Predictors of herpes zoster vaccination among Australian adults aged 65 and over

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Abstract

Objective(s): To estimate HZ vaccine coverage in Australia among older Australians and to identify potential barriers to vaccination

Design: Analysis of data from three cross-sectional surveys administered online between 2019 and 2020

Setting and participants: Adults aged 65 and over residing in Australia

Main outcome measures: Self-reported herpes zoster vaccination

Results: Among the 744 adults aged 65 and over in this sample, 32% reported being vaccinated for HZ, including 23% of participants aged 65-74, 55% of participants aged 75-84, and 0% for participants aged 85 and above. Those who are vaccinated with other immunisations are more likely to have received HZ vaccine, including seasonal influenza (OR = 4.41, 95% CI: 2.44 - 7.98) and pneumococcal vaccines (OR = 4.43, 95% CI: 2.92 – 6.75). Participants with a history of certain conditions, such as stroke (OR = 2.26, 95% CI: 1.13 – 4.49), were more likely to be vaccinated against HZ. Participants that reported smoking tobacco daily were less likely to be vaccinated against HZ (OR = 0.48, 95% CI: 0.26 – 0.89). Participants were less likely to be vaccinated against HZ if they preferred to develop immunity 'naturally' (OR = 0.29, 95% CI: 0.15 – 0.57) or expressed distrust of vaccines (OR = 0.34, 95% CI: 0.13 – 0.91).

Conclusion(s): Further research is required to understand the barriers to HZ vaccine uptake. Increasing the funding eligibility for those who are at risk of complications from shingles, or lowering the age of eligibility, may increase vaccine coverage.

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Introduction

Herpes zoster (HZ), also known as shingles, is an infectious disease caused by the reactivation of varicella zoster virus (VZV), commonly known as chickenpox. After the initial stage of VZV resolves, the virus lies latent in the dorsal root ganglia and can reactivate decades later causing painful, itchy vesicular rash and blisters usually around the thoracic region of the body (1). Statistically, about 1 in 3 people who previously had chickenpox will develop shingles at some point in their lives (2).

Although most cases of herpes zoster resolve after 3 to 5 weeks, approximately 10-18% of cases result in post-herpetic neuralgia (PHN), a condition where a person develops neuropathic pain and vesicular rash that often results in hospitalisation (3, 4). Despite antiviral treatment, PHN can last for many years after onset and heavily affects quality of life (5).

Although the majority of the population is at risk of VZV reactivation, over 70% of shingles cases occur in adults aged 50 and over (6). The cause of VZV reactivation is not well understood, but is likely due to immunosenescence, the progressive decline of the immune system after the age of 50 (7). Certain health conditions increase the risk of developing HZ and post-zoster complications, such as human immunodeficiency virus (HIV), immunosuppressive conditions, stroke, myocardial infarction, chronic obstructive pulmonary disease (COPD), asthma, and emphysema (8-10). There has also been a reported association with COVID-19 vaccines and reactivation of HZ (11, 12).

The Australian Immunisation Handbook (AIH), currently recommends HZ vaccination for people aged 60 and over, regardless of their history of VZV infection (13) HZ vaccine was added to the National Immunisation Program (NIP) in 2016, which provides funding for all adults 70 years of age, as well as a catch up program for those aged 71-79 until 2023 (14). In Australia, the only available and registered HZ vaccines are the live-attenuated vaccine, Zostavax (Oka strain) and the inactivated, adjuvanted recombinant vaccine, Shingrix (15, 16).

A recent study by Lin et al (2020) concluded that only 47% coverage was achieved for people aged 70-79 years old in Australia between 2016 and 2018. They compared their data extracted from the Australian Immunisation Registry (AIR) with the distribution of vaccine and concluded that the HZ vaccine coverage rate might be underestimated due to the uneven distribution of vaccines (17). However, this is considerably lower than coverage for other adult vaccines on the National Immunisation Program such as influenza and pneumococcal vaccines. The estimates of influenza and pneumococcal vaccine coverage in adults aged 65 and over are reported to be 82% and 56%, respectively, in 2015 in Australia (18).

Given the aging population and increasing chronic disease prevalence, the burden of HZ is likely to increase over time. Therefore, in this study we aim to estimate the current HZ vaccine coverage rate among older Australians and identify potential barriers to vaccination.

Methods

This paper reports data on HZ vaccination collected from three different cross-sectional surveys: (1) survey on adult immunisation (AIS) in Australia in October of 2019; (2) phase 1 of a study on 'Bushfire, Respiratory protection, Emphysema, bronchitis, and Asthma Triggering Health Effects' (BREATHE); and (3) a survey on mask use survey (MUS) during the COVID-19 pandemic in Australia, the United States, and the United Kingdom. This analysis includes participants that are over the age of 65. All three surveys were reviewed and approved by the University of New South Wales Human Research Ethics Committee (HC #190617, #200460, and # 200477).

