Title: Differences in the health, mental health and health-promoting behaviours of rural versus urban cancer survivors in Australia

Running title: Rural versus urban cancer survivors

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Abstract

Purpose: People affected by cancer who live in rural Australia experience inferior survival compared to their urban counterparts. This study determines whether self-reported physical and mental health, as well as health-promoting behaviours, also differ between rural and urban Australian adults with a history of cancer.

Methods: Weighted, representative population data were collected via the South Australian Monitoring and Surveillance System between 1 January 2010 and 1 June 2015. Data for participants with a history of cancer (n= 4,295) were analysed with adjustment for survey year, gender, age-group, education, income, family structure, work status, country of birth and area-level relative socioeconomic disadvantage (SEIFA).

Results: Cancer risk factors and co-morbid physical and mental health issues were prevalent among cancer survivors regardless of residential location. In unadjusted analyses, rural survivors were more likely than urban survivors to be obese and be physically inactive. They were equally likely to experience other comorbidities (diabetes, chronic obstructive pulmonary disease, cardiovascular disease, arthritis or osteoporosis). With adjustment for SEIFA, rural/urban differences in obesity and physical activity disappeared. Rural survivors were more likely to have trust in their communities, less likely to report high/very high distress, but equally likely to report a mental health condition, both with and without adjustment for SEIFA.

Conclusions: There is a need for deeper understanding of the impact of relative socioeconomic disadvantage on health (particularly physical activity and obesity) in rural settings and the development of accessible and culturally appropriate interventions to address rural cancer survivors' specific needs and risk factors.

Key words: cancer, onco-, rural, regional, survivor, disparity, psych-

Introduction

Rural cancer patients experience a number of stressors in addition to those faced by their urban counterparts (e.g. travel for treatment), and are more likely to have unmet psychosocial needs [1-3] and inferior treatment outcomes [4, 5]. Australian cancer patients from remote or very remote areas are 35% more likely to die within 5 years of a cancer diagnosis than those living in highly accessible areas, while those in moderately accessible areas are 4% more likely to die within this time frame [4]. While survival for most common types of cancer is improving, there is evidence that the disparity in survival between rural and urban patients is growing [6, 7]. Australian studies comparing outcomes between rural and urban cancer patients have generally focused on the immediate post-diagnosis phase and crude survival and have not examined the potential influence of place of residence on large, representative samples of cancer survivors' post-treatment physical health, mental health or engagement in behaviours that may prevent cancer from reoccurring (e.g. exercise, non-smoking). Given rural patients' poorer five year survival [4], the fact that approximately one third of people with cancer in Australia live in rural and regional areas, and that research has identified the post-treatment phase as a *particularly* challenging time for this group [8-11], it is important to consider whether rural residence may be an important predictor of physical and mental health, and participation in preventive behaviour among Australian cancer survivors.

In addition to recognised disparities in cancer screening [12] and treatment [5, 13], there are numerous other reasons to suspect that geographic isolation may influence post-cancer treatment outcomes in Australian cancer survivors; for example costs and difficulties associated with accessing health care, lower socioeconomic status and education levels, and greater representation of more disadvantaged groups (e.g. Aboriginal and Torres Strait Islander people). Feelings of isolation and poor knowledge of available support services are also problems experienced by this population [9, 14].

Australian studies have found a high prevalence of co-morbid chronic conditions [15, 16], risk-promoting behaviours such as smoking [16] in the general cancer survivor population. In the United Kingdom, there is also evidence of ongoing poor health and well-being [17]. However, there is currently very limited Australian research *comparing these attributes across geographic groups*. One exception, is a study that compared levels of anxiety, depression and stress between rural and urban Australian haematological cancer survivors and did not find any differences between the two groups [18]. In the United States (U.S.) more research has been done, and increasing rurality is known to be associated with lower overall quality of life and lower functional well-being

among breast cancer survivors [19] and higher incidence of cancers that are associated with modifiable risk-factors [20]. Other U.S.-based studies have found that rural survivors report worse health in all domains including distress, many years after their cancer diagnosis [21] and have significantly poorer mental health functioning, higher levels of anxiety and depression, more distress, lower life satisfaction and more emotional problems than their urban counterparts, independent of education and physical functioning [22]. As a result of these findings, addressing rural-urban cancer disparities is now receiving much attention in the U.S. [23], but the applicability of American findings to the Australian context is unclear.

