Influenza vaccination coverage in a population-based cohort of Australian-born Aboriginal and non-Indigenous older adults

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# Abstract

## Background

There is limited information on vaccination coverage and characteristics associated with vaccine uptake in Aboriginal and/or Torres Strait Islander adults. We aimed to provide more current estimates of influenza vaccination coverage in Aboriginal adults.

## Methods

Self-reported vaccination status (n=559 Aboriginal and/or Torres Strait Islander participants, n=80,655 non-Indigenous participants) from the 45 and Up Study, a large cohort of adults aged 45 years or older, was used to compare influenza vaccination coverage in Aboriginal and/or Torres Strait Islander adults with coverage in non-Indigenous adults.

## Results

Of Aboriginal and non-Indigenous respondents aged 49 to <65 years, age-standardised influenza coverage was respectively 45.2% (95% CI 39.5–50.9%) and 38.5%, (37.9–39.0%), *p*-value for heterogeneity=0.02. Coverage for Aboriginal and non-Indigenous respondents aged ≥65 years was respectively 67.3% (59.9–74.7%) and 72.6% (72.2–73.0%), p-heterogeneity=0.16. Among Aboriginal adults, coverage was higher in obese than in healthy weight participants (adjusted odds ratio (aOR)=2.38, 95%CI 1.44–3.94); in those aged <65 years with a medical risk factor than in those without medical risk factors (aOR=2.13, 1.37–3.30); and in those who rated their health as fair/poor compared to those who rated it excellent (aOR=2.57, 1.26–5.20). Similar associations were found among non-Indigenous adults.

## Conclusions

In this sample of adults ≥65 years, self-reported influenza vaccine coverage was not significantly different between Aboriginal and non-Indigenous adults whereas in those <65 years, coverage was higher among Aboriginal adults. Overall, coverage in the whole cohort was suboptimal. If these findings are replicated in other samples and in the Australian Immunisation Register, it suggests that measures to improve uptake, such as communication about the importance of influenza vaccine and more effective reminder systems, are needed among adults.

Keywords: Aboriginal, Vaccination, Influenza, Coverage

# Introduction

In Australia, vaccine-preventable diseases disproportionately affect Aboriginal and Torres Strait Islander (hereafter respectfully referred to as Aboriginal) adults and children. Rates for influenza hospitalisation are significantly higher in Aboriginal adults than in non-Indigenous adults. Between 2010 and 2013, rates among Aboriginal adults aged 50–64 years were estimated to be more than four times higher than those in non-Indigenous adults. This difference is thought to be due to higher prevalence of comorbidities associated with an increased risk of severe influenza among Aboriginal adults.1

Vaccination is the key public health action to prevent the spread of infectious diseases such as influenza. In particular, adult vaccination is important as increasing the rates of coverage is a cost-effective measure that could have a significant impact on influenza morbidity and mortality, and coverage rates are currently low.2 Hence ensuring the adult influenza vaccination program is working effectively is imperative and vaccination coverage is a key measure of program success.

Recommendations and funding for influenza vaccine have varied over the years and across jurisdictions.3 The National Immunisation Program (NIP) in Australia provides free vaccination to groups at high risk of disease and since 1999 annual influenza vaccine has been available through the program for all adults aged ≥65 years. Recognising the greater burden of influenza in Aboriginal populations, since 2010, annual influenza vaccine has also been provided free for all Aboriginal adults aged ≥15 years and pregnant women, and in 2015 Aboriginal children aged >6 months to <5 years were also eligible for free influenza vaccine.3 As of December 2018 the Pharmaceutical Benefits Advisory Committee also recommended that annual influenza vaccine also be provided to all Aboriginal children aged 5–14 years.4

Despite the higher burden of influenza in Aboriginal adults and targeting for free influenza vaccination under the National program, there is very limited information on uptake of vaccination in Aboriginal adults. A systematic review in 2015 identified seven reports of vaccination coverage in Aboriginal adults, all conducted prior to 2010, before eligibility for influenza vaccination in this group was expanded.2 The review found coverage for those aged ≥50 years ranged from 51% to 96%,5–7 and coverage for those aged ≥65 years ranged from 71% to 89%.7–9 Since 2010, we identified a further study reporting influenza vaccination coverage in Aboriginal adults. Among Aboriginal peoples aged ≥50 years and 15–49 years, influenza vaccination coverage in the previous 12 months was 57% and 28% respectively.10

To add to the limited information on this topic, we used data collected in a cohort study of adults aged ≥49 years during 2012–2014 to provide more contemporaneous estimates of influenza vaccination coverage in Aboriginal adults and to compare these estimates to those for Australian-born non-Indigenous adults recruited into the same cohort study.