Data collection and participant selection

Out data was collected via three cross-sectional surveys administered by two consumer research panels, Lucid (https://luc.id/) and Dynata (19). All participants gave informed consent prior to beginning a survey. Failure to complete the survey was considered revocation of consent and data was not used.

Survey 1 was the Australian Immunisation Survey (AIS). Data was collected via Lucid (https://luc.id/) in October 2019. Participants were included if they were aged 18 or over and residing in Australia. The sample was stratified to be representative of Australia in terms of age, gender, and state or territory of residence. The survey aimed to evaluate participants' vaccination status as well as the general attitudes about immunisation. To understand participants attitude towards immunisation attitude, we provided statements about vaccine attitude and asked the participants whether they agree or disagree with the statements using 2- and 4-point Likert scales (20). The statements include "I don't trust vaccines", "Myself or someone I know has had a bad experience with a vaccine", "I prefer to develop immunity naturally, rather than take vaccines." "I am afraid of needles", and "I have difficulties getting an appointment with my doctor to get vaccinated". Additional details on survey methods have been published previously (21, 22).

Survey 2 collected data on health outcomes during the 2019-20 bushfire season in Australia. Participants aged 18 and over from bushfire-prone postcodes were recruited from Dynata's consumer research panel in July 2020. The survey specifically targeted 50% participants to be with chronic lung diseases and 50% without. More detailed survey methods have been published elsewhere (23).

Survey 3 collected data on attitudes towards mask use and vaccination during the COVID-19 pandemic. Participants were recruited from Dynata's consumer research panel. The survey was distributed the survey to a random sample of adults in Melbourne and Sydney via email. Detailed survey methods can be found elsewhere (23).

All three surveys used the same question regarding HZ vaccination. We asked the question: "have you ever received a vaccine for shingles (zoster)", with response options "yes", "no", and "not sure". We combined the "no" and "not sure" responses into one category during data analysis.

All three surveys included questions about participants demographic characteristics such as their age, gender, country of birth, education level and health insurance status. Questions on their health history were also asked in all three surveys. These questions include whether the participants have self-reported heart disease, lung disease, cancer or history of cancer, stroke, weak immunity, and whether they are regular smokers of tobacco. The details of these questions can be found in the supplementary tables.

Data Analysis

Descriptive statistics were calculated for all characteristics of interest, such as gender, age, education level, country of birth, private health insurance status, HZ vaccination status, as well as vaccination attitudes for the AIS Survey only. To account for differences in the sampling frames for the three surveys, sampling weights were calculated using data for age group, gender, and the prevalence of chronic lung disease using data from the Australian Bureau of Statistics (24). These were used to calculate weighted estimates of demographic characteristics of the combined sample, which have been published previously (25).

In the unweighted sample, we used Pearson's chi-square test to determine whether any sociodemographic characteristics were associated with self-reported HZ vaccine status. In the weighted sample, we used Pearson's chi-square test with the Rao and Scott correction for survey data (26). We also used Pearson's chi-square test to identify perceived barriers associated with self-reported HZ vaccination in the AIS (survey 1) data. Data were analysed using STATA version 16 IE by StataCorp LLC (TX, USA).

Results

A total of 3,162 participants responded to the three surveys and 744 (23%) participants were aged 65 and over and thus included in this analysis, including 339 (28%) from survey 1, 285 (17%) from the survey 2, and 120 (23%) from survey 3. Weighted and unweighted demographic characteristics for this study sample have been published previously (25).

For participants aged 65 and above, the weighted estimate for HZ vaccine coverage is 32%, ranging between 28% in the survey 3 and 32% in survey 1. Estimates of HZ vaccine coverage by age are: 23% of participants aged 65-74; 55% of participants aged 75-84; and 0% for participants aged 85 and above.

Rates of HZ vaccination were higher among those with a history of stroke ($p=0.05$) or cancer ($p=0.003$), but there was no association with cardiovascular disease ($p=0.21$), chronic lung disease ($p=0.2$), immunocompromising conditions ($p=0.32$), or smoking status ($p=0.14$). Participants that reported smoking tobacco daily were less likely to be vaccinated against HZ ($p=0.02$). We did not observe any association between HZ vaccination and gender ($p=0.21$), being born overseas ($p=0.1$), education level (0.65), or having private health insurance ($p=43$). The HZ vaccination rate was higher among those who received influenza and pneumococcal vaccines with high significance value ($p<0.001$).