The objective of this study was to compare the health and behaviour of rural and urban South Australians with a history of cancer, to guide interventions and practices to address the location-specific needs of cancer survivors in Australia. It was hypothesised that rural people with a history of cancer would have poorer self-reported physical and mental health than their urban counterparts, and would be less likely to engage in behaviours that reduce risk of cancer (or other chronic diseases). It was anticipated that these outcomes would be maintained when survey year, gender, age-group, education, income, family structure, work status, country of birth and relative socioeconomic disadvantage (using the Socioeconomic Index for Areas or SEIFA) were controlled for. Differences in access to health services were also explored because access is a factor that is widely assumed to account for differences in outcomes.

Methods

Data collected between January 2010 and June 2015 were obtained from the South Australian Monitoring and Surveillance System (SAMSS) from respondents aged 18 and over. SAMSS is a computer-assisted telephone survey that monitors population trends in health, chronic disease risk factors and service use over time [24, 25]. At the time of accessing the data, the data was owned by the state health jurisdiction (SA Health) and the survey was administered by the epidemiological chronic disease and risk factor monitoring system, provided by the Population Research and Outcome Studies (PROS) group within the Discipline of Medicine, University of Adelaide.

All South Australian households with a number listed in the electronic White Pages are eligible for random selection. The person who had their birthday last is selected to participate, or if they are under 16 years of age, the survey is completed by a proxy (i.e. parent or guardian). Since the SAMSS survey was started in 2002, approximately 600 respondents have been reached per month, with an average response rate of approximately 70% [24, 25]. It is possible that a participant may be surveyed twice but this is highly unlikely due to the random

nature of household selection and the requirement that the person interviewed is the member of the household with the most recent birthday. Participants (between January 2010 and June 2015) with a history of cancer were selected for inclusion based on their response to the question "Have you ever been told by a doctor that you have cancer?" Those who indicated in a follow-up question that their cancer was "skin non-melanoma", were excluded from the analysis as their treatment is minor compared to other forms of cancer.

The measures employed in the survey are described in Table 1. Where available, references to papers outlining the reliability and validity of instruments are detailed in Table 1, but a limitation is that little information on most measures (possibly designed specifically for this survey) is publically accessible. Participants with K10 scores of 22 or above were classified as having 'high/very high levels' of psychological distress. According to internal documents, this scoring methodology was adopted by the SAMSS data managers based upon a combination of the cut-offs employed by the Clinical Research Unit for Anxiety and Depression (CRUfAD) and the Collaborative Health and Wellbeing Survey. The cancer type variable should be interpreted with some caution, due to the subjective nature of reporting and reporting of multiple cancers by some respondents.

Ethics approval to use the data for this purpose was granted by the SA Health Human Research Ethics Committee (reference number HREC/15/SAH/100) and participants gave verbal informed consent prior to participating in the survey.

Statistical analysis

Analyses were performed with Stata MP 14.0 (StataCorp, Texas, USA) using survey estimation commands that allows weighting for probability of sampling (based on sex, age, area and probability of selection of household). We compared urban and rural cancer survivors for self-report of; physical health, mental health, engagement in health-promoting behaviours and access to health services. Group differences in categorical variables were assessed by survey design-based Pearson chi-squared tests. Multiple binary logistic regression was used to explore whether differences between residential areas could be explained by potential confounders. For each analysis, three models were constructed: Model 1 - residential area (urban versus rural) as the single independent variable; this model provides a crude picture of this study population; 2), Model 2 - adjusted for survey year, gender, age-group, family structure, work status, country of birth, education level and household income; this model tested whether demographic factors moderated the differences between the rural and urban groups; and Model 3 - Model 2 with additional adjustment for SEIFA, an area level indicator of relative socioeconomic disadvantage. Multicollinearity was examined by calculating tolerance and Variance Inflation Factors (VIFS).

VIFs ranged from 1.0 to 1.8., indicating that multicollinearity was not problematic in any of the models. As we tested outcomes across four different domains (physical health, mental health, engagement in health-promoting behaviours and access to health services) and some also included sub-domains with similar measures, to adjust for multiple comparisons we used p<.01 to signal statistical significance.