# Methods

## Study sample

The Sax Institute’s 45 and Up Study is a large prospective cohort study (n=267,153) of adults aged ≥45 years at recruitment aiming to investigate healthy ageing. Participants were randomly sampled from the Australian universal health insurance database, Medicare, and were resident in the Australian state of New South Wales (NSW). To provide adequate statistical power those aged 80 years and older and rural and remote residents were oversampled. The study recruitment methods have been described in detail elsewhere.11

A recruitment questionnaire was posted between January 2006 and December 2008, collecting detailed information on demographic, health and behavioural factors. A total of 267,153 people completed the baseline questionnaire, approximately 1 in 10 people in this age group in NSW.12 Of the total baseline cohort, 0.7% of participants were Aboriginal and/or Torres Strait Islander adults.13 Follow-up of participants is ongoing, with postal questionnaires including questions about vaccination for influenza and pertussis sent to participants about five years after recruitment.[[1]](#footnote-1) At the time of analysis, follow-up data were available for 105,902 participants who completed a questionnaire sent to them in either September 2012 (survey mailed to 41,400 participants, return rate=65%), November 2013 (survey mailed to 86,250 participants, return rate=58%) or December 2014 (survey mailed to 52,644 participants, return rate=54%).12

## Statistical analysis

We excluded participants whose Aboriginality status was unknown, who were overseas-born or had unknown country of birth, based on recruitment questionnaire data. Those with unknown influenza vaccination status (including those with no vaccination date) were excluded from analyses. Participants were categorised as Aboriginal and/or Torres Strait Islander if they answered ‘yes’ to the question ‘Are you of Aboriginal or Torres Strait Islander origin?’, or Australian-born non-Indigenous if they answered ‘no’ and indicated their country of birth as ‘Australia’. Influenza vaccination coverage was calculated as the percentage of those reporting influenza vaccination within the last year who answered ‘yes’ to the question ‘Have you ever had the flu vaccine?’, and for whom the date of vaccination was less than a year prior to the date that they completed their questionnaire. Annual uptake of influenza vaccination was examined separately in Aboriginal and Australian-born non-Indigenous participants. Crude and age-standardised influenza vaccination uptake was estimated, using the 2011 Australian Census Population data14 in 5-year age groups for age-standardisation. Significant differences in vaccination uptake were tested for using the two sample test of proportions (Z-test). Vaccination was examined by: age at completion of follow-up questionnaire (49–64 and ≥65 years), sex, annual household income (<$50,000, ≥$50,000), education (university, no university), area of residence (major city, inner regional, outer regional, or remote based on the Accessibility/Remoteness Index of Australia (ARIA)),15 in paid employment (yes, no), smoking status (never, past, current), alcohol consumption (non-drinkers, 1–7 drinks per week, >7 drinks per week), body mass index (BMI) (<18.5 kg/m2, 18.5–<25 kg/m2, 25–<30 kg/m2, ≥30 kg/m2), self-rated health (excellent, very good/good, fair/poor) and underlying medical condition (stroke, asthma, diabetes, heart disease, Parkinson’s disease and cancer). Logistic regression was used to examine associations between the factors and the likelihood of influenza vaccination with separate models for Aboriginal and non-Indigenous participants. Regression models were adjusted for age (in 5-year age categories) and sex. The variables sex, Aboriginality, country of birth, area of residence and BMI were obtained from the baseline questionnaire. All other variables were obtained from the follow-up questionnaire.

All analyses were undertaken using Stata 12.0.15

## Ethical approval

This study was approved by the NSW Population and Health Services Research Ethics committee, the University of New South Wales Human Research Ethics Committee (HREC/10/CIPHS/97) and the Aboriginal Health and Medical Research Council of NSW Ethics Committee (1169/16). Written consent was obtained from all study participants.

