THE PERSONAL CANCER SCREENING BEHAVIOURS OF NURSES AND MIDWIVES'

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ABSTRACT

Aim:

To identify the personal cancer screening behaviours of nurses and midwives in New South Wales, Australia, and identify factors predictive of cancer screening uptake.

Background:

The nursing workforce may have a higher risk for some cancers and is ageing. In Australia, more than 40 percent are over 50 years - an age where cancer incidence rises rapidly, but when screening may reduce cancer mortality. Nurses and midwives are important health role models for the population, but their engagement in cancer screening is unknown.

Design:

A cross-sectional survey conducted in 2014-15.

Methods:

Data were obtained from the 'Fit for the Future' study on 5,041 working nurses and midwives in New South Wales, Australia, and analyses were conducted on subsets of age-eligible respondents. Demographic, geographical and occupational data were analysed in relation to population-based screening for breast, cervical, and bowel cancers and opportunistic screening for prostate and skin cancer screening participation, in line with Australian recommendations.

Results:

Nurses' and midwives' recent screening rates were higher than the Australian general population across relevant age groups. Compared with full-time nurses and midwives, part-time/casual/pool workers were significantly more likely to undertake cervical, breast and bowel screening. Compared to those working office hours, shift workers were significantly less likely to undertake breast and bowel screening, but more likely to undertake skin screening.

Conclusions:

Disparities in reported screening prevalence and factors predictive of screening uptake indicate opportunities for targeted strategies to inform and/or promote workforce engagement with screening programs and protect the health of this ageing workforce.

Key words: nurses, midwives, cancer screening, workforce health, bowel screening, breast screening, cervical screening, skin screening, prostate screening

SUMMARY STATEMENT

Why is this research needed?

- Nurses and midwives may have a higher risk of certain cancers compared with the general population, which is attributed to occupational features. The workforce is also ageing and with age comes an increased risk for cancer.
- Little is known about nurses and midwives' cancer screening behaviours despite the role of screening in reducing cancer morbidity and mortality.
- By identifying workforce cancer screening behaviours and factors predictive of screening uptake, this study provides information to support development of targeted strategies to promote nurses and midwives' engagement in routine screening (where appropriate)

What are the key findings?

- Nurses' and midwives' recent screening rates were higher than the Australian general population across relevant age groups. However, although higher than the general population, nurses and midwives have low participation in bowel and skin cancer screening.
- Over half of male nurses had recently been screened for prostate cancer, despite a lack of support for prostate specific antigen (PSA) testing by leading cancer control agencies at the time of screening (new guidelines emphasise informed consent and biennial screening 50-69 years if appropriate).
- Compared with full-time nurses and midwives, part-time/casual/pool workers were significantly more likely to undertake cervical, breast and bowel screening. Shift workers were significantly less likely to undertake breast cancer and bowel screening than those working office hours.

How should the findings be used to influence policy?

- Given the impact of cancer and other non-communicable diseases on health and productivity, and the global shortage of nurses, it is time to identify and support preventive health behaviours of nurses and midwives.
- Targeted strategies in the workplace should be developed that focus on informing and/or enabling full-time and shift workers to engage in routine cancer screening.
- Targeted workplace-accessible screening programs should be developed that focus on informing and/or enabling bowel and skin cancer screening in nurses and midwives.

INTRODUCTION

Nurses may have a higher risk for certain cancers compared with the general population (Shen *et al.* 2013, Kjaer and Hansen 2009), attributed to long-term shift and night work and occupational exposure to carcinogens (Schernhammer *et al.* 2001, Schernhammer *et al*. 2003, Ratner *et al*. 2010). Furthermore, some specific occupational characteristics have been correlated with unhealthy lifestyle behaviours in nurses and midwives that increase the risk of cancers, including harmful drinking and long working hours (Schluter *et al*. 2012) and cigarette smoking and rotating night shift work (Schernhammer *et al.* 2013). The nursing and midwifery workforce is also ageing: the most important risk factor for cancer overall (AIHW 2012). Increased cancer risks provide impetus not just to improve workplace conditions but also to support workforce cancer screening as these actions are likely to reduce cancer incidence and mortality. The adherence of Australian nurses and midwives to cancer screening recommendations is unknown, but by determining participation, effort may be directed toward informing, promoting and enabling uptake where appropriate.

Background

Multiple cohort and case-control studies have found an association between working as a nurse and an increased risk of certain cancers, including breast, ovarian, prostate, melanoma, and bowel cancer (Peipins *et al*. 1997, Gu *et al.* 2015, Kjaer and Hansen 2009, Lie *et al*. 2007, Lie *et al*. 2006, Gunnarsdóttir and Rafnsson 1995, Sankila *et al.* 1990, Rix and Lynge 1996, Morton 1995, Schernhammer *et al*. 2001, Schernhammer *et al.* 2003, Conlon *et al.* 2007, Hansen and Stevens 2012, Jia *et al* . 2013, Lie *et al*. 2011). For breast cancers in particular, this increased risk is primarily attributed to long durations of night shift work, the resulting circadian rhythm disruption, and the reduced secretion of the hormone melatonin that has tumour-suppressing properties (Haus and Smolensky 2013).

The circadian rhythm disruption in night shift workers is also likely to make the skin more susceptible to the damaging effects of ultraviolet (UV) radiation and other stressors, and increase the risk for

skin cancers (Gutierrez *et al.* 2016). However, as with all cancers investigated in nurses the evidence is inconclusive and further studies are required. *Increased* melanoma risk was reported in studies with large nurse samples (Lie *et al.* 2007, Kjaer and Hansen 2009), and a *decreased* risk for skin cancers was reported in nurses working night shifts for 10 or more years, compared with those never working shifts (Schernhammer *et al.* 2011). Rotating night shift nurses were also found to have a decreased risk for cervical cancer compared to the general population (Shen *et al.* 2013).

These data can be placed in context with overall cancer incidence in Australia. In this country, the most commonly diagnosed cancer (excluding non-melanoma skin cancer) is prostate, followed by breast, bowel, melanoma and lung cancers (AIHW 2014). Worldwide, Australia has one of the highest incidence rates for these cancers, most notably melanoma, of which the incidence is two to three times higher than any other country except New Zealand (Parkin *et al*. 2001, Erdmann *et al*. 2003).

