# Adherence to recommended health checks by women in mid-life: data from a prospective study of women across Australia

Julie Byles,[1] Lucy Leigh,[1] Catherine Chojenta,[1] Deborah Loxton[1]


## Abstract

**Objective:** To examine the factors related to Papanicolaou (Pap) tests, mammography and cholesterol testing in mid-aged Australian women as they age.

**Methods:** Data were obtained from the 1946–51 cohort of the Australian Longitudinal Study on Women's Health, a prospective study of the health and lifestyle of Australian women. Data were collected via self-report mailed surveys on a three-yearly basis since 1996, when participants were aged 45–50. Demographic factors, health service use and health-related factors were examined in relation to screening practices in a lagged analysis.

**Results:** As women aged, they were less likely to have a Pap test and more likely to report having a mammogram and a cholesterol test. Smokers were less likely to have all screening tests, and HRT use and more general practitioner (GP) visits were associated with increased odds of having health checks. Compared to healthy weight, higher BMI was associated with increased odds of cholesterol testing but decreased odds for Pap testing; obese women had lower odds for mammography. Underweight women had lower odds for mammography and Pap testing. Worse self-rated health and self-report of a chronic condition were significantly related to increased likelihood of cholesterol testing. While some demographic and area of residence factors were also significantly associated with screening, large inequities based on socioeconomic status were not evident.

**Conclusions:** Health and healthcare use are important determinants of screening.

**Implications:** Greater advantage needs to be taken of opportunities to encourage women with more health risk behaviours and health problems to engage in screening.


**Key words:** mid-aged women, pap tests, mammography, cholesterol testing, screening and prevention

Much of the chronic disease burden in Australia is preventable through adherence to healthy behaviours and through secondary prevention via screening and early detection and management of chronic conditions.[1] As the population ages, the prevalence of these preventable chronic conditions is increasing, and the imperative for prevention is becoming ever more urgent. In Australia[2] and internationally,[3] there is increasing emphasis on encouraging healthy behaviours and disease prevention as the major means to reduce chronic disease burden and healthcare costs.

The Royal Australian College of General Practitioners (RACGP) Guidelines for preventive activities in general practice (the *Red Book*)[4] recommend a number of health checks that apply to mid-aged women. These checks include cholesterol checks, Papanicolaou (Pap) tests and mammography. The RACGP recommends regular testing for high cholesterol and abnormal lipid profiles for all adults aged 45 to 74 years.[4] Pap tests to detect cervical cancer and pre-cancerous changes are recommended every two years for women who have had sexual intercourse and have an intact cervix, starting from 18 to 20 years of age (or up to two years after first having sexual intercourse, whichever is later) and can cease at age 70 for women who have had two normal Pap tests in the previous five years.[4] To reduce the risk of death from breast cancer, women aged 50–69 years are recommended to undergo mammographic screening every two years.[4] While charges for these health checks and associated medical practitioner visits are covered by Medicare, women may have to pay a share of the costs.

While these tests are recommended for mid-aged women, the screening rates remain low. Breast screening rates for women aged 50–69 years decreased from 56.9% in 2005–2006 to 54.9% in 2007–2008 across Australia.[5] Pap test rates from 2008–2009 were 59% of eligible women.[6] While national data on cholesterol screening are not available, it is estimated that more than 3.5% of all general practice encounters in 2009–10 resulted in an order for lipid testing.[7] While patient perceptions and beliefs related to GP screening have been identified, there is an acknowledgement that objective measures of use of preventive health tests are required in Australia.[8]

Cross-sectional analyses of screening behaviour identify demographic factors such as age and education[9] and healthcare factors such as smoking,[10] health service use,[11] health insurance[10] and parity[12] as significant factors in relation to adherence to screening guidelines. However, these studies do not identify how screening participation changes

*1. Research Centre for Gender, Health and Ageing, University of Newcastle, New South Wales*
**Correspondence to:** Professor Julie Byles, Research Centre for Gender, Health and Ageing, HMRI Building, The University of Newcastle, University Drive, Callaghan NSW 2308; e-mail: julie.byles@newcastle.edu.au
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over time as women age. Longitudinal data are required to examine the long-term factors that have an impact on adherence to screening guidelines at older ages, and therefore reduce opportunities for detection of risk and early disease as well as opportunities for interventions to promote early treatment or disease prevention for health conditions such as cancers and heart disease.

