

# What isn't measured isn't done – eight years with no progress in Aboriginal and Torres Strait Islander adult influenza and pneumococcal vaccination

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Influenza and invasive pneumococcal disease (IPD) are major causes of morbidity and mortality in Aboriginal and Torres Strait Islander (hereafter respectfully referred to as Indigenous) people. This is likely related to the fact that Indigenous adults have much higher rates of chronic disease compared to non-Indigenous adults, the root causes of which are related to the social determinants of health. Many of these conditions (such as renal disease, diabetes and cardiac disease) are accompanied by a higher risk of severe outcomes from influenza infection and IPD.<sup>1,2</sup> In Indigenous adults aged 25–49 years, reported rates of influenza and its complications have been found to be at least eight times higher for hospitalisations and 20 times higher for deaths when compared to their non-Indigenous counterparts (over various periods from 2003–2015).<sup>2–4</sup> The notification rate of IPD in the Indigenous population was 31.4 per 100,000 in 2014, approximately six times the rate in the non-Indigenous population (5.3 per 100,000).<sup>5</sup>

In recognition of these disparities, influenza and pneumococcal vaccines are recommended for use in a broader age range for Indigenous people than for the non-Indigenous population.<sup>6</sup> Beginning in 1999, annual influenza vaccination was funded under the National Immunisation Program (NIP) for all adults aged ≥65 years, Indigenous people aged ≥50 years, and 15–49-year-olds with chronic medical conditions predisposing them to severe complications of influenza.

## Abstract

**Objectives:** To describe and compare vaccination coverage for Aboriginal and Torres Strait Islander (hereafter referred to as Indigenous) adults in 2004–05 and 2012–13, including the impact of national vaccination funding initiatives.

**Methods:** National Aboriginal and Torres Strait Islander Health cross-sectional surveys – 2004–05 (n=5,757) and 2012–13 (n=5,482) – were compared. Self-reported influenza and pneumococcal vaccination coverage among Indigenous adults was analysed by age, remoteness, gender and risk factor status.

**Results:** Influenza vaccination coverage among Indigenous adults in 2004–05 and 2012–13 remained low. While coverage increased for those aged 18–49 years from 23% to 29%, it declined for those aged ≥65 years from 84% to 74%. For remote areas, influenza coverage among those aged 50–64 years declined from 76% to 66%. Pneumococcal vaccination coverage remained very low and declined across all age groups in 2004–05 and 2012–13 (50–64 years: 30% to 23%). For remote areas, pneumococcal coverage declined among those aged 50–64 years from 52% to 32%.

**Conclusions:** Indigenous adult vaccination coverage for influenza and pneumococcal disease remains unacceptably low. Between 2004–05 and 2012–13, declines occurred in pneumococcal vaccination coverage across all age groups ≥18 years. Despite national funding of influenza vaccine in 2010, there was no increase in influenza coverage, except for the 18–49-year age group.

**Implications for public health:** Current approaches to promote, deliver and monitor vaccination of Indigenous adults are inadequate.

**Key words:** vaccination, Aboriginal, Indigenous, coverage, adults

Expanded funding to cover annual influenza vaccination of all individuals aged ≥6 months with chronic medical conditions, and all Indigenous people aged 15–49 years, commenced in January 2010. From 1999, polysaccharide pneumococcal vaccine was also funded for Indigenous adults aged ≥50 years and those aged 15–49 years at high risk, and for all Australians aged ≥65 years from 2005.

Reservations have occasionally been expressed in the scientific literature about the roles of both these vaccines, although more so for pneumococcal<sup>7</sup> vaccine than influenza.<sup>8</sup> However, the evidence has been assessed by the Australian Technical Advisory Group on Immunisation and these vaccines have been recommended and funded on that basis. While vaccine hesitancy towards specific vaccines in general may have an

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impact on vaccination rates, it is not possible to estimate that from these data, which focus on implementation of a national policy.