In 2010, the International Agency for Research on Cancer (IARC) assessed all available evidence and classified shift work involving circadian rhythm disruption as 'probably carcinogenic' to humans (IARC 2010). The IARC also identified some biological and chemical agents that nurses may be exposed to in their working lives as 'carcinogenic' or 'probably carcinogenic', including ionizing radiation, anaesthetic waste gases, antineoplastic drugs, ethylene oxide and formaldehyde. Exposure to these hazards has been linked to elevated risks for numerous types of cancers in nurses (particularly breast and leukaemia), although the majority of studies were registry studies with limited data on confounding factors (Lie and Kjaerheim 2003).

Other occupational features of nursing such as the working hours, work practices and conditions have been linked to unhealthy behaviours in nurses and midwives that pose risks for development of cancers, such as a poor diet, low physical activity, smoking and harmful alcohol consumption (Han *et al.* 2011, Wong *et al.* 2010, Tucker *et al.* 2010, Schernhammer *et al.* 2013, Sarna *et al.* 2010, Schluter *et al*. 2012). The prevalence of some negative health behaviours in this workforce are reported at

rates exceeding that of the general population. Obesity for example - a risk factor in bowel, breast and other cancers - was reported as 28% in a study of nurses and midwives, compared with general population rates, which were: 17.5% (Australia), 26.5% (New Zealand) and 25% (United Kingdom) (Bogossian *et al*. 2012).

Internationally, observational study samples tend to report nurses with higher smoking and harmful drinking rates than the public, although large population-based studies have more positive findings. The Australian Health Survey reported the proportion of nurses who smoked (14%) or drank alcohol excessively (11%) as less than other workers in Australia, at 19% and 23% respectively (ABS 2013). Danish nurse samples of over 43,000 and 92,140 demonstrated significantly decreased risks for alcohol and tobacco-related cancers (Lie *et al.* 2007, Kjaer and Hansen 2009). Such studies indicate – at least in regard to alcohol and smoking – relatively healthier lifestyle habits amongst some nurse populations.

The ageing of the nursing and midwifery workforce is also an important consideration given the risk for cancer increases with age. In the past 20 years, the workforce has been ageing faster than the general population and, similar to other 'Western' countries, nearly 40 percent of nurses in Australia are now aged 50 years and older, an age group in which the incidence of cancers increases rapidly (AIHW 2013a). While increased life expectancy may offer nurses and midwives the opportunity to stay longer in the workforce, an increasing burden of cancer and other non-communicable diseases will limit the ability of older workers to meet work demands and may be a factor in early retirement and premature loss of experienced staff (Wong *et al*. 2010).

Given these identified cancer risks for nurses and midwives, prevention and early diagnosis of cancer can be considered a priority. This will not only protect employees' health but also ensure nurses and midwives are available and able to care for the health of the public, including role modelling healthy lifestyles and behaviours. Cancer screening continues to be a cornerstone in reducing mortality from

breast, cervical and bowel cancer (and incidence of bowel and cervical cancer) through organised population-based screening programs (IARC 2015).

Australia currently has three national population-based screening programs: the breast, bowel and cervical programs. These programs invite defined asymptomatic populations to undergo regular screening tests, with the aim of detecting and treating pre-cancerous (cervical and bowel) or early cancerous lesions (breast) before they progress. Breast screening mammography is offered to women aged 50-69 years biennially in Australia, and has just been expanded to include the 70-74 years' age group (BreastScreen Australia 2016). The National Bowel Cancer Screening Program (NBCSP) sends immunochemical faecal occult blood test (FOBT) kits to men and women aged between 50 and 74 every 5 years, but is currently being expanded to offer biennial screening (NBCSP 2016). Routine cervical screening is offered biennially to Australian women aged 18-69 years with a normal history, but change is also underway in this program with the advent of the Human Papilloma Virus (HPV) vaccine and high risk HPV testing (NCSP 2016).

Prostate and skin cancer screening are conducted opportunistically in Australia and are not a part of an organised population screening program (NHMRC 2013 and ACN MGRWP 2008). Regular skin checks by a clinician are not recommended for asymptomatic people at average risk of skin cancer, because non-melanoma skin cancer has low mortality; general practitioner examination is not sufficiently accurate and a population screening program cannot be justified on economic grounds (Helfand *et al.* 2001, Cancer Council Australia 2014). However, current skin screening recommendations encourage people to regularly check their skin for new or changed skin lesions, and to undergo opportunistic skin examination by a medical practitioner if concerned (Cancer Council Australia, 2014).

Both skin clinical and self-examination are likely to increase the chances of detecting thinner melanoma lesions which are less likely to have metastasised (Carli *et al.* 2003, Aitken *et al.* 2010). However, there are no randomised trials evaluating the impact of clinical visual skin examination

on melanoma mortality, and only one case control study supports a link between skin self-examination and reduced melanoma mortality (Berwick *et al*. 1996). Nationwide clinical skin cancer screening in Germany (introduced in 2008) has not demonstrated a decline in mortality (Katalinic *et al.* 2015).

Population-based prostate-specific antigen (PSA) screening for men at average risk is not recommended by leading Australian cancer control bodies because evidence that PSA screening reduces mortality is inconsistent, the test is unreliable and there are concerns about potential harms associated with over-diagnosis (NHMRC, 2013). If prostate cancer is diagnosed, it may not be life-threatening and yet harms associated with treatment are substantial, including sexual dysfunction and compromised urinary and bowel function (NHMRC 2013, Cancer Council Australia 2010). Current Australian recommendations are that men at average risk, aged 50-69 years, who have been informed of the benefits and harms of screening and decide to undergo prostate screening, have a PSA blood test every 2 years (PCFA and Cancer Council Australia, 2015). Informed consent is emphasised: the positive and negative aspects of PSA testing should be discussed with a General Practitioner before making a decision about whether to proceed (PCFA and Cancer Council Australia, 2016).