The aim of this paper is to describe the factors related to changes in health screening practices for mid-aged Australian women as they age. It is expected that women will increase their participation in screening as they age and as their health risks increase, and that demographic factors, healthcare patterns and health status will also affect participation in health screening.

## Methods

This paper used data collected by the Australian Longitudinal Study on Women's Health (ALSWH); a nationally representative, prospective study of more than 40,000 participants, that has been running since 1996. Participants were recruited via the Medicare Australia database, and data were collected via self-report mailed surveys about every three years. Three age-based cohorts of women were recruited: born in 1973–78; 1946–51; and 1921–26. Further details on the project have been published elsewhere[13,14] and detailed methods of the ALSWH are available from www.alswh.org.au. This paper presents data collected from the 1946–51 cohort who completed surveys in 1996 (Survey 1, aged 45–50, N=13,715); 1998 (Survey 2, aged 47–52, N=12,338); 2001 (Survey 3, aged 50–55, N=11,226); 2004 (Survey 4, aged 53–58, N=10,905); 2007 (Survey 5, aged 56–61, N=10,638); and 2010 (Survey 6, aged 59–64, N=10,011).

Participants were asked if they had had the following preventive health checks in the three years prior to each survey: cholesterol testing (from Survey 3 onwards), and mammography and Pap testing (from Survey 1 onwards). Explanatory factors included demographic factors such as area of residence (classified using Accessibility/Remoteness Index of Australia- ARIA),[15] highest education level attained, marital status, employment status and private health insurance. Healthcare factors included use of Hormone Replacement Therapy (HRT), hysterectomy and frequency of GP visits. Health-related factors included self-rated health, health conditions (diabetes, heart disease, hypertension, breast cancer, cervical cancer, skin cancer and chronic lung conditions), parity and smoking status. Body Mass Index (BMI) was calculated from self-reported height and weight.

Longitudinal analyses were run on data from women who had one or more responses for the three outcomes: cholesterol testing, mammography and Pap testing. Generalized Estimating Equations (GEEs)[16] were used for the longitudinal analyses using PROC GENMOD in SAS. GEEs deal with the correlated nature of the repeated measures and are suitable for non-normal response variables.[17] Demographic variables including ARIA, marital status, employment, education, private hospital insurance and age at baseline were included in multivariate GEEs and lagged a survey behind the outcome. Further GEEs were run separately for each of the following health and healthcare factors as predictors: self-rated health, number of self-reported conditions, smoking status, HRT use, more than seven visits to a GP in the past year, BMI, hysterectomy and parity; adjusted for age and demographic factors. For all analyses on the outcome 'Pap test', women who had had a hysterectomy were excluded. These GEEs were also lagged by one survey so that the three outcomes of interest at each survey were analysed against the potential predictive effect of health conditions and demographic factors at the previous survey. For example, outcomes at Survey 2 were predicted by health conditions and demographic factors measured at Survey 1.

## Results

In 2010, when the women were aged 59–64 (Survey 6), 81% of women reported having their cholesterol checked in the past three years, 83% reported having a mammogram in the past two years, and 80% of eligible women reported a Pap test in the past two years.

Women were less likely to have had a Pap test at Survey 6 compared to Survey 2 (Table 1). After accounting for this decrease in screening over time, demographic factors associated with having a Pap test included marital status and private health insurance. Married women were more likely to be screened than those who were separated, divorced, widowed or never married. Women with private hospital insurance were more likely to be screened than those without private hospital cover. After adjusting for these demographic factors, women were less likely to have had a recent Pap test if they had had no births, rated their health as good, fair or poor (rather than excellent), were current smokers, were underweight, overweight or obese, did not use HRT, or had seen a GP fewer than seven times in the past year (Table 2).

Women were more likely to report having had a mammogram at Survey 6 compared to Survey 2 (Table 1). This increased participation in screening may reflect the ageing of the women in the cohort, particularly as most women would not have reached the target age for mammographic screening until after Survey 2. The older the women were at the start of the study (i.e. the closer they were to age 50 years), the more likely they were to have had a mammogram. After accounting for this increase in screening over time as well as the women's age, demographic factors associated with mammographic screening included area of residence, marital status, having private hospital insurance and education. Compared to women living in major cities, women in outer regional and remote areas were more likely to have had a recent mammogram. Married women were more likely to be screened than those who were separated, divorced, widowed or never married. Women with tertiary education qualifications were less likely to be screened when compared with those who did not complete six years of high school. After adjusting for these demographic factors and women's age at the start of the study, women were less likely to have had recent mammography if they had more than three children, rated their health as fair or poor, were current smokers, were underweight or obese, did not use HRT, had not had a hysterectomy or reported fewer than seven GP visits (Table 2).

