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Differences in cancer incidence by age at diagnosis between Aboriginal and non-Aboriginal people for cancer types included in Australian national screening programs

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ABSTRACT

Background: This study examined age distributions and age-specific incidence of screened cancers by Aboriginal status in New South Wales (NSW) to consider the appropriateness of screening target age ranges.
Methods: The NSW Cancer Registry identified invasive (female) breast, cervical and bowel cancers in people diagnosed in 2001–2014.
Results: Aboriginal people were younger at diagnosis with higher proportions of breast and bowel cancers diagnosed before the screening target age range (< 50 years) compared with non-Aboriginal people (30.6% vs. 22.8%, and 17.3% vs. 7.3%, respectively). Age-specific incidence rate ratios (IRRs) were lower/similar for breast and bowel cancers in younger and higher in older Aboriginal than non-Aboriginal people. All age-specific cervical cancer IRRs were higher for Aboriginal compared with non-Aboriginal people.
Conclusion: Although higher proportions of breast and colorectal cancers were diagnosed before screening commencement age in Aboriginal people, this does not necessarily indicate a need for earlier screening commencement. Other aspects needing consideration include benefits, harms and cost-effectiveness.

1. Introduction

Australia has three organized population-based screening programs directed at cancers of the breast, cervix and bowel [1]. The economic case for screening includes comparisons between effectiveness, absolute cost and cost-effectiveness of screening and alternative uses of screening resources [2]. Screening target age ranges were decided largely through these kinds of comparative analyses and considering potential harms and benefits [3].

Age has been the main demographic factor used for targeting Australian screening programs [1]. The National Breast Screening Program actively invites women aged from 50 to 74 years for biennial screening. The National Cervical Screening Program has been using HPV (human papillomavirus) testing since December 2017 and recommends 5-yearly screening of women aged 25–74 years. The National Bowel Cancer Screening Program invites people to bowel screening between ages 50 and 74 years.

Little account has been taken of other socio-demographic factors, such as ethnicity, when targeting screening programs, although they can affect cancer risk [4]. Aboriginal and Torres Strait Islander peoples (referred to in this paper as Aboriginal people) are generally diagnosed with cancer at a younger age than non-Aboriginal people [5]. It is unclear whether national screening programs should be modified for Aboriginal people to optimize screening coverage and outcomes.

This study examined age distributions and age-specific incidence of invasive breast, cervical, and bowel cancers by Aboriginal status to consider appropriateness of current screening target age ranges.

2. Material and methods

The NSW Cancer Registry (NSWCR) data for cases aged ≥15 years diagnosed with primary invasive cancer of the (female) breast, cervix or bowel in 2001–2014 were included in this study. The International Statistical Classification of Diseases and Related Health Problems (10th Revision, Australian Modification) codes were used to identify breast (C50), cervix (C53) or bowel (C18-C20) cancers. If the same person was

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diagnosed with more than one of these cancers, these cancers were counted as separate events. Population data were based on data from the Australian Bureau of Statistics and obtained through SAPHaRI (NSW Ministry of Health).

Cases were categorised as Aboriginal or non-Aboriginal people. In 2011, about 30% of Australian Aboriginal people lived in NSW [6]. Due to known under-recording of Aboriginal people, we used a 'weight of evidence' method to enhance the recording of Aboriginal status using data from the NSW Admitted Patient Data Collection, the NSW Emergency Department Data Collection and the Australian Coordinating Register Cause of Death Unit Record File [7]. Approval for the study was obtained from the NSW Population and Health Services Research Ethics Committee (HREC/15/CIPHS/15) and the Aboriginal Health and Medical Research ethics committee (HREC Ref. No. 1201/16). The study operated under guidance from the Aboriginal Advisory Group of the Cancer Institute NSW.

Age distributions at diagnosis were described using means, standard deviations (SD), medians and interquartile ranges (IQRs). The Pearson chi-squared test was used to compare age distributions and proportions of cases diagnosed at a younger age than current screening target age ranges by Aboriginal status.

