Sydney Policy Reform Project

Research Paper for NSW Council of Social Service: Barriers to vaccination for people experiencing disadvantage

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About the Sydney Policy Reform Project

The Sydney Policy Reform Project ('Project') facilitates University of Sydney students to write research papers for policy organisations, and submissions to government inquiries, under supervision from University of Sydney academics. The Project is a volunteer, extra-curricular activity.

The Project is an initiative of the Student Affairs and Engagement Team within the Faculty of Arts and Social Sciences, and the Division of Alumni and Development, at the University of Sydney. The Project is funded by a donor to the University of Sydney.

The students who wrote this paper were Ms Elinor Stephenson, Mr Kitae Yoo, and Ms Anna-Sophia Zahar. The academic supervisor for this paper was Dr Aditi Dey, Senior Lecturer.

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Legal disclaimer

Abstract

Introduction: In the context of the current dissemination of the COVID-19 vaccine in Australia, this study analyses the significant barriers to vaccination that exist for people facing disadvantage.

Objectives: The aim of this literature review was to determine and analyse the barriers to vaccination for people experiencing disadvantage in New South Wales, Australia and comparable jurisdictions, from the year 2000 onwards, for use of the NSW Council of Social Service in its ongoing program of research on the social determinants of health.

Methods: The authors reviewed 134 records from Australian and international journals, screened based on search criteria, focusing on summarising attitudinal, logistical, and awareness barriers, as well as service systems issues. Records were used for the study if they were published between 1 January 2010 and 12 April 2021, and related to adult vaccination in NSW or a comparable jurisdiction. Key search terms included 'attitude', 'logistic', 'awareness', 'service', 'culture' and 'religion'.

Results: With regards to attitudinal barriers, misinformation leading to sceptical attitudes towards vaccines was more prevalent among culturally and linguistically diverse groups, and people experiencing disadvantage, who are more likely to have experienced health inequity as well as lower vaccination rates. In terms of logistical barriers, lack of state government preparedness and coordination, as well as physical barriers for elderly people, and cost barriers for people experiencing financial pressure, were all found to affect the level of vaccine coverage among these populations. Evaluation of literature relating to awareness-based barriers revealed significant language barriers and lack of culturally appropriate resources being shared among migrant and refugee communities, as well as among Aboriginal and Torres Strait Islander people. However, health practitioners themselves also demonstrated significant lack of awareness and vaccine knowledge. Finally, with regards to service system issues, a dearth of culturally appropriate services and information, and a lack of national coordination, was found to hinder the effectiveness of these systems in increasing vaccine coverage.

Conclusion: There remain significant barriers to vaccination for people facing disadvantage in NSW. These particularly apply to people who are financially disadvantaged, culturally or linguistically diverse, or who are Aboriginal or Torres Strait Islander. Existing barriers were found relating to all areas of the study: attitudinal barriers, logistical barriers, awareness-based barriers, and service systems issues.

1. Introduction

This literature review was undertaken with the intention of summarising the available academic literature that describes barriers to vaccination for people experiencing disadvantage in New South Wales, Australia, and comparable jurisdictions, from the year 2010 onwards. It was specifically intended for the use of the NSW Council of Social Service (NCOSS) to form part of its ongoing program of research on the social determinants of health. In the context of the roll-out of the COVID-19 vaccination, the rationale for this study was the identification of barriers that have the potential to prevent full uptake of the vaccine among Australian adults experiencing some form of disadvantage. The key literature analysed for this study, summarised in Table 1, was largely focused on the situation surrounding adult vaccination in Australia, and particularly in New South Wales. The aims of this study were to determine the extent of attitudinal, logistical, and awareness-based barriers, as well as service-system issues and religious barriers that were inhibiting vaccine uptake for adults in NSW experiencing some form of disadvantage, as well as taking note of the existence of any other barriers found in the literature. In the available literature, there was very little information regarding the existence of religious barriers to vaccination for adults experiencing disadvantage in NSW, leading the authors to instead focus on the particular impacts of each other barrier we had identified for culturally diverse and Aboriginal and Torres Strait Islander groups in Australia.

2. Method

The primary objective of this review was to identify and synthesise available studies describing or investigating various types of barriers to vaccination for people experiencing disadvantage. In particular, the literature review was developed drawing on the PRISMA (preferred reporting items for systematic reviews and meta-analysis) guidelines (PRISMA 2021).

2.1. Inclusion/Exclusion criteria

Both peer-reviewed qualitative and quantitative studies were included if they examined barriers to adult vaccination. The search was limited to recent studies published in English and conducted in Australia and comparable Commonwealth jurisdictions, such as New Zealand, UK and Canada. Studies were excluded if they were: (1) focused on barriers to childhood immunisation, (2) associated with medical barriers to vaccination, or (3) published prior to 2010.