Results

Participants

From 2010 to 2015, 36,442 people participated in the survey, 5426 (14.9%) of whom had a history of cancer. Among these, 1131 (3.1%) described their cancer as "skin non-melanoma" and were excluded, leaving a sample of 4,295 (11.8%). A small number of people from the "remote" group (n= 140, 3.1%), were combined with the "rural" group (n=776).

Demographic characteristics of the survey sample are shown in Table 2. When first diagnosed with cancer, 33.4% of participants were aged under 50, 47.5% aged 50-69, and 19.1% aged 70 or older. There was no difference in age at first diagnosis between the urban and rural groups.

Self-reported cancer type by gender is reported in Table 3. Based upon figures from the Australian Institute for Health and Welfare's 2017 Cancer in Australia Report [26], the most commonly diagnosed types of cancer in both Australian males (prostate, colorectal, melanoma of the skin, lung) and females (breast, colorectal, melanoma of the skin, lung) were well represented in the sample.

Table 4 compares the proportions in each group with a particular condition or risk factor. Table 5 shows the odds ratio (OR) of having a particular condition or risk factor for rural versus urban cancer survivors, according to the three statistical models.

Physical health Rural cancer survivors were more likely to be obese (32.5% vs 24.1%, p=.002), in both unadjusted (Model 1: OR=1.51, 95% CI=1.20,1.91, p<.001) and partially adjusted analyses (Model 2: OR=1.40, 95% CI=1.10,1.77, p=.006). However, the difference became non-significant with adjustment for SEIFA (Model 3).

There were no group differences in the proportion of participants who had ever been diagnosed with diabetes, chronic obstructive pulmonary disease (COPD), cardiovascular disease (CVD), arthritis or osteoporosis, or in

self-rated health status, current high blood pressure, current high cholesterol, ability to perform normal duties, or likelihood of experiencing these conditions, both with and without adjustment (see Table 4).

Mental health

There was no difference in the proportion of urban cancer survivors who reported K10 scores consistent with high/very high levels of distress (urban 9.6% vs rural 7.0%, p=.04). However, rural cancer survivors' lower odds of reporting high/very high distress was evident in the partially adjusted (Model 2: OR=0.59, 95% CI=0.41, 0.84, p=.004 and fully adjusted model (Model 3: OR=0.47, 95% CI=0.32, 0.69, p<.001).There was a higher proportion of rural cancer survivors who indicated they believed that in their neighbourhood, people generally trusted one another (88.7% vs 79.8%, p<.001) which was confirmed in unadjusted and adjusted models (p<.001 in all three models). There were no differences in the prevalence of self-report of a current mental health condition (p=0.61), suicidal ideation (p=.22),or in the extent to which survivors felt they had control over decisions that affect their life (p=.25), which was confirmed in unadjusted and adjusted models (p>.01 in all three models for all three variables).,.

Health promoting behaviours

Compared to urban cancer survivors, rural cancer survivors were more likely to report "no physical activity" (rural 32.9% vs urban 26.2%, OR=1.38, 95% CI=1.12,1.71, p<.001), which remained after partial adjustment (Model 2: OR=1.40, 95% CI=1.13,1.72, p<.001) but disappeared when SEIFA was included in the model (Model 3: p=.10). There was no difference between groups in engaging in sufficient physical activity (rural 39.8% vs urban 41.6%, p>.01 in all three models). The rural and urban groups were not different on lifetime risk of alcohol-related harm, compliance with recommended vegetable or fruit intake or in the likelihood of being a current smoker (p>.01 in all three models for all three variables). A high proportion in both groups did not meet dietary guidelines and still smoked (see Table 4).

Access to health services

When participants were asked whether they travelled over 100 kilometres to access a health service, 47.7% of rural cancer survivors said "yes", compared to only 15.7% for urban cancer survivors (p<.001). This difference was evident with and without adjustment (OR range from 4.88 to 5.33 in all models, all p<.001). There were no group differences in perceived problems with transport.