# Results

Of the 105,902 participants, 82,413 were Australian-born. The response rate to the follow-up questionnaire according to Aboriginality and other characteristics is shown in the appendix. The response rate was lower among Aboriginal participants than non-Indigenous participants (42.7% and 61.3% respectively). For Aboriginal participants, responders and non-responders were of a similar age (49–64 years 42.9%, ≥65 years 42.1%). Aboriginal responders were more likely than Aboriginal non-responders to: have a university education compared to no university education (54.1% vs 41.6%), live in a city compared to living in inner regional or outer regional/remote areas (45.3%, 41.9% and 39.5% respectively) and to be in paid employment compared to no paid employment (47.5% vs 38.2%). For non-Indigenous participants, responders were more likely than non-Indigenous non-responders to: be younger (49–64 years 63.8%, ≥65 years 56.2%); have a university education compared to no university education (73.2% vs 58.0%); and be in paid employment compared to no paid employment (64.5% vs 57.8%). Response rates were similar among non-Indigenous participants for those living in a city compared to inner regional or outer regional/remote areas (61.1%, 61.7% and 60.1% respectively).

Among respondents, 1,199/82,413 (1.5%) had an unknown influenza immunisation status, yielding data for 81,214 cohort members, of whom 559 were Aboriginal and 80,655 Australian-born non-Indigenous (Aboriginal peoples represent 3.1% of the NSW population).16 The characteristics of the participants according to Aboriginality are shown in Table 1. Compared to Australian-born non-Indigenous participants, Aboriginal participants were on average younger, more likely to reside in rural or remote areas, less likely to be university educated or be in paid employment, had lower household incomes, more likely to be smokers, have a higher average BMI and have one or more pre-existing medical conditions increasing the risk of serious complications from influenza.17

Table 1: Characteristics of study participants according to Aboriginal status

|  | Aboriginal adults(total = 559) | Australian-born non-Indigenous adults(total = 80,655) |
| --- | --- | --- |
| **statistics** | **%** | **SD** | **%** | **SD** |
| mean age | 63.1 | 8.2 | 66.2 | 9.7 |
| mean BMI, kg/m2 | 28.6 | 5.5 | 27.0 | 4.8 |
| **characteristics** | **%** | **N** | **%** | **N** |
| <65 years | 65.3 | 365 | 50.2 | 40,500 |
| men | 42.6 | 238 | 43.3 | 34,927 |
| reside in outer regional/remote | 20.4 | 114 | 12.8 | 10,094 |
| university educated | 19.0 | 106 | 27.4 | 21,963 |
| annual household income <$50,000 | 48.8 | 273 | 39.5 | 31,458 |
| currently in paid employment | 39.4 | 220 | 41.6 | 33,548 |
| current smoker | 10.7 | 60 | 4.0 | 3,183 |
| past smoker | 41.7 | 233 | 33.8 | 26,945 |
| consuming >7 drinks a week | 30.8 | 172 | 33.1 | 26,710 |
| reporting medical conditiona | 41.0 | 229 | 30.7 | 24,745 |

% represent the proportion in each column (excluding missing observations)

a Stroke, asthma, diabetes, heart disease, Parkinson’s disease and cancer

Comparing influenza vaccination in Aboriginal and Australian-born non-Indigenous adults for all ages, age-standardised estimates were similar; 54.4% (95%CI 49.9–58.9%) versus 52.7% (52.4–53.1%) respectively; p=0.5. For adults aged ≥65 years, age-standardised coverage estimates were not statistically different comparing Aboriginal and non-Indigenous adults (67.3% vs 72.6%, p=0.16). For adults aged 49–64 years, influenza vaccination coverage was significantly higher in Aboriginal versus non-Indigenous participants (45.2% vs 38.5%, p=0.02), and for adults whose annual household income was <$50,000, coverage was significantly higher in Aboriginal versus non-Indigenous participants (58.3% vs 51.1%, p=0.03).