Compared to the general adult population in Australia, coverage for vaccination programs targeted specifically at Indigenous adults is substantially lower.<sup>4</sup> Vaccine coverage among Indigenous adults aged 15–49 years with medical risk factors was reported in the 2004–05 National Aboriginal and Torres Strait Islander Health Survey (NATSIHS) to be 29% for influenza and 13% for pneumococcal.<sup>4</sup> In 2004–05, 73% of non-Indigenous adults aged ≥65 years were vaccinated for influenza and 43% of non-Indigenous adults aged ≥65 years were vaccinated for IPD in accordance with the national program at the time.<sup>4</sup>

The only national data available on vaccination coverage among Indigenous adults to inform program planning and delivery efforts are from the NATSIHSs, conducted by the Australian Bureau of Statistics (ABS). The most recent survey was conducted in 2012–13, eight years after the previous survey in 2004–05.

The aim of this study was to calculate influenza and pneumococcal vaccination coverage among NIP-eligible adult participants (overall and among those with medical risk factors) in the 2012–13 NATSIHS, then compare with 2004–05 NATSIHS published estimates to measure changes in coverage over the period between surveys and the impact of national vaccination funding initiatives, including the expanded funding of the influenza vaccine in 2010.

## Methods

### Participants

The study participants were Indigenous people aged ≥18 years who were surveyed as part of the 2012–13 NATSIHS (n=5,482).<sup>9</sup> Results were compared to published data on Indigenous people aged ≥18 years surveyed as part of the 2004–05 NATSIHS (n=5,757).<sup>4</sup>

### Sampling and sample weights

NATSIHSs are cross-sectional population prevalence surveys of Indigenous residents conducted using a stratified multistage area sample of private dwellings selected in both remote and non-remote areas throughout Australia, as categorised by the Remoteness Structure for the Australian Statistical Geography Standard (ASGS) Remoteness areas.<sup>9</sup> As both the NATSIHSs were conducted on a sample of private households, and a

person's chance of selection in the survey varied depending on the state or territory in which the person lived, the use of weights was necessary. ABS person weights were used to adjust for the probability of sample selection. The person weight indicates how many population units are represented by the sample units. An initial weight is assigned to each person by the ABS, which is equal to the inverse of the probability of being selected in the survey. For the 2012–13 survey, the ABS then calibrated all person weights by age, sex and state/territory to the Indigenous estimated resident population living in private dwellings of Australia at 30 June 2011, based on the 2011 Census of Population and Housing.<sup>9</sup> The 2004–05 survey was calibrated to the Indigenous estimated resident population at 31 December 2004, based on the 2001 Census.<sup>10</sup> The methodology for calculating weighted proportions has been described in detail elsewhere.<sup>9</sup>

### Participant characteristics

Participant demographics, along with vaccination and medical risk factor status, were collected through face-to-face interview using a structured questionnaire,<sup>9</sup> without referring to any written records. The methodology used was very similar for the 2004–05 and 2012–13 surveys and has been described in detail elsewhere.<sup>9,10</sup>

### Outcome definitions

Outcome measures were vaccination coverage for influenza and IPD for: i) the whole of survey population by age group, geographic remoteness and gender, and ii) those aged 18–49 years with one or more medical risk factors that are indications for vaccination (as defined by the *Australian Immunisation Handbook*<sup>6</sup>). Coverage was measured as self-reported vaccination for influenza in the 12 months prior, and for IPD in the five years prior to the surveys. As some medical risk factors captured in the 2012–13 survey did not exactly match those listed in the *Handbook*, those that best matched the *Handbook* were included (Supplementary File 1). Some medical risk factors listed in the *Handbook* were either not captured in the 2012–13 survey or not able to be analysed separately using the ABS Confidentialised Unit Record Files (CURFs) – see Supplementary File 2 – or were recommended but not funded (obesity for influenza vaccination) and therefore were not included in the analysis. The medical

risk factors included in the analysis of the 2004–05 NATSIHS<sup>4</sup> and 2012–13 NATSIHS were very similar. However, some medical risk factors captured in the 2004–05 survey were not included in the analysis of the 2012–13 survey due to the level of detail available for analysis in the CURFs (Supplementary File 3).