Discussion

This study found that although all cancer survivors had high prevalence of comorbid health issues and risk behaviours regardless of their residential location, rural cancer survivors were more likely than urban to be obese, and be physically inactive. When household levels factors (e.g. household income) were controlled for, these differences remained. However, they disappeared after also adjusting for SEIFA, an area based measure of socio-economic status. This finding underscores the importance of contextual population-based approaches to improving rural cancer outcomes that reach beyond the level of individual considerations and address health needs in the context of local rural communities and regions.

Both groups were equally likely to report a current mental health condition, which is consistent with the other Australian research of Hall et al. who found equivalent levels of anxiety, depression and stress among rural and urban haematological cancer survivors [18]. Interestingly, rural survivors were less likely to report high/very high distress in both adjusted models, which was surprising given US findings to the contrary [21, 22]. It is possible that the high levels of community trust experienced by the rural survivors in this study, and associated lay support that may result from it (known to be highly valued in rural Australia in the context of cancer [10]), may buffer them from factors (e.g. limited access to mental health services) that place cancer survivors in other rural contexts, at risk of poorer mental health.

It is important to note that cancer risk factors and co-morbid health and mental health issues were found to be a problem for an alarming number of cancer survivors across South Australia, regardless of where they live, and fewer differences between the two groups were detected than anticipated based upon research conducted in other contexts. This underscores the importance of secondary prevention strategies for all Australian cancer survivors. However, similarities in outcomes, risk factors and co-morbidities between rural and urban cancer survivors does not necessarily mean that the same interventions will be effective in both contexts. Locally nuanced interventions and policies that are co-designed with cancer survivors and decision makers and carefully take in to account the preferences, attitudes and resources available to people living in specific communities and regions, are most likely to achieve engagement and gains. For example, our finding that rural survivors were no more likely than their urban counterparts to report problems with transport, despite having to travel longer distances to access specialist care, highlights the need to look beyond the widely cited explanation that problems with transport and physical access to health services, are responsible for the rural population's worse health outcomes [27].

Limitations of this study include possible self-report bias, which may have been different between the comparison groups (e.g. rural stoicism may have resulted in underreporting of distress in rural participants [28]). Another potential limitation of the study is our inability to determine whether Aboriginal and Torres Strait Islander cancer survivors were adequately represented and the lack of a non-cancer survivor control group to determine whether or not the differences between the two groups are unique to cancer survivors, or reflect common differences between rural and urban populations. Strengths of the study include the large, representative sample and inclusion of detailed demographic information which allowed for adjustment for possible confounding.

Our findings also leave a number of questions unanswered. Firstly, as SEIFA is derived from a large number of weighted variables it is unclear which aspects are responsible for the observed effects and how amenable to change they are [29]. Secondly, SEIFA may be confounded with rurality [29, 30] and as it is based on postcode, may not appropriately reflect the fact that there can be great diversity in individual socioeconomic status within one postcode in rural and remote areas [31]. To better understand these issues, a geospatial analysis, that not only captures SEIFA, but also location, may be useful.

Despite the aforementioned challenges with understanding and addressing specific drivers of relative socioeconomic disadvantage in rural contexts, our findings do suggest that improving access to interventions that increase physical activity, and improve the management of obesity in rural Australia should be a priority, and may help to improve rural cancer survivors' quality of life and well-established poorer rates of cancer survival. Given the high levels of community trust observed among rural cancer survivors in this study, interventions that are designed to capitalize on this, may be particularly effective in rural communities.
In conclusion, this study highlights the higher burden of physical inactivity and obesity among rural and urban cancer survivors in Australia and the influence of area based measures of socioeconomic disadvantage on risk factor prevalence, versus geographic location associations. These findings will assist cancer service providers in prioritising the provision of targeted health, supportive care and secondary and tertiary prevention interventions to those Australian cancer survivors who need them most.

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. This article does not contain any studies with animals performed by any of the authors.

Informed consent

Informed consent was obtained from all individual participants included in the study.

Conflicts of interest

None to declare. We have control of all primary data and agree to allow the journal to review our data if required.

