Maturitas 76 (2013) 370–376

Contents lists available at ScienceDirect

Maturitas

journal homepage: www.elsevier.com/locate/maturitas

Population attributable risk of modifiable risk factors associated with invasive breast cancer in women aged 45–69 years in Queensland, Australia

Louise F. Wilson[a,*], Andrew N. Page[b], Nathan A.M. Dunn[c], Nirmala Pandeya[a], Melinda M. Protani[a], Richard J. Taylor[d]

[a] School of Population Health, University of Queensland, Public Health Building, Herston Road, Herston, QLD 4006, Australia
[b] School of Science and Health, University of Western Sydney, Building 24, Campbelltown Campus, Penrith, NSW 2571, Australia
[c] BreastScreen Queensland, 15 Butterfield Street, Herston, QLD 4006, Australia
[d] School of Public Health and Community Medicine, Faculty of Medicine, University of New South Wales, Kensington Campus, Samuels Building, Botany Street, Randwick, NSW 2052, Australia

ARTICLE INFO

Article history:
Received 28 June 2013
Received in revised form 9 August 2013
Accepted 3 September 2013

Keywords:
Population attributable risk
Breast cancer
Modifiable risk factors
Australia

ABSTRACT

Objectives: To quantify the population attributable risk of key modifiable risk factors associated with breast cancer incidence in Queensland, Australia.
Study design: Population attributable fractions (PAFs) for high body mass index (BMI), use of hormone replacement therapy (HRT), alcohol consumption and inadequate physical activity were calculated, using prevalence data from a representative survey of women attending mammographic screening at BreastScreen Queensland in 2008 and relative risk estimates sourced from published literature. Attributable cancers were calculated using 'underlying' breast cancer incidence data for 2008 based on Poisson regression models, adjusting for the inflation of incidence due to the effects of mammographic screening.
Main outcome measures: Attributable burden of breast cancer due to high body mass index (BMI), use of hormone replacement therapy (HRT), alcohol consumption and inadequate physical activity.
Results: In Queensland women aged 45–69 years, an estimated 12.1% (95% CI: 11.6–12.5%) of invasive breast cancers were attributable to high BMI in post-menopausal women who have never used HRT; 2.8% (95% CI: 2.7–2.9%) to alcohol consumption; 7.6% (95% CI: 7.4–7.9%) to inadequate physical activity in post-menopausal women and 6.2% (95% CI: 5.5–7.0%) to current use of HRT after stratification by BMI and type of HRT used. Combined, just over one quarter (26.0%; 95% CI: 25.4–26.6%) of all invasive breast cancers in Queensland women aged 45–69 years in 2008 were attributable to these modifiable risk factors.
Conclusions: There is benefit in targeting prevention strategies to modify lifestyle behaviours around BMI, physical activity, HRT use and alcohol consumption, as a reduction in these risk factors could decrease invasive breast cancer incidence in the Queensland population.

1. Introduction

Trends in breast cancer incidence may be affected by the introduction of population-based mammography screening [1–3], changing demographics (i.e. ageing) in a population [1,4], and changing trends in risk factors (e.g. increasing obesity prevalence [1,4], and changing patterns of hormone therapy use [1,3,4]).

At the population level, the impact of a risk factor depends upon both the strength of association of that factor with the disease as well as the prevalence of the risk factor in the population of interest. The population attributable fraction (PAF) measures the amount of disease attributable to a risk factor in a particular population by calculating the proportion of cancer cases that may be prevented if the risk factor could be removed from the population; on the assumption that the risk factor is causal to the disease, measurement of the risk association and prevalence of the risk factor are unbiased and the elimination of the risk factor will have no effect on the distribution of other risk factors [5].

Some of the strongest risk factors for breast cancer include age, family history, reproductive factors, previous breast disease and breast density [6–8]. These risk factors, while strong in terms of the magnitude of the effect size, are not amenable to

* Corresponding author. Tel.: +61 7 3399 5690; fax: +61 7 3365 5442.
E-mail addresses: l.wilson8@uq.edu.au, loufw28@gmail.com (L.F. Wilson).

0378-5122/$ – see front matter © 2013 Elsevier Ireland Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.maturitas.2013.09.002

modification through behaviour change. However, modifiable lifestyle and environmental factors also play a role in breast cancer risk [6]. These factors may be associated with smaller effect sizes, but they can be more prevalent in the population. The World Cancer Research Fund (WCRF) has concluded that there is causal evidence of a positive association between body mass index (BMI) and breast cancer in post-menopausal women, and between alcohol and breast cancer in both pre- and post-menopausal women [9]; as well as a protective effect for physical activity against breast cancer in post-menopausal women [9]. The International Agency for Research on Cancer (IARC) has concluded that there is evidence that combined oestrogen + progesterone and oestrogen-only hormone replacement therapy (HRT), prescribed to women who have had natural or surgical menopause, causes breast cancer [10]. These four risk factors have been selected for this study on the basis of this evidence; in addition, prevalence can be influenced through suitable prevention and education strategies that impact on the lifestyle and behaviour of individuals, even at a later stage in life.