For non-Indigenous participants, significantly higher uptake was observed in those ≥65 years than in those aged 49–64 years (adjusted OR=6.44, 95%CI 5.91–7.01); in women than in men (aOR=1.22, 1.18–1.25); in those with an annual household income ≥$50,000 (aOR=1.06, 1.02–1.09); in those who were overweight or obese than in those of healthy weight (aOR=1.17, 1.13–1.21; aOR=1.40, 1.34–1.45 respectively); in those who had a medical condition associated with higher risk of complications irrespective of age (aOR=1.93, 1.83–2.02, aOR=1.44, 1.37–1.51); and in those who reported good/very good or fair/poor health than in those who reported excellent health (aOR=1.41, 1.35–1.47; aOR=1.93, 1.82–2.05 respectively). Characteristics associated with a lower uptake of vaccination included living in inner regional or outer regional/remote areas compared to those living in cities (aOR=0.93, 0.90–0.96; aOR=0.84, 0.80–0.87 respectively); being in paid employment (aOR=0.81, 0.78–0.84); and current smokers compared to those who never smoked (aOR=0.70, 0.65–0.75).

Our analysis of Aboriginal participants found significantly higher uptake only in those who were obese than in those of healthy weight (aOR=2.38, 95%CI 1.44–3.94); in those aged 49–64 years with a medical risk factor than in those of any age without risk factors (aOR=2.13, 1.37–3.30); and in those who rated their health as fair/poor versus excellent (aOR=2.57, 1.26–5.20).

# Discussion

We conducted this study to add to the very limited contemporaneous data available reporting influenza vaccination in Aboriginal adults in Australia. We found that reported influenza vaccination coverage was marginally higher in non-Indigenous adults than in Aboriginal adults aged ≥65 years, however this was not statistically significant. Coverage was higher in Aboriginal adults aged 49–64 years than in their Australian-born non-Indigenous counterparts. Given that all those aged ≥15 years are eligible for free vaccine, the overall uptake of influenza vaccination in Aboriginal adults was still low with less than half of those aged 49–64 years reporting receiving the vaccine. The vaccination uptake for funded childhood immunisations is in excess of 90%, but much lower for funded adult vaccines in Australia, in the range 50–60%.18 The vaccination gap between adults and children, whether Aboriginal or non-Indigenous, is an area for improvement nationally. A rise in coverage from 50 to 80% could result in substantial gains in disease prevention.19

The rate of influenza vaccine coverage in Aboriginal adults aged ≥65 years found in this study (67.3%, 95%CI 59.9–74.7%) is lower than that reported in earlier studies with estimates ranging from 71% to 84% in Aboriginal peoples nationally. However, NSW-specific estimates in these earlier studies have been lower than the national average.7–9 Earlier estimates may differ from the current analysis as they were from national studies whilst our study was in NSW residents only. Barriers to increasing adult vaccination coverage differ from those related to childhood vaccination. Vaccination is often undervalued and financial support is less than that provided for childhood vaccines.20 Reviews have found interventions shown to increase adult vaccination coverage include increasing access (i.e. home visits), incentives for patients and provider, and provider recalls.20,21

Among responders aged 49–64 years, Aboriginal participants had higher vaccination coverage than non-Indigenous adults. This suggests that the NIP recommendations and targeted funding for influenza vaccine in Aboriginal peoples aged ≥15 years has had a measureable impact. The most recent nationally reported data for influenza vaccine coverage in Aboriginal adults aged <50years was the 2012–2013 Aboriginal and Torres Strait Islander Health Survey which reported coverage of 56.8%,22 marginally higher than our estimate. Previous estimates in those aged ≥50 years from 1995 to 2003 range from 51% to 96%.2 The 2009 Adult Immunisation Survey for Aboriginal people aged >18 years reported coverage of 27.5% for influenza vaccination.23 This variability and inconsistency in reporting of vaccination coverage in Aboriginal adults likely reflects the small sample sizes and highlights the need for more robust and up-to-date coverage estimates. Apart from our study, almost all other reports were conducted prior to 2010 when national funding for influenza vaccination for Aboriginal adults changed from those aged <50 with a medical indication for influenza vaccine to all Aboriginal peoples aged ≥15 years.24

Table 2: Crude and age-standardised annual influenza vaccination coverage in Aboriginal and Australian-born non-Indigenous adults