In summary, in common with all appropriately aged Australians, ostensibly healthy nurses and midwives in Australia are actively invited to take part in three national cancer screening programs and skin self-examination and prostate screening are recommended (with provisos). Identification of participation in screening of this ageing workforce will provide information to support development of targeted strategies to promote their informed consent and/or engagement in recommended screening. Screening may protect their health, contribute to the retention of experienced workers and boost their role modelling of health protective behaviours.

THE STUDY

Aim

To identify the personal cancer screening behaviours of nurses and midwives in New South Wales, Australia and identify factors predictive of screening uptake.

Design

A cross-sectional survey conducted in 2014-15.

Data collection

Sample

This sub-study used data collected for the 'Fit for the Future' study, that included a cross-sectional web-based survey with 5,041 useable responses from nurses and midwives working in New South Wales (NSW), Australia. Recruitment was via email to the membership of the New South Wales Nurses and Midwives Association (NSWNMA) - a professional association and trade union - and through publicity material in trade journals, electronic staff newsletters, professional networks and social media. Three reminder emails were sent to NSWNMA members. The survey was launched in June 2014 and open until February 2015.

Participants

Approximately 88,319 Registered and Enrolled nurses and 9,524 midwives were eligible to join the 'Fit for the Future' study; Assistants in Nursing (unlicensed health workers), whose numbers in NSW are unknown, were not excluded. The online nature of the survey and the diverse recruitment techniques mean the numbers who received an invitation to participate are not known. Of the total 5,446 responses, 405 (7.4%) were excluded due to missing data or because respondents were non-practicing, leaving 5,041 respondents. The respondent profile was similar to that of the Australian nursing workforce (Perry *et al*. 2016).

Sub-study participants were those who completed the relevant screening questions and met the following age criteria in accordance with Australian cancer screening guidelines/ recommendations:

(1) Cervical screening: female nurses and midwives aged 18-69 years (N= 3,710), to identify those who had ever undergone screening/screening within the last two years ('Pap' test);

(2) Breast screening: female nurses and midwives aged 50-69 years (N= 2,162), to identify those who had ever undergone screening /screening within the last two years (mammography);

(3) Bowel screening: male and female nurses and midwives aged 50-74 years (N= 2,235), to identify those who had ever undergone screening / screening within the last two years (FOBT, but may also include sigmoidoscopy (FS) and/or colonoscopy);

(4) Skin cancer screening: adult male and female nurses and midwives of any age (N= 4,260), to identify those who had ever undergone screening (self-examination and/or clinical skin examination); and

(5) Prostate screening: male nurses aged 50-70 years (N= 169), to identify any screening (PSA with or without DRE).

Ethics approval

The study was approved by the relevant hospital and university Human Research Ethics Committees.

Validity, reliability and rigour

Questionnaire items were selected and/or adapted from other studies, with some additional items developed by the authors based on the literature review, consultation and preliminary testing in two acute hospitals in Sydney (Perry *et al.* 2015). The screening behaviour questions were drawn from the Australian Longitudinal Study on Women's Health a long-running, extensively validated population-based study (Brown *et al*. 1996).

Sub-study measures

Full details of the questionnaire are reported elsewhere (Perry 2016), but briefly, the Fit for the Future questionnaire comprised: (1) demographic characteristics, (2) workforce variables and (3) general health, health behaviours and well-being.

Demographic and occupational factors:

Demographic and employment variables included age, gender, work roles, shifts and work contract. Participants' current primary work roles were classified as: (1) Assistants in Nursing (AINs); (2) foundational nurse (front-line clinical staff); (3) domain specific (educators/ managers/ researchers); (4) advanced practice nurses and midwives (with a scope of practice beyond that allowed by ordinary registration). We collapsed the separate categorisation identified by Gardner *et al*. (2016) to collate Nurse/ Midwife Practitioners with Advanced Practice nurses, due to their low numbers. Shift work was defined as work performed outside of 'office' hours and included evening shifts, rotating shifts and night shifts or a combination of these. Work contract was classified as working full-time or part-time (including casual/ pool contracts).

Cancer screening: the stem question used to assess engagement in cancer screening asked 'When did you last have a routine screening test?' Each item was answered by indicating if respondents had a routine Pap test, a mammogram, prostate test, a bowel cancer check and/or skin check in the past two years, more than two years ago, never, or the question was not applicable to them. Those who did not reply to these questions were excluded from this sub-study.

Statistical analyses

Data were entered into SPSS version 22.0® for cleaning and analysis. In calculating screening rates, where age and sex-eligible respondents indicated the question was not applicable for them, we

excluded them: and N=277, N=10, N=31, N=92 and N=3 respondents indicated that cervical, breast, bowel, skin and prostate screening was not applicable for them, respectively. Differences in screening rates within the previous two years were analysed according to demographic (age and gender), geographical area, and work-related variables using chi-square tests. Chi-square value, degrees of freedom and p value are presented (Table 1). Both univariate and multivariate logistic regression model analyses were used to assess the associations between cancer screening, demographic and work-related characteristics. Assumptions of the models were tested and met; a level of significance of 5% was accepted. Wald test value (z), Odds Ratio (OR), P value and 95% Confidence Interval (CI) were used to present the results.

RESULTS

Cervical screening (Pap test)

Table 1 shows the uptake of age-appropriate cancer screening by NSW nurses and midwives compared to the Australian population. Overall, nurses and midwives showed greater adherence to cervical screening recommendations than the Australian general population across age groups.

Of the total 5,041 respondents, 4,355 female nurses and midwives responded to the question on cervical screening. Only 3.8% (N=164) had never had a Pap test. Of those aged 18 to 69 years, 72.6% (N=2,688) reported having a Pap test within the previous two years. Differences in screening rates within the previous two years were analysed according to age and gender, residential and workplace geographical area, work role, contract and hours. Significant differences by age were found amongst sub-group members, with screening more likely to have occurred within the last two years amongst those older (X^2(df9)=37.5, p<0.001), for those working part time and casual hours (X^2(df1)=15.5, p<0.001), and in advanced practice roles (X^2(df3)=8.48, p=0.03) (Table 1).