Perceived barriers that were significantly associated with self-reported HZ vaccination included distrust of vaccines in general ($p<0.001$) and preferring to develop immunity naturally ($p<0.001$). We did not observe any association between HZ vaccination and any of the following perceived barriers: being afraid of needles ($p=0.63$), having difficulties getting an appointment with their doctor ($p=0.92$), having a bad experience with a vaccine (0.93), having mobility issues that make it difficult ot visit GP ($p=0.25$), or not having time to visit the GP to get vaccinated ($p=0.06$).

Discussion

After HZ vaccine was added to the National Immunisation Program in 2016, the number of prescriptions for HZ antivirals declined significantly among adults aged 70-79, suggesting that the program is effective at decreasing the incidence of HZ (27). However, HZ vaccine uptake has been slow. In Australia, the coverage of HZ vaccine between 2006 to 2013 was less than 2% for adults aged 60 and over (28). According to the NCIRS, in the first 17 months after the funded program was introduced, HZ vaccine coverage was below 30% for adults aged 70-79 (29). In 2019-2020, we found that approximately 30% of adults aged 65 and over have received HZ. We estimated 55% coverage among Australians aged 75-84, which was comparable to findings by Lin et al, who found there was 47% coverage among adults aged 70-79 (17). HZ vaccine coverage in Australia is low compared to other western countries with similar health systems such as the UK, which has coverage as high as 77% among adults 76 years of age (30). Several factors identified in literature review may have been contributing factors for low HZ vaccination coverage, including uneven distribution of the vaccine and restricted funding of the program for people aged 70 and above only (29).

Surprisingly, we did not observe any association between self-reported HZ vaccination and perceived logistical barriers to vaccination, such as having mobility issues, having difficulties getting an appointment with a GP, or not having enough time to get vaccinated. However, there were several participants (10%) that agreed or strongly agreed with the statement of "I don't trust vaccines", and nearly 1 in 4 agreed with the statement "I prefer to develop immunity naturally". Unsurprisingly, both attitudes were associated with lower rates of HZ vaccination. This could possibly be a result of increased social media and internet influence in the past two decades contributing to health decision-making (31).

The need to increase HZ vaccination uptake has never been greater. There has been a significant increase in HZ incidence for the last several decades. Between 2002 and 2012, the incidence of HZ in Australia increased from 11.9 to 15.4 per 1,000 persons (32). Although it is often regarded as a mild illness, HZ results in thousands of hospitalizations in Australia each year (33). In addition, treatment and hospitalization for post-herpetic neuralgia results in significant economic burden (34). Given the aging population of Australia and increasing rates of immunosuppression, the incidence of HZ is likely to continue to increase without intervention. There is also emerging evidence that mRNA COVID-19 vaccines may trigger HZ, as well as the reactivation of human herpesvirus-6, -7 and Epstein-Barr virus (11, 12). As of January 2020, more than 30 million doses of mRNA COVID-19 vaccines have been administered in Australia (35).

Limitations

This study was not without limitations. Firstly, this analysis used data from three separate studies that used different sampling frames, meaning that the three study populations had key demographic differences and are not necessarily representative of the general Australian population. Furthermore, consumer research panels are not always representative of the general population, particularly for older adults [48]. Another limitation is that survey 3 sampled only from the Sydney and Melbourne metropolitan areas, so regional Australia is potentially underrepresented in this analysis. We utilized survey weights in this analysis to mitigate potential biases due to the sampling frames used. Lastly, the question regarding age was asked categorically for two out of three surveys, with response options: "55-64", "65-74", "75-84", and "85 and over". Thus, we were unable to determine the coverage rate among adults aged 60-69 or 70-79. This is notable, as these age ranges align with HZ vaccine recommendations in Australia.

Conclusions

The overall HZ vaccination rate in Australia between 2019-2020 is suboptimal, despite the government funded HZ vaccine program and the recommendation from Australian Technical Advisory Group on Immunisation. We recognised that the government funded HZ vaccine program is only aim at people aged 70-79 in Australia, however, compared to countries with similar health system such as the UK, the coverage rate is still low. Further research is required to evaluate drivers and barriers to HZ vaccination, including health access equity, socioeconomics, and awareness of HZ vaccine.

Declaration of Competing Interest

The authors have no competing interests to declare.