|  | Aboriginal adults | Australian-born Non-Indigenous adults |  |
| --- | --- | --- | --- |
| Characteristics | Total population | Crude vaccination coverage % | Age- standardised vaccination coverage % (95% CI) | Total population | Crude vaccination coverage % | Age- standardised vaccination coverage % (95% CI) | *p-value*a |
| **Total population** | **559** | **54.4** | **54.4 (49.9–58.9)** | **80,655** | **55.8** | **52.7 (52.4–53.1)** | **0.460** |
| **Age group (years)** |  |  |  |  |  |  |  |
| 49–64b | 365 | 47.7 | 45.2 (39.5–50.9) | 40,500 | 40.3 | 38.5 (37.9–39.0) | 0.021 |
| >65b | 194 | 67.0 | 67.3 (59.9–74.7) | 40,155 | 71.4 | 72.6 (72.2–73.0) | 0.160 |
| **Sex** |  |  |  |  |  |  |  |
| Men | 238 | 52.1 | 50.6 (43.4–57.8) | 34,927 | 54.9 | 50.0 (49.4–50.5) | 0.870 |
| Women | 321 | 56.1 | 56.4 (50.4–62.3) | 45,728 | 56.4 | 54.5 (54.1–55.0) | 0.532 |
| **Place of residence** |  |  |  |  |  |  |  |
| Major cities | 229 | 55.9 | 56.6 (49.9–63.3) | 37,618 | 56.6 | 53.9 (53.4–54.4) | 0.430 |
| Inner regional | 207 | 53.6 | 50.4 (42.4–58.4) | 31,196 | 55.8 | 52.2 (51.6–52.8) | 0.660 |
| Outer regional/remote/very remote | 114 | 52.6 | 51.2 (42.2–60.3) | 10,094 | 53.2 | 49.9 (48.9–50.9) | 0.779 |
| **Annual household income ($AUD)** |  |  |  |  |  |  |  |
| <50,000 | 273 | 56.8 | 58.3 (51.9–64.7) | 31,458 | 61.5 | 51.1 (50.4–51.9) | 0.029 |
| >50,000 | 253 | 51.4 | 53.7 (46.6–60.7) | 44,958 | 50.8 | 53.2 (52.8–53.7) | 0.889 |
| **University education** |  |  |  |  |  |  |  |
| No | 449 | 53.0 | 52.1 (47.1–57.1) | 58,057 | 57.1 | 52.3 (51.8–52.7) | 0.937 |
| Yesb | 106 | 59.4 | 59.2 (50.8–67.6) | 21,963 | 52.2 | 53.6 (52.9–54.3) | 0.192 |
| **Paid employment** |  |  |  |  |  |  |  |
| No | 339 | 60.2 | 54.9 (48.6–61.1) | 47,107 | 65.5 | 53.5 (52.7–54.3) | 0.663 |
| Yesb | 220 | 45.4 | 41.4 (31.6–51.1) | 33,548 | 42.2 | 49.5 (48.7–50.3) | 0.104 |
| **Smoking** |  |  |  |  |  |  |  |
| Never | 259 | 54.4 | 54.2 (47.6–60.9) | 49,538 | 55.7 | 52.8 (52.3–53.2) | 0.680 |
| Past | 233 | 56.6 | 57.3 (50.4–64.2) | 26,945 | 57.6 | 53.7 (53.1–54.4) | 0.308 |
| Current | 60 | 46.7 | 40.7 (29.6–51.8) | 3,183 | 39.9 | 44.8 (42.8–46.8) | 0.476 |
| **Alcohol consumption/week** |  |  |  |  |  |  |  |
| None | 229 | 56.7 | 55.4 (48.0–62.7) | 24,874 | 58.7 | 53.4 (52.7–54.1) | 0.595 |
| 1–7 drinksb | 158 | 59.5 | 60.8 (52.6–68.9) | 29,071 | 56.5 | 54.4 (53.8–55.0) | 0.124 |
| >7 drinks | 172 | 46.5 | 46.9 (38.2–55.6) | 26,710 | 52.3 | 50.5 (49.9–51.1) | 0.418 |
| **BMI (kg/m2)** |  |  |  |  |  |  |  |
| <18.5 | NCc | – | – | 717 | 53.9 | 49.0 (45.3–52.6) | – |
| 18.5–24.9 | 113 | 45.1 | 48.7 (40.5–56.9) | 27,251 | 52.9 | 50.4 (49.8–51.0) | 0.685 |
| 25–29.9 | 210 | 51.9 | 52.2 (44.4–59.9) | 30,292 | 56.5 | 52.5 (51.9–53.1) | 0.939 |
| >30b | 172 | 64.5 | 61.7 (53.0–70.4) | 17,009 | 58.9 | 56.6 (55.8–57.4) | 0.252 |
| Missing | 54 | 48.1 | 49.8 (36.9–62.7) | 5,386 | 56.9 | 52.8 (51.4–54.2) | 0.650 |
| **Medical conditionsd and age** |  |  |  |  |  |  |  |
| No | 330 | 47.3 | 50.3 (44.6–55.9) | 55,910 | 50.9 | 49.6 (49.2–50.1) | 0.808 |
| Yes (age <65 yrs)b | 135 | 60.0 | 57.6 (47.5–67.6) | 10,045 | 52.7 | 50.0 (48.9–51.2) | 0.140 |
| Yes (age =>65 yrs)b | 94 | 71.3 | 67.3 (56.0–78.5) | 14,700 | 76.5 | 76.7 (76.1–77.4) | 0.102 |
| **Self–reported general health status** |  |  |  |  |  |  |  |
| Excellent | 46 | 41.3 | 45.8 (31.2–60.5) | 11,955 | 43.3 | 46.4 (45.5–47.4) | 0.936 |
| Very good/good | 365 | 52.0 | 52.4 (46.9–57.9) | 57, 443 | 56.3 | 53.0 (52.6–53.4) | 0.831 |
| Fair/poor | 128 | 62.5 | 63.4 (54.4–72.4) | 9,922 | 66.6 | 59.6 (58.5–60.7) | 0.500 |