Breast screening mammography

A total of 4,325 female nurses and midwives responded to the breast screening questions. Overall, 31.8% (N=1,376) had had a mammography; 14.9% (N=617) had, at some point, received an abnormal result. A sub-sample of 2,161 female nurses and midwives aged 50-69 years responded to the breast screening questions, of whom 76.9% (N=1,654) had undergone routine mammography within the previous two years. Differences in screening rates within the previous two years were analysed according to age and gender, residential and workplace geographical area, work role, contract and hours. Screening uptake was significantly higher for older nurses and midwives (X^2(df3)=20.1, p<0.001), for those working office hours rather than shifts (X^2(df1)=11.2, p=0.001), on a part time rather than full time basis (X^2(1)=5.62, p=0.02), and in primary, community or outpatient settings (X^2(df3)=10.9, p=0.01) (Table 1).

Bowel screening

A total of 4,648 male and female nurses and midwives responded to the bowel screening questions. Overall, 48.1% (N=2,234) had never undergone a bowel cancer screening test; 4.3% (N=184) had, at some point, received an abnormal result. A sub-sample of 2,257 nurses and midwives aged 50-69 years replied to these questions, of whom 53.2% had undergone a bowel cancer screening test in the previous two years. Differences in screening rates within the previous two years were analysed according to age and gender, residential and workplace geographical area, work role, contract and hours. Screening uptake was significantly lower at age 50-54 years and progressively increased to peak at 65-69 years (X^2(df3)=43.3,p<0.001), and greater amongst part-time rather than full time employees (X^2(df1)=11.4, p=0.001) (Table 1).

Skin cancer screening

In total, 4,711 (93.5%) of survey respondents replied to the skin screening questions. Overall, 42.2% (N=1,945) respondents had undertaken some form of skin cancer screening in the previous two years; 18.5% (N=931) had, at some point, received an abnormal result. Differences in screening rates within the previous two years were analysed according to age and gender, residential and workplace geographical area, work role, contract and hours. Screening rates increased significantly with age (X^2(df9)=202.9, p<0.001). Screening occurred significantly less often amongst those working in hospitals compared to all other settings (X^2(df3)=21.9, p<0.001), amongst full-time compared to part-time workers (X^2(df1)=31.0, p<0.001), and those working shifts rather than day workers (X^2(df1)=9.32, p=0.002). Those working in AIN rather than all other roles were significantly less likely to have undertaken skin cancer screening (X^2(df3)=13.0, p=0.005) (Table 1).

Prostate screening

Of 458 male respondents, 444 responded to the prostate screening question. In total, 44.1% (N=196) of all male respondents reported undergoing prostate screening at some time; 49.3% (N= 219) had never undergone prostate screening; 5.7% (N=14) had experienced an abnormal result. Differences in screening rates within the previous two years were analysed according to age, residential and workplace geographical area, work role, contract and hours. Of 170 male respondents aged 50-70 years who responded to the prostate screening question, overall 76.5% (N=130) had undergone prostate screening at some time, and 51.2% (N=87) within the past two years. Screening rates increased significantly with increasing age (X^2(df2)=8.15, p=0.02) (Table 1).

Logistic regression models

There were differences in cancer screening uptake across workplace settings and locations, age groups, shift patterns, work roles and contracts. Associations between cancer screening and these

potential predictor factors were assessed using logistic regression models. Both univariate and multivariate model analyses were conducted and results are presented in Table 2.

For cervical screening of females aged 18-69 years, the final multivariate regression model revealed strong associations between uptake and work setting and contract status. Compared with nurses and midwives who worked in aged care, rehabilitation and disability settings, those who worked in hospitals (z=2.72, p=0.007, 95% CI: 0.09; 1.69), primary care, community, out-patient (z=3.14, p=0.002, 95%CI: 1.17; 1.99) and other settings were significantly more likely (z=2.40, p=0.02, 95% CI: 1.08; 2.10) to undertake cervical screening (OR=1.35, 1.53 and 1.50 higher, respectively). Compared with full-time workers, those who worked part-time and casual hours were also more likely to have been screened (OR=1.38, z=4.17, p<0.001; 95% CI: 1.18; 1.60) (Table 2).

For females aged 50-69, significant associations were found between breast screening and age (z=4.01, p<0.001, 95% CI: 1.03; 1.08), contract status (z=2.70, p=0.007, 95% CI: 1.08; 1.65), and roster status (z=-3.74, p<0.001, 95% CI: 0.54; 0.83). Older nurses and midwives were 5% more likely to have undertaken breast screening. Compared with full-time workers, part-time and casual nurses and midwives were 34% more likely to have been screened, whilst shift workers were 33% less likely to have been screened than day workers (Table 3).

For bowel screening, there were significant associations with both contract (z=3.74, p<0.001, 95% CI: 1.17; 1.66) and roster status (z=-2.57, p=0.01, 95% CI: 0.67; 0.95) for males and females aged 50-69 years. Part-time and casual workers were 39% more likely to have been screened than full –time nurses and midwives, with shift workers 20% less likely to have been screened than day workers (Table 4).

For skin cancer screening, there were significant associations with age, work roles and roster status for both males and females aged 20-69 years. Older nurses and midwives were 4% more likely to undertake skin screening (z=12.8, p<0.001, 95% CI: 1.03; 1.05). Compared with AINs, those working as foundational (z=1.48, p=0.14, 95% CI: 0.92; 1.77), domain specific (z=2.60, p=0.009, 95% CI: 1.13;

2.32) and advanced practice nurses and midwives (z=1.78, p=0.08, 95% CI: 0.97; 2.12) were all more likely to undertake skin screening (OR=1.28, 1.62 and 1.43, respectively). Compared with full-time workers, part-time nurses and midwives were 35% more likely to undertake skin screening (z=4.30, p<0.001, 95% CI: 1.18; 1.54) (Table 5).

No significant differences were found in relation to prostate screening.