### Statistical analyses

Unidentifiable CURFs containing individual unit record data were analysed via the ABS's secure Remote Access Data Laboratory (RADL) using Stata 10.0 (StataCorp). Vaccination coverage was estimated by age group (≥18, 18–49, 50–64 and ≥65 years), remoteness, gender, and medical risk factor status. The results were compared to published information (based on unit record data) from the 2004–05 NATSIHS.<sup>4</sup> Remoteness was defined using the ASGS<sup>11</sup> in the 2012–13 survey that replaced the Australian Standard Geographic Classification (ASGC)<sup>12</sup> used in the 2004–05 survey. As data on remoteness was reported in both surveys as being either non-remote or remote, the surveys were only able to be compared by using these two broad categories. A two proportion Z-test was used to compare coverage estimates between surveys<sup>10</sup> and a chi-squared test was used to compare coverage rates within the 2012–13 survey.<sup>13</sup> The delete 1 group jackknife replication method was used for calculating the weighted proportions.<sup>9</sup> A *p* value <0.05 was defined as statistically significant.

The calibrated age group specific coverage estimates for the 2004–05 and 2012–13 NATSIHSs were directly compared. For the purpose of comparing coverage estimates for the ≥18-year age group between the two surveys, it was necessary to test for any confounding effects of differences in population age structure between the two periods. Therefore, two coverage estimates for the ≥18 year age group from the 2012–13 NATSIHS were calculated – one age standardised against the Indigenous estimated resident population of Australia at 30 June 2011 based on the 2011 Census, and the other to the Indigenous estimated resident population of Australia at 30 June 2001 based on the 2001 Census (to compare with the 2004–05 NATSIHS). Age standardisation was accomplished using the direct method,<sup>13</sup> with five-year age groupings; 95% confidence intervals (CIs) of the direct age standardised rates were calculated as recommended by Boyle and Parkin (1991).<sup>14</sup>

## Approvals

Ethics approval for the study was granted by the Aboriginal Health and Medical Research Council of NSW. Approval was obtained from the ABS to analyse relevant CURFs through the RADL.

## Results

### Influenza vaccination coverage

In the eight years between surveys, influenza vaccination coverage remained low in those aged 18–49 years, both with or without a medical risk factor, and those aged 50–64 years (Figure 1). Influenza vaccination coverage increased with age in 2012–13, even though it is low in those aged 50–64 years, similar to 2004–05 (Figure 1). Between 2004–05 and 2012–13, influenza coverage increased in those aged 18–49 years from 23% to 29% but declined in those aged ≥65 years from 84% to 74%; however, there was no meaningful change in those aged 18–49 years with a medical risk factor, or those aged 50–64 years (Figure 1). There was no statistically significant difference between 2012–13 coverage in those aged ≥18 years standardised to the 2001 Census (34% [95%CI, 34–34]) and standardised to the population at 30 June 2011 (35%; 95%CI, 34–37).

While influenza coverage was low in all regions, it was substantially higher in remote compared to non-remote areas in 2012–13 for those aged ≥18 years (Table 1). From 2004–05 to 2012–13, influenza coverage in remote areas declined significantly in 50–64-year-olds from 76% (95%CI, 72–80) to 66% (95%CI, 61–70), but did not change significantly in non-remote areas in this age group – from 43% (95%CI, 39–47) in 2004–05 to 47% (95%CI, 43–50) in 2012–13. Similar trends were observed in those aged ≥50 years (data not shown). No other age groups were available for comparison.

In 2012–13, influenza coverage in those aged ≥18 years was low for both males and females but significantly higher for females (Table 1). There was no published data from the 2004–05 NATSIHS on gender for comparison.

### Pneumococcal vaccination coverage

In 2012–13, pneumococcal vaccination coverage was very low, and similar to 2004–05 (Figure 2). Pneumococcal vaccination coverage increased with age in both surveys but remained very low across all age groups

(Figure 2). Pneumococcal coverage declined slightly between 2004–05 and 2012–13 in Indigenous adults aged 18–49 years from 12% to 10%, and more markedly in those aged 50–64 years from 30% to 23%, but there were no significant changes in those aged 18–49 years with a medical risk factor, or those aged ≥65 years (Figure 2). There was no statistically significant difference between 2012–13 coverage in those aged ≥18 years standardised to the 2001 Census (13% [95%CI, 13–13]) and standardised to the population at 30 June 2011 (14% [95%CI, 13–15]).