a Two-sample test of difference in proportions between age-standardised vaccination coverage for Aboriginal and non-Indigenous adults

b Difference in age-standardised vaccination coverage between Aboriginal and non-Indigenous adults greater than 5 percentage points

c not calculated due to small numbers

d Stroke, asthma, diabetes, heart disease, Parkinson’s disease and cancer

Table 3: Age- and sex-adjusted odds ratio for association between various characteristics and influenza vaccination in Aboriginal and Australian-born non-Indigenous adults

| Characteristics | Aboriginal adults | Australian-born Non-Indigenous adults |
| --- | --- | --- |
| **Age group (years)** |  |  |
| 49–64 | 1.00 | 1.00 |
| >65 | 3.02 (0.71–12.93) | 6.44 (5.91–7.01) |
| **Sex** |  |  |
| Men | 1.00 | 1.00 |
| Women | 1.26 (0.89–1.79) | 1.22 (1.18–1.25) |
| **Place of residence** |  |  |
| Major cities | 1.00 | 1.00 |
| Inner regional | 0.88 (0.60–1.30) | 0.93 (0.90–0.96) |
| Outer regional/remote/very remote | 0.93 (0.58–1.48) | 0.84 (0.80–0.87) |
| **Annual household income ($)** |  |  |
| <50,000 | 1.00 | 1.00 |
| >50, 000 | 1.02 (0.71–1.47) | 1.06 (1.02–1.09) |
| **University Education** |  |  |
| No | 1.00 | 1.00 |
| Yes | 1.50 (0.97–2.35) | 1.04 (1.01–1.08) |
| **In paid employment** |  |  |
| No | 1.00 | 1.00 |
| Yes | 0.78 (0.53–1.15) | 0.81 (0.78–0.84) |
| **Smoking** |  |  |
| Never | 1.00 | 1.00 |
| Past | 1.12 (0.77–1.61) | 1.09 (1.06–1.12) |
| Current | 0.82 (0.46–1.47) | 0.70 (0.65–0.75) |
| **Alcohol consumption/week** |  |  |
| None | 1.00 | 1.00 |
| 1–7 drinks | 1.16 (0.75–1.77) | 1.07 (1.03–1.11) |
| >7 drinks | 0.75 (0.49–1.15) | 0.93 (0.89–0.97) |
| **BMI (kg/m2)** |  |  |
| <18.5 | 3.34 (0.78–14.20) | 0.94 (0.80–1.11) |
| 18.5–24.9 | 1.00 | 1.00 |
| 25–29.9 | 1.29 (0.80–2.09) | 1.17 (1.13–1.21) |
| >30 | 2.38 (1.44–3.94) | 1.40 (1.34–1.45) |
| Missing | 1.09 (0.55–2.14) | 1.11 (1.05–1.19) |
| **Medical conditionsa and age** |  |  |
| No | 1.00 | 1.00 |
| Yes (age <65 yrs) | 2.13 (1.37–3.30) | 1.93 (1.83–2.02) |
| Yes (age >65 yrs) | 1.47 (0.79–2.69) | 1.44 (1.37–1.51) |
| **Self–reported general health status** |  |  |
| Excellent | 1.00 | 1.00 |
| Very good/good | 1.56 (0.82–2.95) | 1.41 (1.35–1.47) |
| Fair/poor | 2.57 (1.26–5.20) | 1.93 (1.82–2.05) |