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Table 1. Summary of measures

Variable	Description of measure
Self-reported health	Rated on a five-point Likert scale from 'excellent' to 'poor'
Existence of comorbid conditions Diabetes COPD CVD Arthritis Osteoporosis	Assessed by asking if they had ever been told by a doctor that they had the disease
Current risk factors High cholesterol or High blood pressure	Assessed by asking if they had ever been told by a doctor that they had the risk factor and whether or not they still have it (despite treatment)
Body mass index (BMI)	Calculated using self-reported weight and height
Presence of a current mental health condition	Assessed by asking if in the past 12 months, they had been told by a doctor they have anxiety, depression, a stress-related problem or any other mental health problem, and then whether or not they stated 'yes' to 'Do you still have this condition'
Psychological distress	Using the Kessler Psychological Distress Scale (K10)[a]
Suicidal ideation	Using four questions from the General Health Questionnaire (GHQ-28)[b] whereby if participants answer 'rather more than usual' or 'much more than usual' to any of these questions, they were classed as having suicidal ideation
Alcohol-related lifetime risk	Risk was determined if they reported drinking more than two standard drinks on any given day, as defined by the National Health and Medical Research Council guidelines[c]
Current smoker	If reported smoking 'daily' or 'occasionally'
Sufficient physical activity	Defined according to the National Physical Activity Guidelines for Australian Adults[d] (i.e. in the past week, 150 minutes of walking, moderate or vigorous activity, accumulated over 5 sessions, with vigorous multiplied by two to account for its greater intensity)
Met dietary guidelines Vegetables Fruit	In accordance with the Australian Guide to Healthy Eating[e], participants were classed as having met guidelines if they had consumed five or more serves of vegetables and two or more serves of fruit per day
Cut down or totally unable to work or carry out normal duties	Assessed by asking if they had had to cut down or were totally unable to work or perform normal duties because of health at least one day out of the past four weeks
Perceived problems with transport	Assessed by asking if they have never/ sometimes/ all the time experienced problems with transport
Had to travel more than 100km to access a health service in the last 6 months	Assessed by asking if they had to travel more than 100km to access a health service in the last 6 months (yes/no)
Control over decisions that affect their lives	Assessed by rating on a Likert scale the extent to which they felt they generally had control over the decision that affect their lives (strongly agree-strongly disagree)
Neighbourhood trust each other	Assessed by asking whether people in their neighbourhood generally trust one another (yes/no/do not know)

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Table 2. Demographic characteristics (n=4,295[a])

	Number	Unweighted percentage	Weighted percentage [b]
Survey year			
2010	930	21.6	17.2
2011	606	14.1	16.1
2012	706	16.4	18.3
2013	797	18.6	19.3
2014	846	19.7	20.7
2015	410	9.6	8.4
Gender			
Female	2,496	58.1	53.8
Male	1,799	41.9	46.2
Age-group			
18-24	15	0.4	0.9
25-34	24	0.6	2.5
35-44	60	1.4	5.2
45-54	487	6.7	13.6
55-64	916	21.3	22.4
65+	2,993	69.7	55.3
Residential area			
Urban	3,379	78.7	80.7
Rural	776	18.1	16.2
Remote	140	3.3	3.1
Family structure			
Adult living alone	1,702	39.8	23.1
Adults (2 or more) living without children	2,270	53.1	57.8
Adults (2 or more) living with children	303	7.1	19.2
Work status			
Employed	543	12.6	19.7
Unemployed [c]	3,748	87.4	80.3
Country of birth			
Australia	3,197	74.4	75.6
UK/Ireland	659	15.3	14.2
Other/don't know/refused	439	10.2	10.2
Education (n=4,285)			
No schooling to secondary	2,515	58.7	53.4
Trade, certificate, diploma	1,074	25.1	28.1
Degree or higher	696	16.2	18.6
Income (AU$)			
≤60,000	2,430	56.6	47.3
60,001-100,00	452	10.5	14.9
More than 100,000	287	6.7	11.2
Don't know/refused	1,126	26.2	26.6
SEIFA (n=4,289)			
Lowest quintile	788	18.4	18.6
Low quintile	892	20.8	19.3
Middle quintile	885	20.6	19.5
High quintile	810	18.9	19.2
Highest quintile	914	21.3	23.5

[a] Otherwise, number was stated in the table.
[b] Values were weighted for probability of sampling, which is generated based on sex, age, area and probability of selection of household.
[c] Unemployed includes those economically inactive, e.g. home duties, student, retired, unable to work, etc.