2.2. Search strategy

We conducted electronic searches of articles from five databases: PubMed, CINAHL, Google Scholar, Embase and Web of Science. The key search terms included ‘vaccine’, ‘vaccination’, ‘immunisation’, ‘equity’, ‘inequity’, ‘barrier’, ’systematic Review’, ‘NSW’, ‘attitude’, ‘logistic’, ‘awareness’, ‘service’, ‘culture’ and ‘religion’ with relevant associated text or thesaurus terms. These terms were searched both individually as well as in combinations. The detailed search strategy can be found in Table 2 in the Appendix. The last search was conducted on 12 April 2021.

2.3. Data abstraction and synthesis

The systematic review involved four stages: identification, screening, eligibility, and inclusion of literature, using the PRISMA framework. The process of literature selection is illustrated in Figure 1. During the identification stage, data were extracted by one author (Anna-Sophia Zahar) through the search strategy explained above. Subsequently, duplicate articles were removed, and the titles of the remaining articles were first screened by one author (Kitae Yoo) to determine relevance to the review. The abstracts or executive summaries were then screened by all three authors (Anna-Sophia Zahar, Elinor Stephenson and Kitae Yoo). During the eligibility stage, the full texts of articles were again reviewed by all three authors for relevance and to be included in the review.

3. Results

The initial search strategy yielded 2,173 titles from five databases. Of these, 117 were removed as duplicates. Subsequently, 2,056 items underwent title and abstract screening and 1,562 items were excluded for various reasons as presented in Figure 1 (below). Thus, 494 articles were included for full-text review. Then, full-text screening identified 134 articles which met the inclusion criteria for inclusion in the literature review. Of these, there were 25 key studies that were most relevant to our review which are summarised in Table 1 (below).