DISCUSSION

A positive picture emerged from this study of nurses' and midwives' cancer screening behaviours, particularly in regard to cervical and breast screening, in which, 72.6% and 76.9%, respectively, were adherent to recommended screening guidelines. Furthermore, approximately half of the age-eligible participants were up-to-date with biennial bowel screening. With a sample approximating to the Australian nursing and midwifery workforce (Perry *et al.* 2016), comparisons of results to those of the Australian population showed nurses with higher uptake rates of cervical (at 72.6% compared to 58.2%), breast (at 76.9% compared to 54.6%) and bowel screening (at 53.2% compared to 37.3%) within the recommended two-year period. Uptake of organised screening, particularly bowel screening, could still be improved in this Australian nursing workforce, as high rates of participation are associated with mortality reduction among appropriate age groups.

Skin cancer screening (clinical or self-examination) was conducted in the past two years by only 42.2% of participants. This also may be at higher rates than Australian general populations, reported to range from 26% to 48% for annual/regular skin self-examination (Girgis *et al.* 1991, Aitken *et al.* 2004) and 11% to 18% for annual clinical skin examination (Girgis *et al.* 1991, Janda *et al.* 2004). Current Medicare (2015) estimates of approximately 20% of Australian men aged 45-74 years having a PSA test every year (778,500 PSA tests were performed in 2012) (AIHW 2013b) may not be dramatically different to findings of 51.2% of respondent male nurses undergoing prostate screening in the previous two years. None of these comparisons are precise, given differences in inclusion

criteria, some potential differences in test methods and some uncertainty about the risk status of those replying that survey questions were 'not applicable'.

Overall, findings show the majority of age-eligible nurses and midwives in this study are relatively more adherent to screening recommendations than the general population, indicating proactive engagement in protecting their health. It is heartening that geographical location was not a deterrent to screening participation, with no significant effect observed for regional and rural residence. In the Australian general population, lower participation in cancer screening is usually found in remote communities compared to regional or metropolitan areas (AIHW 2015, 2016 a,b). Lower participation is usually linked with factors such as low socio-economic status, low health literacy and low patient-provider communication (Siahpush and Singh 2002, Martini *et al.* 2011, Ward *et al.* 2011, McLachlan *et al.* 2012). Fear, embarrassment and disgust of the screening test are also well-known barriers (Bukowska-Durawa and Luszczynska, 2014, Chambers *et al.* 2016, Chorley *et al*. 2016).

Working nurses and midwives might be anticipated to be less affected by socio-economic status; should have good health literacy and communication with healthcare providers, and may be more immune to fear and embarrassment of the test, due to the nature of their roles. This is perhaps what is reflected by similar screening rates for these participants across all areas and age groups. Nurses' uptakes of screening were in line with studies showing that internationally, nursing populations in 'Western' countries prioritise screening. Eighty-six percent of 1021 health workers (n=490 nurses) in the United Kingdom (UK) had a Pap test in the previous 5 years (Jinks *et al.* 2003) and in Canada, nurses (N=1,769) were more likely to ever have had a Pap test or mammography compared with other occupations (Pap test 97.4% vs 91.0%, mammography 49.8% vs 36.0%) (Ratner and Sawatzky 2009). Lower cervical screening rates in Asian nursing workforces, of 42.2% in Singapore (Tay et al. 2015), 53.8% in Korea (Ju *et al.* 2003) and 48.9% in Taiwan, may reflect more limited acceptability of the Pap test in these countries (Chung et al. 2011). In low income countries,

many without organised cancer screening programs, screening is extremely low in nurse and general populations (Odusanya *et al*. 2001, Mutyaba *et al*. 2006, Canbulat *et al*. 2008, Akhigbe *et al*. 2009).

Internationally, there are few data concerning nursing workforce uptake of bowel, prostate and skin cancer screening. Extremely low FOBT screening (1.2%) and relatively high PSA testing (65.7%) were reported in Brazilian physicians, nurses and assistants (N=333) (Gonçalves-Silva *et al.* 2010). In the United States (US), shift workers from a variety of professions including health care (N=9,009), had high participation in breast and cervical screening, but only about half were adherent to bowel screening (Tsai *et al.* 2014). This is similar to screening rates among nurse shift workers in this study, with relatively high cervical and breast screening and lower bowel screening (72.0%, 73.6% and 50.2%). However, direct comparisons are limited by the difference in recommended screening intervals for cervical, breast and bowel screening between the two countries.

FOBT testing is recommended biennially in most countries, although recommended annually in the US. Australia is generally more conservative with its biennial cervical screening recommendation, as most other countries (including the US and UK) recommend Pap smears triennially. Breast screening recommendations vary between 2 to 3 year intervals worldwide. Australia is in line with other countries for the age of commencement of bowel and breast screening at 50 years but cervical screening commencement is at 18 years in Australia, compared with 20-25 years in many countries (Public Health England 2015a,b, American Cancer Society 2016a,b, USPTF 2012, Linos *et al*. 2000).

No country has implemented a population-based prostate or skin screening program, except for the German national clinical skin screening program (Trautmann *et al.* 2016). Routine screening by full skin clinical examination is not recommended in most countries, including those with high incidences of melanoma (New Zealand Cancer Society 2010, Cancer Research UK 2016, Norwegian Cancer Society 2016, USPTF 2016). Skin self-examination and opportunistic clinical examination of unusual skin changes is more widely recommended (NZ Cancer Council 2010, Cancer Council Australia 2014, Cancer Research UK 2016, Canadian Cancer Society 2016). Routine PSA screening is also not

recommended in most countries, although this is very contentious and conflicting advice is often given (USPTF, 2016, American Cancer Society 2016c).

The balance of benefit is widely accepted for bowel and cervical cancer screening programs. The decline in cervical cancer incidence by 33%, and mortality by 36%, in the years following the introduction of the cervical screening program are largely attributed to routine screening and improvements in treatment (Canfell *et al.* 2006). Randomised trials of FOBT screening have reported reductions of bowel cancer mortality of 33% (annual screening) and 16% (biennial screening) (Mandel *et al*. 1993, Hardcastle *et al.* 1996). Furthermore, despite controversy and debate, the recent IARC review panel concluded that mammography screening is effective in reducing breast cancer mortality for women aged 50-74 years based on available evidence, and this reduction outweighs the adverse effects for women (Lauby-Secretan *et al.* 2015). Health benefits could therefore follow if nurses' and midwives' screening behaviours were more aligned to recommended practice.