Age-specific incidence rates per 100,000 and incidence rate ratios (IRRs) with 95% confidence intervals (CI) were calculated for Aboriginal and non-Aboriginal people. Population estimates for NSW at 30 June each year (2001–2014) were used for each age group by Aboriginal status. The Mantel-Haenszel chi-squared test of homogeneity was used to examine whether cancer risk by Aboriginal status differed by age. We also examined interactions between Aboriginal status and age in Poisson models. If over-dispersion was detected, negative binomial modelling was performed instead. The Wald chi-square test was used to examine the overall significance of interactions.

All analyses were performed using Stata Statistical Software: Release 13 (College Station, TX: StataCorp LP) and SAS Version 9.4 (SAS Institute, Cary, NC).

3. Results

Aboriginal people were on average younger than non-Aboriginal people at diagnosis and age distributions differed significantly by Aboriginal status for all cancers (all p-values < 0.01) (Table 1).

The proportion of women diagnosed with breast cancer at age < 50 years was higher among Aboriginal compared with non-Aboriginal people (30.6% vs. 22.8%, $p < 0.001$). Less than five Aboriginal women ($< 3\%$) and 44 non-Aboriginal women (1.3%) were diagnosed with cervical cancer at age < 25 years ($p = 0.146$). The proportion of people diagnosed with bowel cancer aged < 50 years was higher among Aboriginal compared with non-Aboriginal people (17.3% vs. 7.3%, $p < 0.001$).

IRRs indicated that Aboriginal women had lower or similar age-specific breast cancer incidence rates than non-Aboriginal people in women aged < 60 years and higher age-specific cancer incidence in older age groups (≥ 60 years) (Table 2, Fig. 1). There was a significant difference in cancer incidence by Aboriginal status by age ($p < 0.001$). For cervical cancer, Aboriginal women had higher age-specific incidence in all age groups compared with non-Aboriginal women, although differences were not statistically significant in the youngest and oldest age groups. For bowel cancer, Aboriginal people had higher age-specific incidence compared with non-Aboriginal people, significantly higher in those aged 40–49 and ≥ 60 years, as indicated by the IRRs. For cervical and bowel cancer, differences in cancer incidence by Aboriginal status across age categories were not significant (all p values > 0.05) indicating age gradients were largely parallel.

4. Discussion

Table 1

Age at diagnosis in Aboriginal and non-Aboriginal people, NSW Cancer Registry 2001–2014.

	Aboriginal people	Non-Aboriginal people	p value [a]
Breast cancer [b]			
Overall n	962	61,763	
Mean age (SD)	56.6 (12.4)	60.8 (14.0)	
Median age (IQR)	56.0 (47.0–65.0)	60.0 (50.0–71.0)	
Age distribution, n (%)			
15–29	< 5 (< 1)	324 (0.5)	< 0.0001
30–39	71 (7.4)	2,990 (4.8)	
40–49	220 (22.9)	10,771 (17.4)	
50–59	281 (29.2)	15,456 (25.0)	
60–69	244 (25.4)	15,469 (25.1)	
70–79	104 (10.8)	9,936 (16.1)	
80+	39 (4.1)	6,817 (11.0)	
Cervical cancer			
Overall n	147	3,383	
Mean age (SD)	45.8 (13.3)	52.3 (17.3)	
Median age (IQR)	44.0 (36.0-53.0)	49.0 (39.0–65.0)	
Age distribution, n (%)			
15–29 [c]	15 (10.2)	242 (7.2)	0.0013
30–39	35 (23.8)	680 (20.1)	
40–49	45 (30.6)	779 (23.0)	
50–59	29 (19.7)	571 (16.9)	
60–69	13 (8.8)	462 (13.7)	
70+ [d]	10 (6.8)	649 (19.2)	
Bowel cancer [e]			
Overall n	834	63,624	
Mean age (SD)	62.7 (13.8)	69.3 (13.0)	
Median age (IQR)	64.0 (55.0–72.0)	71.0 (61.0–79.0)	
Age distribution, n (%)			
15–29	19 (2.3)	509 (0.8)	< 0.0001
30–39	32 (3.8)	996 (1.6)	
40–49	93 (11.2)	3,115 (4.9)	
50–59	162 (19.4)	8,663 (13.6)	
60–69	261 (31.3)	16,222 (25.5)	
70–79	187 (22.4)	19,330 (30.4)	
80+	80 (9.6)	14,789 (23.2)	

SD: Standard Deviation; IQR: Interquartile range.