Women were more likely to report having cholesterol tested at Survey 6 compared to Survey 3 (when this question was first asked; see Table 1). The older the women were at the start of the study the more likely they were to have their cholesterol tested. Women were less likely to have had cholesterol testing within the past three years if they lived outside of a major city, were in full-time work, had trade/diploma or higher levels of education or did not have private health insurance. After adjusting for these demographic factors and women's age at the start of the study, women were less likely to

**Table 1: Odds Ratios (and 95% confidence intervals) for demographic factors associated with Pap tests, Mammography and Cholesterol testing over time (significant results in bold).**

| | | Cholesterol Testing n = 11,547 | Mammograms n = 12,317 | Pap Tests n = 8,268 |
|---|---|---|---|---|
| Survey | 2 | Ref | Ref | Ref |
| | 3 | | **2.08 (1.98-2.19)** | **1.07 (1.0-1.15)** |
| | 4 | **1.37 (1.3-1.44)** | **2.51 (2.37-2.66)** | **0.88 (0.82-0.94)** |
| | 5 | **2.11 (2.0-2.24)** | **2.87 (2.70-3.04)** | **0.89 (0.83-0.96)** |
| | 6 | **3.03 (2.84-3.23)** | **2.84 (2.67-3.02)** | **0.83 (0.77-0.90)** |
| ARIA | Major City | Ref | Ref | Ref |
| | Inner regional | **0.79 (0.74-0.84)** | 1.0 (0.94-1.06) | 1.06 (0.98-1.15) |
| | Outer Regional | **0.75 (0.70-0.82)** | **1.12 (1.03-1.21)** | 1.04 (0.94-1.15) |
| | Remote/very remote | **0.74 (0.64-0.85)** | **1.36 (1.17-1.57)** | 1.17 (0.97-1.43) |
| Marital Status | Married/de facto | Ref | Ref | Ref |
| | Separated/divorced | 0.96 (0.87-1.05) | **0.82 (0.76-0.89)** | **0.86 (0.78-0.95)** |
| | Widowed | 0.96 (0.83-1.11) | **0.81 (0.70-0.94)** | **0.75 (0.64-0.89)** |
| | Never Married | 0.89 (0.76-1.05 ) | **0.76 (0.65-0.90)** | **0.40 (0.33-0.48)** |
| Employment | Full time | Ref | Ref | Ref |
| | Part time | 1.01 (0.95-1.07) | 1.01 (0.96-1.07) | 1.01 (0.95-1.09) |
| | Other | **1.13 (1.06-1.21)** | 0.98 (0.92-1.04) | 0.98 (0.91-1.06) |
| Education (Survey 1) | None/school certificate | Ref | Ref | Ref |
| | HSC | 0.96 (0.88-1.04) | 0.96 (0.88-1.04) | 0.98 (0.88-1.10) |
| | Trade/diploma | **0.86 (0.79-0.93)** | **0.91 (0.84-0.99)** | 1.01 (0.91-1.13) |
| | University education | **0.76 (0.70-0.84)** | **0.81 (0.74-0.89)** | 0.96 (0.85-1.08) |
| Private Hospital Insurance | No | Ref | Ref | Ref |
| | Yes | **1.16 (1.09-1.22)** | **1.4 (1.27-1.42)** | **1.39 (1.29-1.49)** |
| Age at baseline | 45 | Ref | Ref | Ref |
| | 46 | 1.02 (0.93-1.12) | **1.22 (1.11-1.33)** | 1.04 (0.91-1.18) |
| | 47 | **1.11 (1.01-1.22)** | **1.42 (1.29-1.56)** | 0.92 (0.81-1.05) |
| | 48 | 1.08 (0.97-1.19) | **1.68 (1.52-1.85)** | 1.02 (0.90-1.17) |
| | 49 | **1.17 (1.06-1.29)** | **2.17 (1.96-2.41)** | 1.03 (0.90-1.17) |
| | 50 | **1.25 (1.02-1.52)** | **2.6 (2.61-3.28)** | 1.07 (0.82-1.38) |

*Survey number referred to the survey at which the outcome (Cholesterol, Mammogram or Pap test) was measured. Demographic variables lagged one survey behind the screening test outcome, such that the demographic variables precede the screening tests.*

have had recent cholesterol testing if they rated their health as excellent, had no chronic conditions, were current smokers, did not use HRT or reported fewer than seven GP visits (Table 2). Compared to women who were healthy weight, overweight and obese women were more likely to have cholesterol testing.