Although half of the male nurses had undergone prostate screening in the past two years, the benefits of PSA testing are uncertain and was not supported by leading Australian cancer control agencies (at the time they were screened). Screening behaviour may have reflected uncertainty with recommended guidelines, given the misrepresentations and encouragement for screening in the media and conflicting advice given by urologists (MacKenzie *et al*. 2007). With the development of new Australian guidelines recommending individual choice based on informed consent (and biennial screening if consent is given), nurses may be offered more support in choosing if PSA screening is appropriate for them.

In this study, nurses' uptake of bowel and skin screening in particular still offers considerable scope for improvement. Characteristics linked to screening uptake indicate where future strategies may be directed. Age was an important determinant of higher participation in breast and skin cancer screening programs, with breast and skin screening peaking in older nurses. Full time working posed

a significant barrier to screening access, and there were clear trends of poorer uptake by those working shifts, many of which entail night work. This aligned to US data, where alternating shift workers (evening, night, rotating) were also less adherent to cancer screening compared with daytime workers (Tsai *et al.* 2014).

As the nursing workforce may be at heightened risk for some cancers, and the workforce is ageing, efforts to maintain a sustainable workforce will be supported by effective primary prevention and early detection strategies. Workplace strategies should support adequate diet and exercise and other healthy behaviours; the detection of pre-cancers and cancers at an early curable stage; and limit exposure to carcinogens. Research shows that health facilities can be unhealthy places to work and there are a number of obstacles to the maintenance of a healthy lifestyle and the prevention of ill health, which can be minimised (Wong *et al*. 2010, Han *et al.* 2011).

Nurses and midwives are recognised as role models for the public because of their status as health professionals and their health literacy. However, there is little acknowledgement that for many, engaging in preventive health behaviours may be difficult as they juggle competing demands of domestic responsibilities with inflexible work schedules, long or unsocial hours and emotionally challenging work. Full time working posed a significant barrier to screening access, and there were clear trends of poorer uptake by those working shifts. Shift workers may be less likely to engage in cancer screening because of difficulty accommodating healthy behaviours into shift patterns and balancing work and family commitments, including around alternate shifts (Tsai et al 2015). Lack of time and fatigue have also been reported as barriers to engaging in healthy behaviours (Phiri *et al*. 2014) and health promotion activities at work may be more frequent during day time hours (Tsai *et al.* 2014).

Important opportunities for health promotion may be achieved by integrating cancer prevention and screening into worksite health promotion programs, and organisational support can improve the utilisation of cancer screening tests (Douglas *et al*. 2011, Stone *et al*. 2002). There has also been a

call for flexible hours for shift workers so that preventive health behaviours can be accommodated (Nelson *et al.* 2014). Worksite-based screening and targeting shift-workers might be some ways to overcome access issues and has support among nurses (Jinks *et al*. 2003, Tsai *et al.* 2014, Nahmias *et al.* 2016). These strategies have had some success in increasing knowledge and/or screening uptake among nurses and workers in other occupations (Girgis *et al.* 1994, Allen *et al.* 2001, Jensen *et al.* 2014, Uslu *et al.* 2016). Awareness and education programs should consider a focus on AIN staff, more junior nurses, those with lesser health literacy and for skin cancers for hospital workers in particular. As with all eligible populations, informed decisions should be promoted so that there is increased understanding of both the benefits and the risks of screening, especially for PSA screening where the benefits are less certain.

Study limitations:

Study limitations include that screening rates might be over or under-estimated because the questionnaire did not specifically ask whether testing was done for screening, diagnostic or monitoring reasons, although participants were asked about *routine screening* practices. Some 'not applicable' responses may have been inappropriate and have reflected ignorance of recommended practice. Over or under estimated recall may have occurred when determining biennial screening rates, particularly because the National Bowel Cancer Screening Program invited at five-yearly intervals at the time nurses screening behaviours were determined. The questionnaire did not ask which particular prostate, bowel or skin cancer test participants had, and although PSA, FOBT and skin self-examination are the most common, several test options are available. Caution should be exercised with direct comparisons with general population screening rates where the test is known. Finally, data are self-reported and therefore may be subject to self-report response bias.

CONCLUSION

This was the first Australian study where the personal screening behaviours of nurses and midwives were investigated among a single, nationally comparable sample. Higher participation rates in

nurses, compared with the general public, is good news for the health of nurses and midwives and the community that relies on their care. Study findings suggest this ageing workforce is making protective choices which will impact their future risk of illness and premature departure from the workforce. However, findings also indicate avenues to further improve participation rates, particularly for skin and bowel cancer screening, and to ensure those thinking of undergoing screening fully understand its relative risks and benefits.

The study provides information of use to managers, policy-makers and staff in the development of targeted education and screening interventions capable of delivery in the workplace. With growing alarm over increasing rates of non-communicable disease and the effect on the health and productivity of the workforce, this study suggests practical ways forward to protect the health of workers at the core of the health system. In light of global nursing shortages and the ageing of the workforce, strategies that focus on preventing non-communicable diseases, such as cancer, offer benefits for both organisations and individuals.