In 2012–13, pneumococcal coverage was very low in all regions, but was significantly higher in remote compared to non-remote areas for those aged ≥18 years (Table 1). In the period between 2004–05 and 2012–13, pneumococcal coverage in remote areas declined markedly in 50–64-year-olds from 52% (95%CI, 47–57) to 32% (95%CI, 28–37), but remained steady in non-remote areas in this age group at 22% (95%CI, 19–25) in 2004–05 and 21% (95%CI 18–24) in 2012–13. This trend was also evident in those aged ≥50

years (data not shown). No other comparison data were available.

In 2012–13, pneumococcal coverage in those aged ≥18 years was very low and only slightly higher for females than males (Table 1). No comparable published data from the 2004–05 NATSIHS on gender was available.

Influenza coverage was significantly higher than pneumococcal coverage across all age

**Table 1: Indigenous adults aged ≥18 years (per cent) in Australia reporting influenza and pneumococcal vaccination,<sup>a</sup> by remoteness and gender, 2012–13 NATSIHS.<sup>b</sup>**

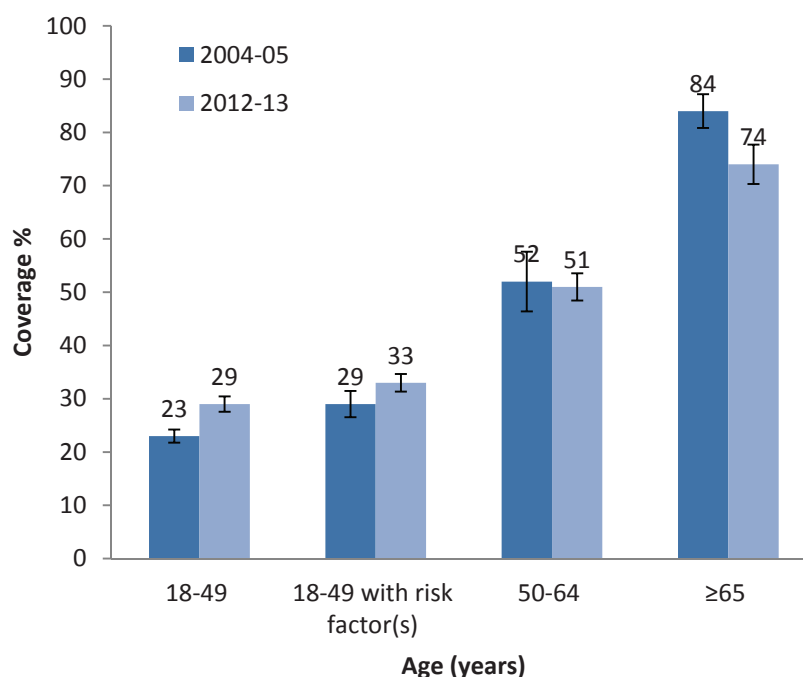
	Influenza Coverage % (95%CI)	Pneumococcal Coverage % (95%CI)
Non-remote	29 (28–31)	11 (10–12)
Remote	56 (54–58)	25 (23–27)
Males	33 (31–35)	13 (12–15)
Females	38 (36–40)	15 (14–16)

Notes:

a: Self-reported as having had influenza vaccination in the 12 months prior to survey or pneumococcal vaccination in the 5 years prior to survey.

b: Standardised to the Indigenous estimated resident population living in private dwellings of Australia at 31 December 2014, based on the 2011 Census of Population and Housing.

**Figure 1: Indigenous adults in Australia reporting influenza vaccination,<sup>a</sup> (Per cent) 2012–13 NATSIHS<sup>b</sup> compared with 2004–05 NATSIHS.<sup>c</sup>**



Notes:

a: Self-reported as having had influenza vaccination in the 12 months prior to survey (respondents were asked if they had ever had a flu shot and if so, was it in the last 12 months?).

b: Standardised to the Indigenous estimated resident population living in private dwellings of Australia at 30 June 2011, based on the 2011 Census of Population and Housing.

c: Standardised to the Indigenous estimated resident population living in private dwellings of Australia at 31 December 2004, based on the 2001 Census of Population and Housing.

groups, for both whole-of-survey population and those aged 18–49 years with a medical risk factor (see Figures 1 and 2; Table 1).