Table 3. Self-reported cancer type by gender (n=4,295)

Cancer type	Males (percentage)	Females (percentage)	Total
Gastrointestinal (colon, bowel)/ liver/ pancreas	15.7	12.5	14.0
Leukaemia/ lymphoma (lymph nodes and bone marrow)	8.9	6.6	7.6
Male cancers (prostate/ testicular)	41.6	N/A	19.5
Skin melanoma	20.0	14.5	17.1
Urinary (bladder/ kidney)	7.3	3.2	5.1
Breast	0.5	40.3	21.9
Female cancers (cervical/ uterus/ ovaries)	N/A	18.7	10.1
Other	10.3	8.5	9.3

Note; This is a multiple response question.

Table 4. Percentage of self-reported physical healthy, mental health and participation in health-promoting behaviours for cancer of urban and rural group (n=4,295[a])

	Total	Urban % [95% CI]	Rural % [95% CI]	P value
Physical health				
SF1 (Would you say your health is)				.36
Excellent/very good	34.6 [32.7,36.6]	34.9 [32.8,37.1]	33.5 [28.8,38.6]	
Good/fair	54.1 [52.1,56.1]	54.3 [52.1,56.5]	53.3 [48.5,58.1]	
Poor	11.3 [10.1,12.5]	10.8 [9.5,12.2]	13.2 [10.6,16.3]	
Diabetes				.03
Yes	15.5 [14.2,16.9]	14.7 [13.4,16.1]	19.0 [15.5,23.0]	
COPD				.052
Yes	7.0 [6.1,7.9]	6.6 [5.6,7.6]	8.7 [6.8,10.9]	
CVD				.12
Yes	18.9 [17.6,20.4]	18.3 [16.9,19.8]	21.5 [17.8,25.6]	
Arthritis				.89
Yes	42.1 [40.3,44.1]	42.2 [40.1,44.3]	41.9 [37.5,46.3]	
Osteoporosis				.96
Yes	10.8 [9.7,11.9]	10.8 [9.6,12.1]	10.8 [8.7,13.3]	
Current high blood pressure				.61
Yes	41.9 [40.0,43.8]	41.7 [39.6,43.8]	42.9 [38.5,47.5]	
Current high cholesterol				.24
Yes	32.9 [31.1,34.6]	32.3 [30.5,34.2]	35.1 [30.9,39.6]	
BMI category (n=4,042)				**.002**
Under/normal weight (<25)	35.4 [33.5,37.4]	36.4 [34.2,38.6]	31.2 [27.2,35.5]	
Overweight (25-29.9)	38.9 [36.8,40.9]	39.5 [37.2,41.7]	36.3 [31.5,41.4]	
Obese (≥30)	25.7 [24.0,27.6]	24.1 [22.3,26.1]	32.5 [28.1,37.3]	
BMI, mean (SEM)	27.5 (0.1)	27.2 (0.1)	28.6 (0.3)	**<.001**
Totally unable to work or carry out normal duties due to health in the past 4 weeks				.11
Yes, at least one day	18.1 [16.5,19.7]	17.4 [15.8,19.1]	21 [17.0,25.7]	
Cut down activities, or did not get as much done as usual due to health in the past 4 weeks				.18