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Table 1. Uptake of age-appropriate cancer screening by New South Wales nurses and midwives* compared to the Australian population

	Cervical screening Female nurses/midwives 18-69 years (biennial)			Breast screening Female nurses/midwives 50-69 years (biennial)			Bowel screening Female & male nurses/midwives 50-69 years (biennial)			Skin screening Female & male nurses/midwives 20-69 years (biennial)			Prostate screening Male nurses/midwives 50-69 (biennial)		
	Yes (n2688)	**X^2 (P value)**	**Aust. pop. (biennial)[1]**	**Yes (n1654)**	**X^2 (P value)**	**Aust. pop. (biennial)[2]**	**Yes (n2226)**	**X^2 (P value)**	**Aust. pop (biennial)[3]**	**Yes (n1782)**	**X^2 (P value)**	**Aust. adult pop. (annual/regular)**	**Yes (n87)**	**X^2 (P value)**	**Aust. male population 25-74 (annual)**
Age group		37.5 (p<0.001)			20.1 (p<0.001)			43.3 (p<0.001)			202.9 (p<0.001)			8.15 (p=0.02)	
20-24	60.0%		42.7%							28.2%					
25-29	68.3%		52.0%							23.5%					
30-34	72.6%		58.1%							27.6%					
35-39	68.0%		61.0%							27.5%					
40-44	77.6%		62.6%							32.1%					
45-49	76.7%		64.5%							41.8%					
50-54	75.6%		64.0%	70.9%		48.9%	48.2%		28.6%	45.4%			40.6%		
55-59	73.2%		61.9%	79.9%		55.0%	54.7%		36.8%	51.4%			61.8%		
60-64	68.3%		60.4%	80.4%		59.9%	71.0%		43.9%	62.3%			66.7%		
65-69	60.0%		52.7%	77.9%		58.5%	64.0%		44.2%	57.3%					
% Total 18-69 years	**72.6%**		**58.2%**							**42.2%**		**11%-48%**			
% Total 50-69 years				**76.9%**		**54.6%**	**53.2%**		**37.3%[3]**				**51.2%**		**20%[5]**
Area		5.01 (p=0.08)			0.15 (p=0.93)			3.97 (p=0.14)			1.61 (p=0.45)			0.54 (p=0.76)	
Major cities	73.7%		58.1%	76.7%		53.1%	54.8%		36.6%	41.5%			54.1%		
Inner regional	71.7%		59.7%	76.6%		57.4%	51.4%		40.0%	43.6%			48.3%		
Outer regional/ remote	69.6%		57.5%	78.0%		59.1%	48.1%		37.5%	43.0%			55.6%		
Gender								0.23 (p=0.64)			0.14 (p=0.71)				
Female							53.2%		40.0%	42.3%					
Male							51.3%		35.0%	41.3%					
Workplace setting		7.46 (p=0.08)			10.9 (p=0.01)			4.90 (p=0.18)			21.9 (p<0.001)			1.01 (p=0.80)	
Hospital	72.7%			75.0%			51.2%			39.4%			49.5%		

Aged care/rehab / disability	68.0%			74.3%			53.1%			43.8%			57.1%		
Primary care/ community/ outpatient	75.2%			81.2%			57.1%			46.5%			50.0%		
Other	73.3%			79.2%			54.1%			49.2%			58.6%		
Shifts		0.81 (p=0.37)			11.2 (p=0.001)			3.28 (p=0.07)			9.32 (p=0.002)			0.03 (p=0.86)	
Day work	73.3%			79.7%			54.9%			44.6%			52.7%		
Shift work	72.0%			73.6%			50.2%			39.9%			51.4%		
Work contract		15.5 (p<0.001)			5.62 (p=0.02)			11.4 (p=0.001)			31.0 (p<0.001)			0.10 (p=0.75)	
Part-time/ casual/pool	75.6%			79.0%			56.7%			46.8%			50.0%		
Full time	69.8%			74.7%			49.6%			38.3%			52.9%		
Role		8.48 (p=0.03)			4.76 (p=0.19)			2.42 (p=0.49)			13.0 (p=0.005)			3.63 (p=0.30)	
**AIN	64.9%			70.6%			46.6%			35.6%			50.0%		
Foundational	72.9%			77.2%			53.6%			41.2%			46.7%		
Domain specific	71.5%			75.4%			51.6%			47.6%			63.0%		
Advanced practice	77.2%			81.7%			55.3%			43.8%			45.0%		

* Of the total 5,446 responses, 405 (7.4%) were excluded due to missing data or because respondents were non-practicing, leaving 5,041 respondents. Chi-square (X^2) tests were used to assess the differences in screening rates within the previous two years according to age (and gender), residential and workplace geographical area, shift, work contract and work roles.

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1. Age standardised rate - the number of Australian women screened in 2012–2013 as a percentage of the Australian Bureau of Statistics (ABS) estimated resident population for women aged 20–69, adjusted to include only women with an intact cervix using age-specific hysterectomy fractions derived from the AIHW National Hospitals Morbidity Database, age-standardised to the Australian population at 30 June 2001 (AIHW, 2016a)
2. Age-standardised (AS) rates are the number of Australian women screened as a percentage of the eligible female population calculated as the average of the 2012 and 2013 ABS estimated resident population and age standardised to the Australian population at 30 June 2001. Period covers Jan 2012- Dec 2013 (AIWH, 2015)
3. Of the Australian population aged 50-65 years invited in the 2 yearly 2013–2014 period, 37.3% participated in the National Bowel Cancer Screening Program – using the Faecal Occult Blood Test (AIHW, 2016b). The participation indicator reports a 2-year period but at the time of this study the eligible population (50- 65 years) were invited 5 yearly (2 yearly screening is currently being implemented)
4. Australian skin screening **annual/regular** prevalence among selected populations is reported to range from 26% to 48% for skin self-examination (Girgis et al. 1991, Aitken et al. 2004) and 11% to 18% for clinical skin examination (Girgis et al. 1991, Janda et al. 2004).
5. Analysis of Medicare Benefits Schedule (MBS) records suggest that each year about 20% of men aged between 45 and 74 have a PSA test, presumably for the purpose of early diagnosis of prostate cancer. This estimate is based on the relevant Medicare Item number, recorded counts of which are fewer than the actual number of tests done (Trevena *et al*., 2013).