### Discussion

Our study demonstrates that coverage for vaccines recommended for Indigenous adults, both with and without medical risk factors, was suboptimal in 2012–13, despite targeted national vaccination programs. Despite an expansion of NIP funding of the influenza vaccine in 2010 to all Indigenous people aged 15–49 years, there is little evidence of impact on vaccination coverage, with only a small but significant increase between survey periods among younger adults (18–49 years) from 23% to 29%. Further, a marked decline in influenza vaccination coverage in the ≥65-year age group – from 84% to 74% – was observed between survey periods. As reported previously,<sup>4</sup> uptake for the pneumococcal vaccine was substantially lower than for the influenza vaccine; in fact, it declined between survey periods from 12% to 10% in those

aged 18–49 years, and 30% to 23% in those aged 50–64 years. Similar to the 2004–05 NATSIHS,<sup>4</sup> the majority of eligible Indigenous adults did not receive their influenza and pneumococcal vaccines. Clearly, vaccination coverage in Indigenous adults is an issue that requires attention. Targeted and innovative strategies, developed in close consultation with key Indigenous stakeholders, are urgently needed to make substantial improvements.

Coverage among Indigenous adults aged ≥18 years was found to be higher in remote areas compared to non-remote areas for both vaccines; a similar finding to the 2004–05 survey. This may be due to people in smaller discreet communities being easier to locate and vaccinate, compared to more diffuse urban populations. A marked decline was observed for both influenza and pneumococcal coverage between 2004–05 and 2012–13 in remote areas in those aged 50–64 years, while coverage in non-remote areas remained largely unchanged over the same period for both vaccines. The reasons for these trends are unclear. However,

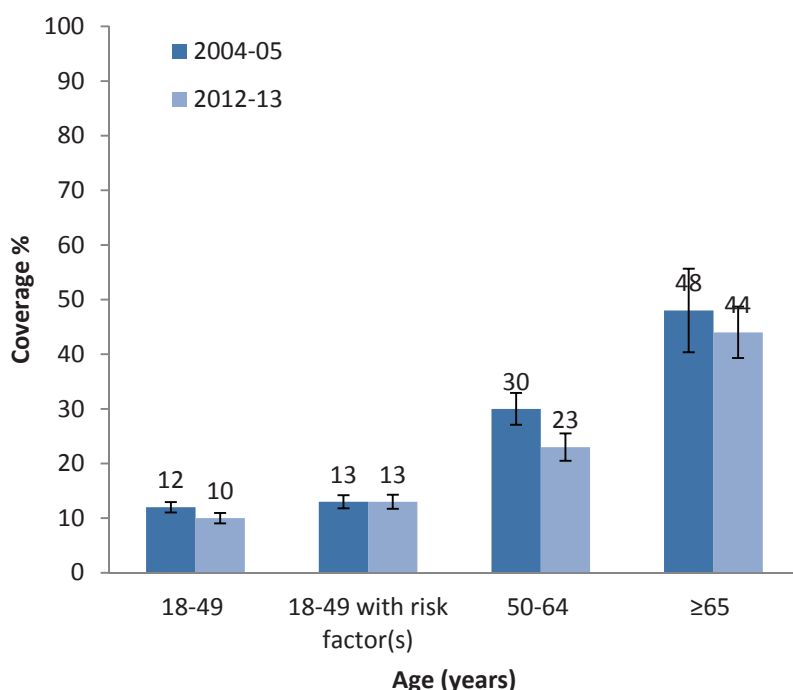
declines in influenza and pneumococcal coverage overall were observed in multiple states/territories (data not shown).

Unlike the 2004–05 survey, which found no significant differences in vaccination coverage for both vaccines between genders (although actual data were not presented),<sup>4</sup> our study found coverage to be significantly higher among Indigenous females aged ≥18 years for the influenza vaccine and to a lesser extent for the pneumococcal vaccine. Influenza vaccination coverage has also been reported to be higher among adult females in the US in 2014–15 and 2015–16.<sup>15,16</sup> Likewise, pneumococcal vaccination coverage has been shown to be higher in females in the US for the period 2011–14.<sup>17</sup> However, other studies have found influenza<sup>18–20</sup> and pneumococcal coverage<sup>17,21</sup> to be lower among females.