Yes, at least one day	30.1 [28.3,32.0]	29.5 [27.5,31.5]	32.8 [28.5,37.5]	
Mental health				
Current mental health condition				.61
Yes, current	19.3 [17.7,20.9]	19.4 [17.7,21.3]	18.5 [15.5,21.9]	
Suicidal ideation				.22
Yes	5.0 [4.3,5.9]	5.3 [4.4,6.3]	4.1 [2.8,5.9]	
K10 score (n=4,261)				.04
Low/moderate	90.9 [89.5,92.1]	90.4 [88.8,91.8]	93 [91.0,94.6]	
High/very high	9.1 [7.9,10.5]	9.6 [8.2,11.2]	7.0 [5.4,9.0]	
Neighbourhood trust each other				**<.001**
Yes	81.5 [80.0,82.9]	79.8 [78.1,81.4]	88.7 [86.1,90.9]	
No	5.6 [4.7,6.6]	6.2 [5.2,7.3]	3.2 [2.1,4.7]	
Don't know	12.9 [11.7,14.2]	14.0 [12.7,15.5]	8.1 [6.3,10.4]	
I have control over the decisions that affect my life				.25
Strongly agree/agree	92.2 [91.0,93.3]	91.8 [90.4,93.1]	93.7 [91.6,95.3]	
Neutral	7.1 [6.1,8.3]	7.4 [6.2,8.8]	5.8 [4.2,7.8]	
Disagree/strongly disagree	0.7 [0.4,1.1]	0.8 [0.4,1.3]	0.5 [0.2,1.2]	
Health promoting behaviours				
Nutrition				
Recommend serves of vegetable/day (n=4,242)				.30
< 5	86.7 [85.3,87.9]	87 [85.4,88.4]	85.4 [82.3,88.0]	
≥ 5	13.3 [12.1,14.7]	13 [11.6,14.6]	14.6 [12.0,17.7]	
Recommend serves of fruit/day (n=4,286)				.19
< 2	51.7 [49.7,53.7]	51.1 [48.9,53.3]	54.5 [49.8,59.1]	
≥ 2 (correct answer)	48.3 [46.3,50.3]	48.9 [46.7,51.1]	45.5 [40.9,50.2]	
Physical activity				
Definition 1 (n=4,193)				**.01**
No activity	27.5 [25.8,29.2]	26.2 [24.4,28.1]	32.9 [28.9,37.1]	
Activity but not sufficient	31.3 [29.5,33.2]	32.3 [30.3,34.3]	27.3 [23.1,31.9]	
Sufficient activity	41.2 [39.2,43.3]	41.6 [39.3,43.8]	39.8 [34.9,44.9]	
Alcohol				
Lifetime risk (n=4,267)				**.01**
Does not drink	26 [24.3,27.8]	25.3 [23.4,27.2]	29.2 [24.7,34.2]	
No risk	55.5 [53.4,57.5]	57.1 [54.9,59.3]	48.5 [43.8,53.3]	
Lifetime risk of alcohol related harm	18.5 [16.9,20.3]	17.6 [15.9,19.5]	22.3 [18.1,27.1]	
Smoking				.62
Non-smoker	43.4 [41.4,45.4]	43.6 [41.5,45.8]	42.4 [37.6,47.4]	
Ex-smoker	48.1 [46.1,50.1]	47.7 [45.5,49.9]	49.9 [45.1,54.7]	
Smoker	8.5 [7.4,9.7]	8.7 [7.4,10.1]	7.7 [5.9,10.0]	