[a] Based on Chi-Square test.

[b] Only women included.

[c] There were < 5 Aboriginal (< 3%) and 44 non-Aboriginal women (1.3%) aged < 25 years.

[d] Age groups were combined due to small numbers.

[e] One person with missing Aboriginal status.

Aboriginal people were younger at diagnosis compared with non-Aboriginal people, reflecting the younger age distribution of the Aboriginal population. Higher proportions of breast and bowel cancers were diagnosed before the screening age range in Aboriginal compared with non-Aboriginal people. This raises the question whether increased capture of cancers earlier would be gained by commencing screening at a younger age in Aboriginal people. Other factors to consider include effectiveness and cost-effectiveness of screening by age and potential for increased false positive and false negative results [3]. All things considered equal, the same principles should determine the screening target age for Aboriginal and non-Aboriginal people.

Compared with non-Aboriginal people, Aboriginal people had higher age-specific breast and bowel cancer incidence rates in older age groups (60+ years for breast and 40–49 and 60+ years for bowel, respectively), although differences in rates by Aboriginal status by age were statistically significant only for breast cancer. Therefore, age-specific incidence rates do not indicate the need for lowering the screening target age for Aboriginal people. That said, these incidence rates are affected by current screening practices, including lower breast and bowel cancer screening rates in Aboriginal people [5]. The need of increasing participation of Aboriginal people in existing screening programs is acknowledged.

Overall, evidence for efficacy of screening by mammography to

Table 2
Age-specific incidence rates and incidence rate ratios for Aboriginal and non-Aboriginal people, NSW Cancer Registry2001–2014.

	Age-specific incidence rate per 100.000		IRR (95% CIs)	P value
	Aboriginal people	Non-Aboriginal people		
Breast cancer				
15–29	0.87	3.43	0.25 (0.05–0.75)	
30–39	39.56	43.54	0.91 (0.71–1.15)	
40–49	140.08	158.59	0.88 (0.77–1.01)	
50–59	278.12	257.64	1.08 (0.96–1.21)	
60–69	468.12	350.17	1.34 (1.17–1.52)	
70–79	439.76	319.11	1.38 (1.12–1.67)	
80+	519.52	297.57	1.75 (1.24–2.39)	
M-H -test of homogeneity [a]				< 0.001
Poisson model [b]				< 0.001
Cervical cancer				
15–29	4.35	2.56	1.70 (0.94–2.86)	
30–39	19.50	9.90	1.97 (1.36–2.77)	
40–49	28.65	11.47	2.50 (1.81–3.37)	
50–59	28.70	9.52	3.02 (2.00–4.38)	
60–69	24.94	10.46	2.38 (1.26–4.12)	
70–79	33.83	11.37	2.98 (1.27–5.93)	
80+	26.64	12.88	2.07 (0.25–7.54)	
M-H -test of homogeneity [a]				0.5554
Negative-binomial model [b]				0.5607
Bowel cancer				
15–29	2.74	2.65	1.03 (0.62–1.63)	
30–39	9.33	7.29	1.28 (0.87–1.82)	
40–49	30.83	23.11	1.33 (1.07–1.64)	
50–59	81.26	72.47	1.12 (0.95–1.31)	
60–69	256.90	184.69	1.39 (1.23–1.57)	
70–79	438.73	328.78	1.33 (1.15–1.54)	
80+	656.28	402.74	1.63 (1.29–2.03)	
M-H -test of homogeneity [a]				0.1399
Poisson model [b]				0.1412

[a] Mantel-Haenszel chi-squared test of homogeneity.

[b] Wald-chi-square test used to examine the significance of the interaction between Aboriginal status and age group.