## Discussion

This paper reports on longitudinal data collected from a large, broadly representative sample of women. The limitations of this paper must also be acknowledged. The first limitation is that the data are self-reported by the women, and may under- or over-represent their screening behaviour. It is also unclear what kind of cholesterol testing was undertaken from the question used to elicit these responses. Further, no data were collected on the outcome of any tests and therefore these outcomes cannot be taken into account. It is also unclear whether screening was initiated by the patient or by their GP, which may be an important determinant in uptake of screening. A survivor bias may also exist, which may explain the higher-than-expected screening rates in the cohort. While response rates remain high in this cohort, it is likely that those who are sicker or less likely to participate in healthy behaviours are more likely to be lost to follow-up or not included in the original sample.

The screening rates reported in this study are similar to the international screening rates of developed countries such as the US and the UK (although these rates may be based on some differences in recommended cancer screening intervals).[18] In the US, for example, 82.5% of 41–50 year old women and 80.8% of 51–65 year old women reported having had a Pap test within the past three years.[19] The rates of cervical screening for women in the UK in the NHS Cervical Screening Programme in 2011/12 were similar, with 77.8% of women aged 50–64 reported to have undergone screening within the past five years.[20] According to the American Cancer Society, the rate of breast cancer screening is lower than the rate of cervical screening, with 62.3% of 40–49 year olds and 72.7% of 50–64 year olds reporting having had a mammogram within the past two years.[19] The rate of breast cancer screening in the UK was also slightly lower than cervical screening, with breast cancer screening rates of 77.0% of women aged 53–70.[21] According to the national data on cholesterol screening in the US, 70% of women aged 20 and over reported having had their cholesterol checked in the past five years.[22] This rate is lower than the finding in this paper, that 81% of women aged 59–64 had a cholesterol check in the past three years, however our study involved an older age group.

Many women do not adhere to the full range of guidelines for screening procedures and routine health checks. However, in this study, rates for mammographic screening did increase over time, as women moved into the target age ranges for this test, with more than 80% of women being screened within the recommended two-year interval by the time they were aged 59–64 (at the time of Survey 6). Cholesterol screening also increased over time and as the women aged, and Pap smear coverage remained at around 80%. The rates found in our data were higher than those reported in administrative datasets,[5,6] which may be due to a cohort effect based on the age range in our sample.

This study found that weight had an influence on the likelihood of adherence to recommended mammography and Pap testing. This finding is consistent with other reports, with obese women found to be less likely to follow physician recommendations for breast and cervical cancer screening despite being as likely to receive the recommendations to undergo these screening tests as non-obese women.[23] Increasing the screening participation levels of obese women is extremely important because obese women are at greater risk of breast and cervical cancer.[23]

Cholesterol tests were more likely to be reported by women who also reported having one or more chronic conditions such as hypertension, diabetes or heart disease. This may suggest that these procedures are more commonly being undertaken to monitor existing conditions rather than to screen for previously undiagnosed conditions or as preventive procedures. While it is also possible that some of this association is due to case finding on routine testing, this interpretation is less likely due to the lagging of the analyses, which meant that the reporting of these conditions preceded the screening. The RACGP recommend that people with lower socioeconomic status, who are at particular risk for CVD and other chronic conditions, should be specifically included in preventive programs.[4] Unlike previous cross-sectional studies,[12] our data suggested that there are not large inequities in screening coverage according to education or employment status, although women who work full-time may be less likely to be screened for some procedures (compared to women working under other conditions). Working women may need to be considered in efforts to increase adherence with screening. Marital status is another factor that is associated with higher rates of screening, particularly for breast cancer.

Our data also show some interesting findings in relation to area of residence. Area of residence is not associated with Pap testing, but women in regional and remote areas were less likely to have cholesterol testing. The opposite effect was observed for mammography with women in outer regional and remote areas being more likely to be screened. BreastScreen Australia provides a national network of screening, with mobile units targeting women in rural and remote Australia.