Access to health services				
Problems with transport (n=4,293)				.42
Never	89.7 [88.3,91.0]	89.7 [88.1,91.1]	89.6 [86.3,92.2]	
Sometimes	8.6 [7.4,10.0]	8.7 [7.4,10.3]	8 [5.6,11.3]	
All the time	1.7 [1.3,2.1]	1.6 [1.2,2.0]	2.3 [1.5,3.6]	
Travel over 100km to access a health service in the last 6 months (n=975)		(n=356)	(n=619)	**<.001**
Yes	36.2 [32.3,40.2]	15.7 [11.6,21.1]	47.7 [42.1,53.4]	

[a] Otherwise, number was stated in the table. Values were weighted for probability of sampling, which is generated based on sex, age, area and probability of selection of household.

Table 5. Risk comparison between urban and rural cancer groups

	Model 1 – no adjustment			Model 2 – full adjustment except SEIFA		Model 3 – full adjustment		
	Urban OR	Rural OR [95% CI]	P value	Rural OR [95% CI]	P vale	Rural OR [95% CI]	P value	
Physical health								
Your health is poor	1.00	1.25 [0.94,1.67]	.12	1.25 [0.94,1.67]	.12	1.08 [0.79,1.47]	.64	
Diabetes	1.00	1.36 [1.04,1.78]	.03	1.40 [1.05,1.85]	.02	1.20 [0.90,1.59]	.21	
COPD	1.00	1.35 [1.00,1.83]	.053	1.27 [0.93,1.73]	.14	1.21 [0.86,1.72]	.28	
CVD	1.00	1.22 [0.95,1.57]	.12	1.28 [0.97,1.69]	.08	1.14 [0.87,1.50]	.33	
Arthritis	1.00	0.99 [0.81,1.21]	.89	1.01 [0.84,1.22]	.89	0.92 [0.75,1.12]	.42	
Osteoporosis	1.00	1.01 [0.77,1.32]	.96	1.09 [0.81,1.46]	.58	1.06 [0.78,1.44]	.71	
Current HBP	1.00	1.05 [0.86,1.29]	.61	1.07 [0.88,1.31]	.49	0.96 [0.77,1.20]	.72	
Current high cholesterol	1.00	1.13 [0.92,1.40]	.24	1.14 [0.91,1.43]	.27	1.06 [0.85,1.33]	.62	
Being overweight/obese	1.00	1.26 [1.02,1.57]	.03	1.13 [0.91,1.40]	.28	1.03 [0.82,1.29]	.82	
Being obese	1.00	1.51 [1.20,1.91]	**<.001**	1.40 [1.10,1.77]	**.006**	1.19 [0.92,1.55]	.18	
Totally unable to work or carry out normal duties due to health in the past 4 weeks - Yes, at least one day	1.00	1.26 [0.95,1.69]	.11	1.24 [0.93,1.65]	.14	1.04 [0.77,1.40]	.82	
Cut down activities, or did not get as much done as usual due to health in the past 4 weeks - Yes, at least one day	1.00	1.17 [0.93,1.47]	.18	1.18 [0.94,1.50]	.16	1.07 [0.84,1.36]	.57	
Mental health								
Current mental health condition	1.00	0.94 [0.74,1.20]	.61	0.89 [0.69,1.15]	.38	0.83 [0.63,1.09]	.17	
Suicidal ideation	1.00	0.76 [0.49,1.18]	.22	0.67 [0.42,1.09]	.11	0.54 [0.33,0.89]	.02	
K10 score being high/very high	1.00	0.71 [0.51,0.98]	.04	0.59 [0.41,0.84]	**.004**	0.47 [0.32,0.69]	**<.001**	
Neighbourhood trust each other - yes	1.00	1.99 [1.53,2.59]	**<.001**	2.08 [1.58,2.76]	**<.001**	3.00 [2.18,4.13]	**<.001**	
I have control over the decision that affect my life - strongly agree/agree	1.00	1.32 [0.93,1.89]	.12	1.55 [1.03,2.32]	.03	1.68 [1.11,2.54]	.02	
Health promoting behaviours								
Nutrition								
Recommend serves of vegetable/day ≥5	1.00	1.15 [0.88,1.49]	.30	1.15 [0.88,1.50]	.32	1.13 [0.85,1.51]	.39	
Recommend serves of fruit/day ≥2	1.00	0.87 [0.71,1.07]	.20	0.96 [0.79,1.17]	.70	1.02 [0.83,1.26]	.82	
Physical activity								
Sufficient physical activity – yes vs. no activity or activity but not sufficient	1.00	0.93 [0.74,1.17]	.53	0.95 [0.75,1.21]	.70	1.16 [0.91,1.49]	.23	
No activity – yes vs. activity but not sufficient/ sufficient physical activity	1.00	1.38 [1.12,1.71]	**<.001**	1.40 [1.13,1.72]	**<.001**	1.22 [0.97,1.53]	.10	
Alcohol								
Lifetime risk of alcohol related harm - yes	1.00	1.34 [1.00,1.79]	.047	1.15 [0.85,1.57]	.37	1.22 [0.89,1.67]	.23	
Smoking								
Being a current smoker	1.00	0.88 [0.63,1.23]	.45	0.76 [0.51,1.14]	.18	0.71 [0.47,1.08]	.11	
Access to health services								
Travel over 100km to access a health service in the last 6 months – yes	1.00	4.88 [3.20,7.45]	**<.001**	5.33 [3.58,7.94]	**<.001**	5.97 [3.99,8.93]	**<.001**	
Problem with transport – all the time	1.00	1.52 [0.89,2.57]	.12	1.62 [0.91,2.89]	.10	1.45 [0.78,2.70]	.24	

Note: Results are odds ratio (OR) with 95% confidence interval, derived from logistic regressions using Stata survey module. Model 1 includes only residential area as the independent variable; model 2 is based on model 1 with adjustment of survey year, sex, age-group, family structure, work status, country of origin, education level and household income; model 3 is based on model 2 with the added inclusion of SEIFA.