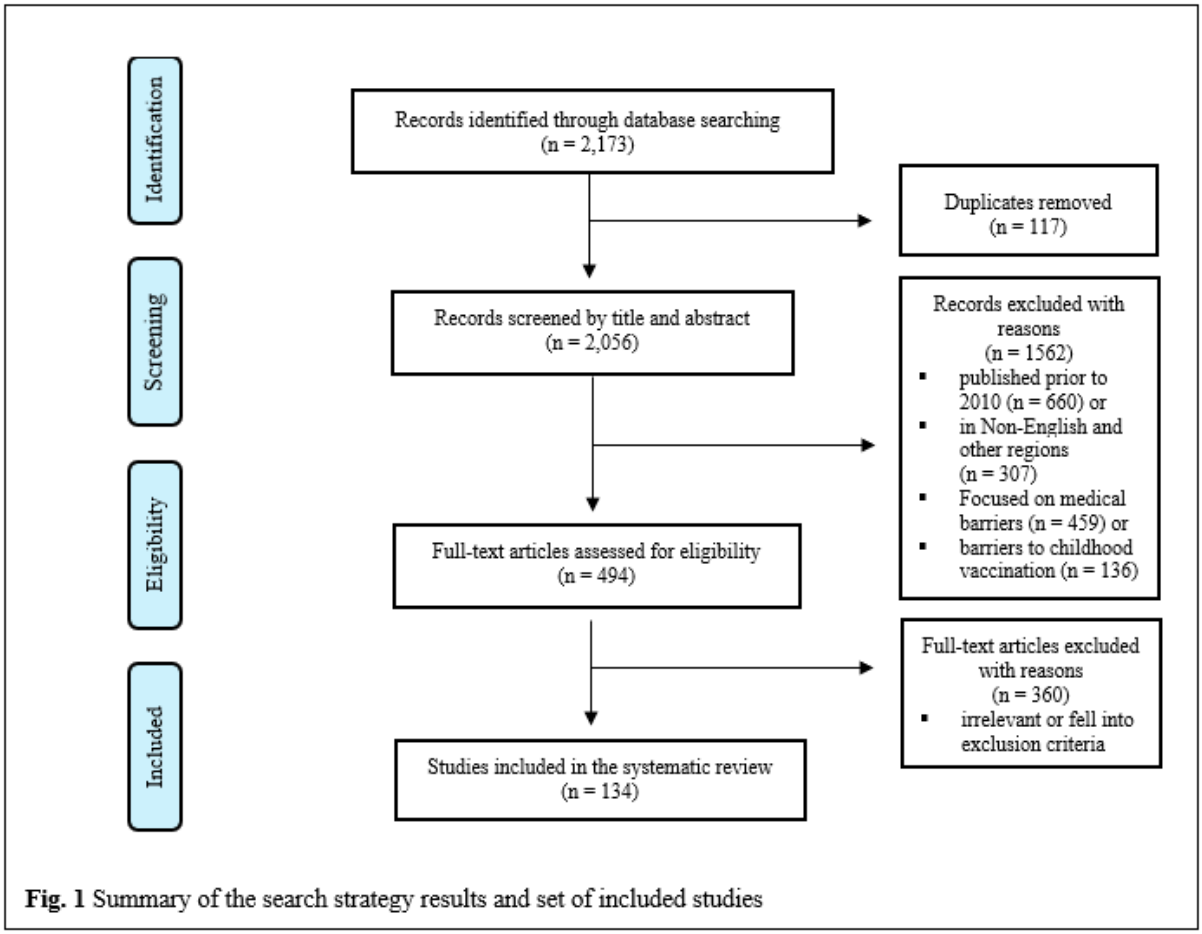

Fig. 1 Summary of the search strategy results and set of included studies

Table 1. Summary of key selected studies on barriers to vaccination, 1 January 2010 to 12 April 2021

Author	Year	Journal	Location	Sample Size	Study design	Summary findings
Australia						
Robbins et al.	2011	Journal of Health Communication	Australia	n=131	Content analysis	Information provided by the media relating to the HPV vaccination was incomplete, and educational interventions would be recommended to fill these gaps
Topp et al.	2013	Preventive	Sydney,	n=139	Clinical trial	Financial incentives

		Medicine	Australia			increase likelihood of vaccine schedule completion, but independent of treatment, Indigenous participants were significantly less likely to receive all three doses of vaccine
Macintyre et al	2016	Vaccine	Sydney, Australia	N/A	Review	Financial barriers to vaccination are significant, particularly for older adults who are not covered by vaccine funding and subsidy programs as children are
Ridda, Gao & Macintyre	2014	Vaccine	Sydney, Australia	n=506	Telephone survey	79.4% of participants had no knowledge of the pertussis adult booster vaccine, indicating low awareness about pertussis vaccination
McIver et al.	2015	Journal of the American Medical Informatics Association	Sydney, Australia	n=704	Clinical trial	SMS reminders did not increase the likelihood of taking 2nd or 3rd doses of the vaccine in the population studied
O'Grady et al.	2015	BMC Research Notes	Australia	n=53	Survey	Information offered to Aboriginal and Torres Strait Islander women by healthcare workers was found to be insufficient to allow them to make an informed choice with regards to the

						vaccination
Karki et al.	2016	Vaccine	NSW, Australia	n=76040	Survey of adults over the age of 45 from Australian and migrant backgrounds	Vaccine coverage was lower amongst immigrants. Lower vaccine coverage is correlated with speaking a language other than English at home. Recognition of migrant background in vaccine surveillance proposed.
Kpozehouen et al.	2016	Australia and New Zealand Journal of Public Health	Australia	N/A	Review	Lack of identifiers for refugees and migrants, unfunded vaccines, and lack of a whole-of-life immunisation register are the main barriers to delivery of catch-up immunisation.
Newcombe et al.	2016	Journal of Paediatric Health	Sydney, Australia	n=101	Cross-sectional survey	Paediatricians in Sydney have considerable gaps in their knowledge of the guidelines surrounding the influenza vaccine
Walker, Newall & Heywood	2016	Vaccine	Sydney, Australia	n=606	Online survey	Awareness of vaccination recommendations was a significant predictor of the likelihood of influenza vaccination for a given student
Mahimbo et al.	2017	Vaccine	Australia	n=30	Qualitative study with semi-structured	Providers' issues with catch-up programs for

					interviews with providers	refugees included: Variability in access for program funding; Lack of national coordination; Unclear roles and responsibilities; Lack of referral to health services upon resettlement; Insufficient GP training; Difficulty managing catch up register.
Itzwerth, Moa & Macintyre	2018	Journal of Public Health Policy	NSW, Australia	n=10	Review	Health system-related issues were better addressed in pandemic preparedness plans than critical infrastructure and essential systems resilience, and the needs of Indigenous populations were rarely considered.
Thomas et al.	2018	Vaccine	Maitland, NSW	n=59	Stakeholder interviews	Barriers to accessing vaccination in a disadvantaged community included financial issues, lack of time, fear of having children taken away, lack of transport to clinics. Opportunistic vaccination and simple reminders and easier to understand schedules recommended.
Webster et al.	2019	Aust NZ Journal of	Australia	n=11239	Cross-sectional	Despite the influenza vaccine