The results for mammography have particular implications in relation to an ongoing debate regarding the efficacy of mammographic screening. While numerous case-controlled studies have examined patterns of screening for women dying of breast cancer versus those who have not died, it is argued that these findings should be adjusted for health-related variables associated with screening[15] or for the self-selection bias inherit in randomised controlled trials.[14] The results of this study provide further evidence for the need to adjust case-controlled studies for health-related variables associated with screening such as excellent self-reported health, non-smoking and lower BMI.

Use of lagged analysis allows inferences to be made about the impact of the predictors on the outcome. Without a lagged analysis, results would represent only contemporaneous associations between the dependent and independent variables.[24] For example, when considering self-rated health and cholesterol checks, any significant results would reflect only that self-reported health at a particular survey was associated with having a cholesterol check at that same survey. However, no inference can be made as to the direction of this association – whether one variable influences the other. For example, does a subject's self-rated health influence whether they decide to have their cholesterol checked, or does the result of a subject's cholesterol check influence their opinion on their self-rated health? Lagging the explanatory variables behind the screening tests allows us to make inferences about the impact of the explanatory variables on the tests. The implicit hypothesis being tested is that the independent variables such as self-rated health, BMI, number of conditions, etc, influence whether a subject has a screening test, and not the other way around.

Health and healthcare factors do appear to be strong determinants of testing. The identification of demographic and healthcare factors associated with testing in women as they age assists general practitioners to recognise and encourage women who are likely to be less adherent to screening guidelines to undergo screening for these preventable conditions that are increasingly prevalent as women age.

**Table 2: Odds Ratios (and 95% confidence intervals) for health and health care factors associated with Pap tests, Mammography and Cholesterol testing over time, adjusted for demographic factors (significant results in bold).**

| Predictor/Level | | Cholesterol Testing | Mammograms | Pap Tests |
|---|---|---|---|---|
| Self-rated Health | Excellent | Ref | Ref | Ref |
| | Very Good | **1.11 (1.03-1.20)** | 1.01 (0.95-1.08) | 1.01 (0.93-1.10) |
| | Good | **1.34 (1.24-1.45)** | 1.03 (0.95-1.10) | **0.90 (0.82-0.99)** |
| | Fair/Poor | **1.56 (1.41-1.73)** | **0.89 (0.81-0.98)** | **0.77 (0.68-0.87)** |
| No. of chronic conditions | 0 | Ref | Ref | Ref |
| | 1 | **1.31 (1.24-1.40)** | 1.02 (0.97-1.08) | 1.05 (0.98-1.13) |
| | 2+ | **1.55 (1.45-1.66)** | 1.0 (0.93-1.06) | 1.00 (0.92-1.09) |
| Smoking status | Never | Ref | Ref | Ref |
| | Ex | 0.96 (0.90-1.03) | **0.92 (0.86-0.98)** | 1.00 (0.92-1.08) |
| | Current | **0.85 (0.79-0.93)** | **0.64 (0.59-0.69)** | **0.68 (0.61-0.76)** |
| HRT | No | Ref | Ref | Ref |
| | Yes | **1.28 (1.21-1.36)** | **1.38 (1.31-1.47)** | **1.46 (1.35-1.59)** |
| Hysterectomy | No | Ref | Ref | N/A |
| | Yes | **1.43 (1.34-1.53)** | **1.09 (1.02-1.16)** | N/A |
| GP Visits (7+) | No | Ref | Ref | Ref |
| | Yes | **1.37 (1.28-1.48)** | **1.08 (1.02-1.15)** | **1.11 (1.01-1.22)** |
| BMI | Under | 0.82 (0.66-1.02) | **0.68 (0.56-0.83)** | **0.75 (0.59-0.96)** |
| | Healthy | Ref | Ref | Ref |
| | Over | **1.28 (1.20-1.36)** | 1.03 (0.97-1.09) | **0.88 (0.82-0.95)** |
| | Obese | **1.79 (1.66-1.92)** | **0.92 (0.86-0.99)** | **0.65 (0.59-0.71)** |
| Parity | 0 | Ref | Ref | Ref |
| | 1-3 | 0.97 (0.87-1.10) | 1.06 (0.94-1.18) | **1.46 (1.27-1.68)** |
| | >3 | 0.96 (0.83-1.10) | **0.85 (0.74-0.96)** | **1.19 (1.0-1.40)** |

*Health factors are lagged one survey behind the screening tests, such that health factors precede the screening tests. Each health factor is a separate GEE, adjusted for demographic variables in Table 1.*

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