a Stroke, asthma, diabetes, heart disease, Parkinson’s disease and cancer

Unlike many other surveys of vaccination uptake, we conducted this cross-sectional analysis within an established cohort study. A more representative population sample may be preferable for a study of vaccine uptake. However, given the paucity of available information on vaccination in Aboriginal adults2 and the relatively large sample of participants who had completed the question on influenza vaccination, our results make a significant contribution to what is known about influenza vaccination in Aboriginal adults. Additionally, the cohort enabled us to make comparisons of vaccine uptake between Aboriginal and non-Indigenous adults who were recruited using a similar strategy, were Australian born, and had information on other characteristics enabling comparisons to be made regarding representativeness, a feature that many other studies that examine only Aboriginal populations lack.

Previous analysis comparing Aboriginal participants who responded to the 45 and Up Study baseline questionnaire to 2006 NSW Census data showed Aboriginal participants had higher education levels and a lower proportion of those ≥65 years who needed help with daily tasks.13 Similar to our findings, a report including 99,927 follow up participants of the 45 and Up Study found that response rates from Aboriginal participants were lower than that for non-Indigenous participants (45% compared to 61%). Factors associated with lower response were similar in both groups, with those who were ill or disadvantaged less likely to respond to the follow up questionnaire. Additionally, Aboriginal participants who reported smoking or an annual household income of <$50,000 were less likely to respond than the same groups of non-Indigenous participants.25 These differences in response are likely to mean that our estimates of coverage are slight overestimates, with more of an overestimation in Aboriginal than in non-Indigenous adults.26 We were able to exclude overseas-born participants as we know from earlier studies that this group have significantly lower influenza vaccine uptake.27

We acknowledge the possibility of responder bias which will impact the representativeness and generalisability of these results. However, comparisons to other NSW data sources show that a number of characteristics within this sample of Aboriginal adults were not substantially different. Data from the 2012–2013 Australian Aboriginal and Torres Strait Islander Health Survey shows that the proportion of those never smoking was 25% and 32% in those aged 45–54 years and those aged ≥55 years respectively, compared to 47% of our sample of Aboriginal participants aged 49+ years. The same survey reports that those who are overweight or obese is 74% and 77% in the same age groups,28 compared to 77% in our sample. Census data from the Australian Bureau of Statistics shows a geographical population spread in NSW of 42% of Aboriginal adults aged ≥45 years living in major cities, 33% living in inner regional areas and 25% living in remote areas.29 Similarly, 42% of our sample lived in major cities, 28% in inner regional areas and 21% in remote areas.

The study used self-report to determine vaccination status and this introduces the possibility of misclassification. However, self-reported influenza vaccination status has been shown to be reasonably accurate30,31 and it is used widely in surveys of adults to estimate coverage.23 Potential bias in our findings could result if accuracy of self-report differed between the comparison groups. Other limitations include the small sample size of Aboriginal participants, which leads to greater uncertainty around the point estimates and the fact our study was limited to adults in NSW.

Increasing vaccination coverage could help to decrease hospitalisations and deaths caused by influenza in Australian adults. This is particulary important for Aboriginal adults who are at higher risk of complications from influenza due to higher prevalence of chronic conditions.1 Research suggests that whilst providing funding for vaccination is important to improve adult coverage, there are other initiatives which could improve uptake. Some strategies which have been shown to be effective include reminders for adults,32 working with primary health care practices to identify a staff member to drive influenza campaigns,33 targeting of people within geographic regions with high disease rates34 and specifically for Aboriginal populations having dedicated Aborignal Health Workers which has had a demonstrable effect on increasing vaccination coverage in Aboriginal children.35 Evaluating the effectiveness of programs to improve adult vaccination uptake is an important area for future research.