While there is a wide range of measures that have been shown to successfully improve vaccination coverage, the foundation stone is regular and reliable coverage data.<sup>22</sup> Therefore, national vaccination coverage data for Indigenous adults are needed much more regularly than every eight years to facilitate close monitoring and assist targeted program delivery efforts. The Australian Immunisation Register (AIR) now records vaccinations for all age groups. It could play an important role in the more timely tracking of vaccination coverage status of individual Indigenous adults, including the important issue of tracking the time since a previous dose of pneumococcal vaccine, as well as population coverage. The provision of regular coverage data and the ability to confirm the vaccination status of individuals will be critical to facilitating adult vaccination. However, the ability of this register to adequately capture the Indigenous status of individuals, and therefore their eligibility for additional vaccines, is unclear. General practitioners and other service providers have a responsibility to ascertain the Indigenous status of their patients, to be aware of the special eligibilities of the Indigenous population and opportunistically vaccinate eligible patients, and to report this to the AIR. Patient recall and reminder systems are also likely to be successful with such low coverage.

While the methods were very similar between the 2004–05<sup>10</sup> and 2012–13<sup>9</sup> surveys, one difference was in the geographical classification structure used for each. The change in the base geography used between the two structures is considered to be minor

Figure 2: Indigenous adults in Australia reporting pneumococcal vaccination,<sup>a</sup> (per cent) 2012–13 NATSIHS<sup>b</sup> compared with 2004–05 NATSIHS.<sup>c</sup>



Notes:

- a: Self-reported as having had pneumococcal vaccination in the 5 years prior to survey (respondents were asked if they had ever had the pneumococcal vaccine and if so, was in the last 5 years).
- b: Standardised to the Indigenous estimated resident population living in private dwellings of Australia at 30 June 2011, based on the 2011 Census of Population and Housing.
- c: Standardised to the Indigenous estimated resident population living in private dwellings of Australia at 31 December 2004, based on the 2001 Census of Population and Housing.

and should not affect comparability of data over time. The study was based on self-reported data, which has some limitations. The long recall period may have posed difficulties for some respondents, particularly those who have irregular influenza vaccinations, and for recalling pneumococcal vaccinations, which could have been given up to five years prior. Studies have examined the validity of self report in elderly patients and found self report of influenza vaccination to be highly sensitive (94–100%) and moderately specific (56–90%),<sup>23–25</sup> while self report of pneumococcal vaccination has been found to be a less sensitive (97–74%) and moderately specific (ranged from 95–53%) measure of vaccination status.<sup>23–26</sup>

## Implications for public health

Regular, frequent and reliable coverage data are urgently needed to monitor and assist vaccination program delivery efforts to Indigenous communities.

## Conclusions

Indigenous adult vaccination coverage remains at unacceptably low levels. In the eight years between national health surveys, coverage has declined in some areas, namely for pneumococcal vaccination across all age groups  $\geq 18$  years, and pneumococcal and influenza vaccination in remote areas (50–64-year-olds). There is little evidence of an impact of funding influenza vaccine for Indigenous adults without medical risk factors in 2010, with only small improvements in influenza vaccination coverage in the 18–49 years age group. Regular, frequent and reliable coverage data are urgently needed to draw attention to this issue and to monitor and assist program delivery efforts.

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## Supporting Information

Additional supporting information may be found in the online version of this article:

**Supplementary File 1:** Risk factors or medical conditions associated with an increased risk of influenza or invasive pneumococcal disease included in the analysis of the 2012–13 NATSIHS.

**Supplementary File 2:** Risk factors or medical conditions associated with an increased risk of influenza or invasive pneumococcal disease not included in the analysis of the 2012–13 NATSIHS.

**Supplementary File 3:** Risk factors or medical conditions associated with an increased risk of influenza or invasive pneumococcal disease included in the 2004–05 NATSIHS analysis but not included in the 2012–13 NATSIHS analysis.