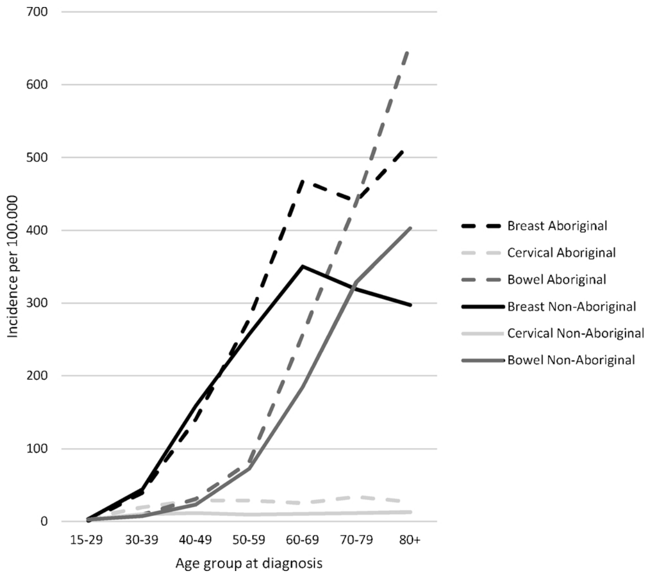

Fig. 1. Age-specific breast, cervix and bowel cancer incidence (per 100.000) in Aboriginal and non-Aboriginal people, NSW Cancer Registry 2001–2014.

reduce breast cancer mortality in women aged 40–49 years is limited [8]. Most high income countries recommend screening target age range to be 50–69 years, with only a few recommending earlier initiation [9]. In the US, breast cancer screening is recommended selectively for younger women. To our knowledge, these recommendations do not acknowledge ethnicity. In Australia, the harms of screening have been considered to outweigh benefits in women aged 40–49 years [3], although whether this applies with newer technology (i.e., digital mammography) requires more investigation.

There is evidence that Aboriginal women are diagnosed with larger breast cancers, which are more likely to have nodal spread, than non-Aboriginal women [10]. Another study did not observe a high frequency of dense breasts or a unique distribution of mammographic parenchymal patterns in Aboriginal women, although their distribution differed from the standard expected Tabár distribution [11]. A comparison with non-Aboriginal people was not performed. High breast density is associated with increased breast cancer risk and lower detection by mammography [4]. Higher interval cancer rates are associated with both younger age and breast density. There is emerging evidence that Aboriginal women have significantly less mammographic density than age- and screen location-matched non-Aboriginal women [12], but whether this varies by age is unknown. Future studies should examine the extent that mammographic density is lower in younger Aboriginal than non-Aboriginal women and the potential impact on screening commencement age in Aboriginal women.

Aboriginal women were diagnosed at a younger age and had higher age-specific cervical cancer incidence rates in all age groups compared with non-Aboriginal people. The number of cancers diagnosed in women aged < 25 years was small and the difference statistically non-significant between Aboriginal and non-Aboriginal women. Cervical screening in women aged 20–24 years has been shown to be less effective in preventing cervical cancer than screening in older women [13]. Aboriginal women are less likely to participate in cervical screening than non-Aboriginal women (2-year participation rates 34% and 56% in 2010–2011) [14]. The most appropriate method for reducing the cervical cancer burden among Aboriginal women might be increasing screening participation.

Limitations include that some comparisons may have been underpowered due to low numbers of Aboriginal people diagnosed with cancer in certain age groups, despite using all available data. We used the best available measure of Aboriginal status augmented by data linkage, but under-recording of Aboriginal people cannot be excluded. Additionally, incidence rates may be affected by numerator-denominator bias as enhancement of Aboriginal status was only applied to cancer incidence data.

In conclusion, evidence was not found for higher age-specific breast or bowel cancer incidence in younger Aboriginal people while cervical cancer incidence was higher in Aboriginal women irrespective of age. Age-specific incidence rates do not indicate the need for lowering the screening target age for Aboriginal people. Nevertheless, higher proportions of breast and bowel cancers were diagnosed before the screening age range in Aboriginal than non-Aboriginal people. While these higher proportions should not be the sole criterion for lowering the screening commencement age for Aboriginal people, the potential to increase screening coverage to lower the burden of breast and bowel cancer in Aboriginal people by commencing screening earlier warrants attention, while considering benefits, harms, and cost-effectiveness.

Author contributions

DR and DCC developed the study protocol. HET analysed the data and drafted the manuscript. DR, SM and HY provided detailed advice on data analyses. All authors contributed to the interpretation of the results and critical revision of the manuscript and approved the final version of the paper.

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Conflict of interest

The authors declare that they have no relevant conflicts of interest.

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