# Conclusion

This study adds to existing knowledge by providing estimates of vaccination coverage in Aboriginal adults and examining differences between Aboriginal and non-Indigenous adults. Overall, given responder bias, our findings suggest for those aged ≥65 years, vaccination coverage in Aboriginal adults is lower than Australian-born non-Indigenous adults, and among those 49–64 years is higher among Aboriginal compared to non-Indigenous adults. However given Aboriginal adults aged ≥15 years are funded by the NIP to receive annual influenza vaccine, the overall estimate of ~50% uptake in adults aged 49 years and greater, are inadequate.19 The introduction of the all of age Australian Immunisation Register36 should allow for more systematic and regular monitoring of vaccine uptake in this priority population. We also note that while our study has limitations, they also highlight the need for much better and more contemporary data on influenza vaccine uptake in Aboriginal adults.

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# Appendix A

|  | Aboriginal | Australian-born non-Indigenous |
| --- | --- | --- |
|  | Responded | Invited | Response rate (%) | Responded | Invited | Response rate (%) |
| **Total** | **568** | **1,329** | **47.2** | **81,845** | **133,541** | **61.3** |
| **Age at baseline (years)** |  |  |  |  |  |  |
| 49–64 | 464 | 1,082 | 42.9 | 57,029 | 89,350 | 63.8 |
| ≥65 | 104 | 247 | 42.1 | 24,816 | 44,191 | 56.2 |
| **Sex** |  |  |  |  |  |  |
| men | 241 | 555 | 43.4 | 35,587 | 58,452 | 60.9 |
| women | 327 | 774 | 42.2 | 46,258 | 75,089 | 61.6 |
| **Place of residence** |  |  |  |  |  |  |
| major cities | 233 | 514 | 45.3 | 38,202 | 62,510 | 61.1 |
| inner regional | 210 | 501 | 41.9 | 31,617 | 51,227 | 61.7 |
| outer regional/remote | 116 | 294 | 39.5 | 10,252 | 17,054 | 60.1 |
| **University education** |  |  |  |  |  |  |
| No | 457 | 1,099 | 41.6 | 58,859 | 101,534 | 58.0 |
| Yes | 106 | 196 | 54.1 | 22,345 | 30,509 | 73.2 |
| **In paid employment** |  |  |  |  |  |  |
| No | 259 | 678 | 38.2 | 37,004 | 64,034 | 57.8 |
| Yes | 309 | 651 | 47.5 | 44,841 | 69,507 | 64.5 |
| **Need assistance with daily tasks** |  |  |  |  |  |  |
| No | 482 | 1,096 | 44.0 | 76,656 | 122,478 | 62.6 |
| Yes | 56 | 145 | 38.6 | 2,429 | 5,433 | 44.7 |
| **Smoker** |  |  |  |  |  |  |
| never | 254 | 566 | 44.9 | 49,831 | 78,645 | 63.4 |
| past | 223 | 476 | 46.8 | 27,421 | 45,351 | 60.5 |
| current | 91 | 286 | 31.8 | 4,571 | 9,515 | 48.0 |
| **BMI (kg/m2)** |  |  |  |  |  |  |
| <18.5 | 10 | 25 | 40.0 | 732 | 1,298 | 56.4 |
| 18.5–24.9 | 115 | 279 | 41.2 | 27,647 | 43,213 | 64.0 |
| 25–29.9 | 213 | 444 | 48.0 | 30,744 | 49,421 | 62.2 |
| 30+ | 176 | 429 | 41.0 | 17,238 | 29,590 | 58.3 |
| Missing | 54 | 152 | 35.5 | 5,484 | 10,019 | 54.7 |
| **Medical conditiona** |  |  |  |  |  |  |
| No | 367 | 853 | 43.0 | 60,098 | 96,036 | 62.6 |
| Yes | 201 | 476 | 42.2 | 21,747 | 37,505 | 58.0 |
| **Self-reported general health status** |  |  |  |  |  |  |
| Excellent | 63 | 127 | 49.6 | 14,348 | 20,602 | 69.6 |
| Very good/good | 352 | 776 | 45.4 | 57,920 | 93,608 | 61.9 |
| Fair/poor | 129 | 357 | 36.1 | 7,685 | 15,531 | 49.5 |
| Missing | 24 | 69 | 34.8 | 1,892 | 3,800 | 49.8 |

a See methods

**Communicable Diseases Intelligence**

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1. Both questionnaires are available at: www.saxinstitute.org.au/our-work/45-up-study/questionnaires/. [↑](#footnote-ref-1)