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Table 1. Demographic characteristics associated with self-reported herpes zoster vaccination

	Self-reported vaccination for herpes zoster							
	No/Not sure	Yes	Odds ratio (unweighted)			Odds ratio (weighted)		
	n (%)	n (%)	OR	95% CI	p-value	OR	95% CI	p-value
Age Group								
65-74	433 (78%)	125 (22%)	ref	-	-	-	-	-
75-84	80 (45%)	98 (55%)	**4.24**	**(2.97, 6.06)**	**<0.01**	**4.12**	**(2.71, 6.23)**	**<0.01**
85 or over	8 (100%)	0 (0%)	-	-	-	-	-	-
Gender								
Male	306 (68%)	142 (32%)						
Female	215 (73%)	81 (27%)	0.81	(0.59, 1.12)	0.21	0.98	(0.67, 1.42)	0.90
Country of Birth								
Overseas	139 (75%)	47 (25%)						
Australia	380 (68%)	176 (32%)	1.36	(0.94, 1.98)	0.11	1.09	(0.69, 1.70)	0.72
Education Level								
High school or less	195 (71%)	79 (29%)	ref	-	-	ref	-	-
Technical diploma	188 (70%)	79 (30%)	1.04	(0.72, 1.50)	0.85	1.01	(0.65, 1.57)	0.96
Tertiary degree	134 (67%)	65 (33%)	1.19	(0.80, 1.76)	0.40	1.19	(0.74, 1.90)	0.47
Private Health Insurance Status								
No	242 (71%)	97 (29%)						
Yes	277 (69%)	126 (31%)	1.14	(0.83, 1.56)	0.43	1.14	(0.78, 1.65)	0.51
Heart Disease								
No	432 (71%)	177 (29%)						
Yes	87 (65%)	46 (35%)	1.35	(0.90, 2.03)	0.14	1.14	(0.70, 1.88)	0.59
Lung Disease								
No	369 (71%)	148 (29%)						
Yes	150 (67%)	76 (33%)	1.32	(0.94, 1.84)	0.11	1.25	(0.84, 1.88)	0.27
Immunocompromising condition								
No	500 (70%)	218 (30%)						
Yes	19 (79%)	5 (21%)	0.46	(0.13, 1.61)	0.22	0.56	(0.13, 2.37)	0.43
Stroke								
No	494 (71%)	204 (29%)						
Yes	25 (57%)	19 (43%)	**1.86**	**(1.00, 3.46)**	**0.05**	**2.26**	**(1.13, 4.49)**	**0.02**
Cancer (past or current)								
No	429 (72%)	163 (28%)						
Yes	90 (60%)	60 (40%)	**1.74**	**(1.20, 2.52)**	**<0.01**	1.29	(0.81, 2.05)	0.27
Smokes tobacco daily								
No	449 (69%)	205 (31%)						
Yes	70 (80%)	17 (20%)	**0.53**	**(0.31, 0.93)**	**0.03**	**0.48**	**(0.26, 0.89)**	**0.02**
Influenza Vaccine								
No/Not Sure	130 (88%)	17 (12%)						
Yes	389 (65%)	206 (35%)	**4.41**	**(2.47, 6.81)**	**<0.01**	**4.41**	**(2.44, 7.98)**	**<0.01**
Pneumococcal Vaccine								
No/Not Sure	307 (85%)	56 (15%)						
Yes	212 (56%)	167 (44%)	4.31	**(3.04, 6.11)**	**<0.01**	**4.43**	**(2.92, 6.75)**	**<0.01**

Table 2. Perceived barriers associated with self-reported herpes zoster vaccine status

	Has received herpes zoster vaccine (self-reported)				
			Odds Ratio		
Perceived barriers	**No/Not sure (n=235), %**	**Yes (n=102), %**	**OR**	**95% CI**	**p-value†**
I do not trust vaccines					
Disagree/strongly disagree	205 (68%)	97 (32%)			
Agree/strongly agree	30 (86%)	5 (14%)	**0.34**	**(0.13, 0.91)**	**0.03**
I prefer to develop immunity naturally					
Disagree/strongly disagree	166 (65%)	91 (35%)			
Agree/strongly agree	69 (86%)	11 (14%)	**0.29**	**(0.15, 0.57)**	**0.001**
I am afraid of needles					
Disagree/strongly disagree	193 (70%)	86 (31%)			
Agree/strongly agree	42 (62%)	16 (28%)	0.86	(0.46, 1.62)	0.65
I have difficulties getting an appointment with my doctor to get vaccinated					
Disagree/strongly disagree	230 (70%)	100 (30%)			
Agree/strongly agree	5 (61%)	2 (29%)	0.93	(0.18, 4.86)	0.92
Myself or someone I know has had a bad experience with a vaccine					
Disagree	188 (70%)	82 (30%)			
Agree	47 (70%)	20 (30%)	0.99	(0.55, 1.77)	0.93
I have mobility issues that make it difficult to visit my GP					
Disagree	218 (69%)	98 (31%)			
Agree	17 (81%)	4 (19%)	0.53	(0.17, 1.61)	0.26
I do not have time to visit my GP to get vaccinated					
Disagree	227 (69%)	102 (31%)			
Agree	8 (100%)	0 (0%)	-	-	-

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