The attributable risk of sets of modifiable risk factors and breast cancer have been calculated for Canada [11], Germany [12], Italy [13], the United States [14,15], the United Kingdom [16] and globally [17]. While it is useful to compare international results with those in an Australian context, there will likely be national differences in the prevalence of these risk factors, limiting generalisability, and the specificity of policy and prevention approaches in the local context. Two studies undertaken in Australia have investigated attributable risk of breast cancer, however, both have focussed on only a single risk factor (use of hormone replacement therapy [18] and family history [19]). To our knowledge, there have been no published analyses that have explored the attributable risk of a set of key modifiable risk factors known to be associated with breast cancer in the Australian context.

The aim of this study was to quantify the proportion of breast cancers in Queensland that could be attributed to key modifiable lifestyle risk factors of higher BMI, use of hormone replacement therapy, alcohol consumption and inadequate physical activity.

2. Methods

2.1. Estimates of relative risks

Relative risks used to calculate the PAF for each of the selected modifiable risk factors were sourced from published meta-analyses or large prospective cohort studies. All of the studies had to be consistent with the conclusions of the WCRF [9] or IARC [10] regarding the respective risk factor and breast cancer, have relative risks with multiple exposure categories (not just high vs low) that could be replicated in the prevalence data, and adjust for the known confounders for breast cancer (age, reproductive history, age at first birth and hormone use [9]). Table 1 details the sources [20–23] and relative risks used for each exposure.

2.2. Prevalence data

Risk factor prevalence was estimated using results from a cross-sectional prevalence survey of 9792 women attending BreastScreen Queensland Screening and Assessment Services between November 2008 and February 2009 (BreastScreen Queensland survey). Details of recruitment and study variables have been described elsewhere [24]. Briefly, the BreastScreen Queensland survey was conducted between November 2008 and February 2009 through inclusion of a self-report questionnaire with appointment confirmation letters for mammography screening. Of the 17,000 questionnaires distributed, 11,537 completed questionnaires were returned via the 74 BreastScreen service locations throughout Queensland (68% response rate). Women aged under 45 years (9.5%) and women who returned questionnaires that could not be linked to the BreastScreen Queensland Registry (5.6%) were excluded, leaving a total of 9792 responses for this analysis (58% of the number of questionnaires initially distributed) [24].

Information was collected on a wide range of variables including reproductive factors, modifiable behavioural factors, HRT use and alternatives, demographic factors, past and current co-morbidities and personal and familial family history of breast cancer [24]. This range ensured that the stratifications reported in the literature for selected risk factors could be replicated from this survey dataset. Only those with known exposure were included in the prevalence estimates.

Body mass index (BMI) was calculated as a continuous variable from self-reported responses to questions on height and weight (BMI = weight in kg/(height in metres)^2). This continuous variable was then categorised into five levels, reflecting the relative risk categories used by Reeves [20]: <22.5 kg/m^2; 22.5–24.9 kg/m^2 (reference category); 25–27.4 kg/m^2; 27.5–29.9 kg/m^2; ≥30 kg/m^2. The variable was then stratified by menopause status and whether or not women were 'never users' or 'ever users' of HRT. Prevalence of BMI in post-menopausal women who never used HRT were used for the PAF.

Alcohol consumption was measured by self-report of the number of glasses of wine (250 ml), beer (250 ml) and spirits (30 ml) consumed on average each week. From this information the average alcohol consumption of grams per day (10 g alcohol per glass) was calculated as a continuous variable. The continuous variable was then categorised to reflect the relative risks associated with levels of alcohol reported by the Collaborative Group on Hormonal Factors in Breast Cancer [21]: 0 g/day (reference category), 5 g/day, 5–14 g/day, 15–24 g/day, 25–34 g/day, 35–44 g/day and ≥45 g/day.

Physical activity questions were based on items included in the Active Australia Survey [24]. Self-reported responses were given to questions that asked for an estimate of how many minutes and hours per week were spent walking, engaged in moderate activity (e.g. gentle swimming, social tennis, golf) and vigorous activity (jogging, cycling, aerobics, competitive tennis). Metabolic equivalent (MET) values for walking, moderate activity and vigorous activity of 3.3, 4.0 and 8.0 were assigned respectively in accordance with the levels recommended by the International Physical Activity Questionnaire, which asks similar questions to the Active Australia Survey [25]. A total physical activity variable (continuous) was calculated by multiplying the MET level for the activity by the hours exercised per week and totalling the values across the three activity levels. This continuous variable was then categorised to reflect the relative risk categories used by Eliassen [22]: <3 MET hours/week, 3 to <9 MET hours/week, 9 to <18 MET hours/week, 18 to <27 MET hours/week and ≥27 MET hours/week (reference category; equivalent to 1 h of brisk walking per day). This variable was then stratified by whether women were premenopausal or post-menopausal. The prevalence data on post-menopausal women were used for the PAF calculation.

To assess *hormone replacement therapy* (HRT) use, women were asked "have you ever used HRT"; and if they had, how many years in total they had used HRT, if they were currently using HRT and the type of HRT they had most recently used. Type of HRT was categorised into "oestrogen only", "oestrogen + progesterone", "Tibolone", "Other" and "Don't Know". For the PAF analysis, HRT use was categorised into current users and never/past users (reference category). Current users were stratified into the categories of type of HRT used (oestrogen only, oestrogen + progesterone, Tibolone) and BMI category (<25 kg/m^2 and ≥25 kg/m^2) as reported by the Million Women Study [23].