Table 2. Logistic regression modelling of significant factors for uptake of age-appropriate cervical cancer screening by NSW nurses and midwives

Factor	Univariate Model			Final Multivariate Model*		
	OR (95% CI)	Wald test values (z)	P value	OR (95% CI)	Wald test values (z)	P value
Age	1.01 (0.99; 1.01)	1.16	0.34			
Area						
Metro (Ref)	1					
Inner regional	0.91 (0.77; 1.07)	-1.19	0.24			
Outer/remoter regional	0.75 (0.57; 0.98)	-1.92	0.04			
Work setting						
Aged care /rehab / disability (Ref)	1			1		
Hospital	1.26 (1.01; 1.55)	2.07	0.04	1.35 (0.09; 1.69)	2.72	0.007
Primary care/ community/ outpatient	1.43 (1.10; 1.85)	2.65	0.007	1.53 (1.17; 1.99)	3.14	0.002
Others	1.29 (0.94; 1.77)	1.84	0.11	1.50 (1.08; 2.10)	2.40	0.016
Contract						
Full-time (Ref)	1			1		
Part-time/casual/pool	1.34 (1.16; 1.55)	3.75	<0.001	1.38 (1.18; 1.60)	4.17	<0.001
Work role						
AIN (Ref)	1					
Foundational	1.45 (1.05; 2.02)	2.13	0.03			
Domain specific	1.36 (0.94; 1.96)	1.51	0.10			
Advanced practice	1.86 (1.20; 2.80)	2.88	0.01			
Roster						
Day work (Ref)	1					
Shift work	0.94 (0.81; 1.08)	-0.95	0.37			

** Final model for cervical screening adjusted for work setting and contract.*

Table 3. Logistic regression modelling of significant factors for uptake of age-appropriate breast cancer screening by NSW nurses and midwives

Factor	Univariate Model			Final Multivariate Model*		
	OR (95% CI)	Wald test value (z)	P value	OR (95% CI)	Wald test value (z)	P value
Age	1.06 (1.03; 1.08)	3.91	<0.001	1.05 (1.03; 1.08)	4.01	<0.001
Area						
Metro (Ref)	1					
Inner regional	0.99 (0.79; 1.24)	0.02	0.93			
Outer/remoter regional	1.07 (0.73; 1.58)	0.45	0.72			
Work setting						
Aged care/rehab / disability (Ref)	1					
Hospital	1.03 (0.78; 1.37)	0.40	0.81			
Primary care/ community/ outpatient	1.55 (1.11; 2.17)	2.61	0.01			
Others	1.31 (0.88; 1.97)	1.43	0.18			
Contract						
Full-time (Ref)	1			1		
Part-time/casual/pool	1.28 (1.04; 1.56)	2.33	0.02	1.34 (1.08; 1.65)	2.70	0.007
Work role						
AIN (Ref)	1					
Foundational	1.41 (0.87; 2.28)	1.51	0.16			
Domain specific	1.28 (0.76; 2.15)	1.03	0.35			
Advanced practice	1.86 (1.02; 3.38)	2.12	0.04			
Roster						
Day work (Ref)	1			1		
Shift work	0.71 (0.58; 0.87)	-3.29	0.001	0.67 (0.54; 0.83)	-3.74	<0.001

** Final model for breast screening adjusted for age, contract and roster status*

Table 4. Logistic regression modelling of significant factors for uptake of age-appropriate bowel cancer screening by NSW nurses and midwives

Factor	Univariate Model			Final Multivariate Model*		
	OR (95% CI)	Wald test value (z)	P-value	OR (95% CI)	Wald test value (z)	P value
Age	1.02 (1.00; 1.04)	1.99	0.03			
Gender						
Female (Ref)	1					
Male	0.92 (0.67; 1.28)	-0.54	0.64			
Area						
Metro (Ref)	1					
Inner regional	0.87 (0.73; 1.05)	-1.56	0.14			
Outer/remoter regional	0.77 (0.55; 1.06)	-1.65	0.11			
Work setting						
Aged care/rehab / disability (Ref)	1					
Hospital	0.93 (0.73; 1.18)	-0.62	0.55			
Primary care/ community/ outpatient	1.18 (0.89; 1.55)	1.03	0.25			
Others	1.04 (0.75; 1.45)	0.26	0.81			
Contract						
Full-time (Ref)	1			1		
Part-time/casual/pool	1.33 (1.13; 1.58)	3.28	0.001	1.39 (1.17; 1.66)	3.74	<0.001
Work role						
AIN (Ref)	1					
Foundational	1.33 (0.86; 2.04)	1.27	0.20			
Domain specific	1.22 (0.77; 1.93)	0.87	0.40			
Advanced practice	1.42 (0.85; 2.35)	1.32	0.18			
Roster						
Day work (Ref)	1			1		
Shift work	0.86 (0.73; 1.01)	-1.82	0.07	0.80 (0.67; 0.95)	-2.57	0.01

** Final model for bowel screening adjusted for contract and roster status*

Table 5. Logistic regression modelling of significant factors for uptake of skin cancer screening by NSW nurses and midwives

Factor	Univariate Model		Final Multivariate Model*	
	OR (95% CI)	P-value	OR (95% CI)	P value
Age	1.04 (1.04; 1.05)	<0.001	1.04 (1.03; 1.05)	<0.001
Gender				
Female (Ref)	1			
Male	0.96 (0.78; 1.19)	0.71		
Area				
Metro (Ref)	1			
Inner regional	1.09 (0.95; 1.25)	0.22		
Outer/remoter regional	1.06 (0.83; 1.37)	0.64		
Work setting				
Aged care/rehab / disability (Ref)	1			
Hospital	0.84 (0.69; 1.01)	0.06		
Primary care/ community/ outpatient	1.12 (0.89; 1.39)	0.33		
Others	1.25 (0.96; 1.62)	0.10		
Contract				
Full-time (Ref)	1		1	
Part-time/casual/pool	1.42 (1.25; 1.60)	<0.001	1.35 (1.18; 1.54)	<0.001
Work role				
AIN (Ref)	1		1	
Foundational	1.27 (0.93; 1.74)	0.14	1.28 (0.92; 1.77)	0.14
Domain specific	1.65 (1.17; 2.31)	0.004	1.62 (1.13; 2.32)	0.009
Advanced practice	1.41 (0.97; 2.05)	0.07	1.43 (0.97; 2.12)	0.08
Roster				
Day work (Ref)	1			
Shift work	0.83 (0.73; 0.93)	0.002		