, those with a cancer diagnosis and at least one additional chronic condition were more likely to report poor health compared with those with cancer alone. While a similar association was found for controls with a chronic condition, these findings highlight the importance of managing chronic illness after a cancer diagnosis. Current models of care may not give the same attention to chronic disease management, despite its potential impact on health care use, costs and productivity.[24] Novel approaches to chronic disease management incorporating self-management strategies have been shown to be efficacious and cost-effective in the non-cancer setting,[25] and their use for patients with a cancer diagnosis should be explored.

Our study was unable to provide detailed information on how many respondents with previous cancer were treated with curative intent, but the data indicate that most (94.5%) had received a cancer diagnosis more than a year prior, with two-thirds diagnosed more than 5 years previously. Of note, 35.7% of the cancer patients had skin cancer, where information about the histological type and type of cancer treatment was not available. To examine any impact of the high proportion of skin cancers on our findings, we repeated the analysis both with and without skin cancer cases and found no difference in the odds of chronic conditions.

Our study offers insight into the disease burden after cancer diagnosis that warrants further investigation. Its limitations relate to the self-reported nature of the data, the cross-sectional study design, and the potential for selection bias of participants. As only residents who had access to a telephone and were well enough to answer it were able to take part, this may select against residents with or without cancer who were very ill or hospitalised. This is in addition to the survival bias inherent in prevalence studies, as those who had more severe cancer or more severe comorbidities may have died before they could participate. However, this potential bias would favour selection of long-term cancer survivors where the information on chronic illness is more relevant.

Research is needed into chronic illness after cancer diagnosis, with a focus on prevalence, underlying mechanisms and development of optimal management strategies.

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