		Public Health			survey	being nationally funded in 2010, the only increase in influenza coverage for Indigenous adults was in the 18-49-year age group
Abdi, Murphy & Seale	2020	Vaccine	Australia	n=27	Review of online vaccine information available to migrants.	Engagement with migrant communities is needed to improve the cultural appropriateness and accessibility of online vaccination resources, in order to increase awareness of vaccines. Tendency for information to be difficult to locate and jargon-heavy.
McHugh et al.	2020	Human Vaccines & Immunotherapeutics	Australia	N/A	Narrative literature review	Aboriginal and Torres Strait Islander women have worse vaccination outcomes during pregnancy, which is connected with: (a) a lack of culturally appropriate antenatal care; (b) insufficient monitoring of maternal vaccination; (c) lack of involvement of Aboriginal people in healthcare service design.
Menzies et al.	2020	Aust NZ Journal of Public Health	Australia	n=273	Focus group and cross-sectional survey	In a 2020 study of the major barriers to vaccination being faced by Indigenous adults, 17% of those surveyed reported

						difficulty in accessing the vaccine, but 53% noted that they had not received a reminder from a health official to get the vaccine/
Rhodes et al	2020	The Lancet Infectious Diseases	Australia	n=2018	Online survey	About 24.2% of Australian stated 'unsure' or 'unwilling' to receive COVID-19 vaccination
Dodd et al	2021	The Lancet Infectious Diseases	Australia	n=4362	Online survey	14.3% of participants were vaccine hesitant. Inadequate health literacy and lower education level were both significantly associated with vaccine hesitancy ($p < 0.001$)
Pickles et al	2021	Journal of Medical Internet Research	Australia	April (n=4362), May (n=1882), and June (n=1369) 2020	Longitudinal national survey	Vaccine hesitancy was associated with male gender, younger age, lower education level, and culturally and linguistically diverse backgrounds.
Seale et al	2021	BMC Infectious Diseases	Australia	n=1420	A national cross-sectional online survey	Public perception towards COVID-19 vaccination was found to be high
Trent, Salmon & Macintyre	2021	Influenza and Other Respiratory Viruses	Australia	n=1444	Online survey	Common perceived barriers to vaccination included misinformation and myths around COVID-19 vaccine
International						

Dubé et al	2013	Human Vaccines & Immunotherapeutics	Quebec, Canada	N/A	Review	A perspective piece of vaccine hesitancy regarding its characteristics and potential causes.
Dubé, Vivion & MacDonald	2014	Expert Review of Vaccines	Quebec, Canada	N/A	Review	A narrative review of the history of anti-vaccination movements and determinants of parent vaccination decisions
Lefevere et al.	2016	European Journal of Health Economics	Flanders, Belgium	n=629	Clinical trial	Removing out-of-pocket costs of the vaccination process with the use of small financial incentives was significant in increasing HPV vaccination initiation among the target group, although this effect was varied in size

3.1. Attitudinal barriers

There is a spectrum of attitudes and perceptions toward vaccination, spanning from complete refusal, uncertainty and hesitancy to full acceptance and advocacy for vaccines (Dubé et al. 2013; Dyda et al. 2020). Studies suggest that opposition to and hesitancy around vaccines pose a major barrier against vaccination uptake (Trent, Salmon & MacIntyre 2021). Such attitudinal barriers are increasingly recognised as a significant threat to public health as they lead to suboptimal immunisation rates and potential outbreaks of preventable illnesses despite the availability of vaccines (Zhang et al. 2021). Individuals who strongly reject all types of vaccines are often classified as ‘anti-vaxxers’ (Dubé, Vivion & MacDonald 2014). They tend to hold intractable views on vaccines and vocally engage in anti-vaccination movements such as protests (Leask 2011). A recent survey result showed that about 23% of Australians expressed unwillingness to take the COVID-19 vaccine (Lim & Scott 2021). Among this group, about 37% are estimated to be outright refusers whereas the remainder have been identified as vaccine hesitant (Lim & Scott 2021). Vaccine hesitant individuals are often defined as a heterogeneous group with varying degrees of concern about vaccination (Larson et al. 2014). In another study about intention to vaccinate against COVID-19, about 24.2% of Australians were hesitant to be vaccinated due to disbelief and distrust in the vaccine (Rhodes et al. 2020).

In particular, concerns around the safety, efficacy and necessity of vaccines are identified as driving uncertainty and hesitancy among Australian adults (Trent, Salmon & MacIntyre 2021). In a 2021 study, psychological barriers such as distrust and fear of side effects were significantly associated with decreased rates of vaccination (Trent, Salmon & MacIntyre 2021). Misinformation about the effectiveness of vaccines acted as deterrents to vaccine uptake among Australian adults, where 36% of participants believed that the vaccine itself can cause diseases and 63% agreed that receiving vaccines can make them ill afterwards (Trent, Salmon & MacIntyre 2021).

Another study conducted in 2020 also found that misinformed beliefs about the effectiveness of vaccines have negative influences on individuals' motivations to be vaccinated (Pickles et al. 2021). It is reported that over 20% of participants were misinformed that: hot temperatures can kill the virus (22%), UV rays kill the virus (21.5%), the effectiveness of vaccines is made up (17.3%), and vitamin C is an effective treatment to COVID-19 (4.5%) (Pickles et al. 2021). Furthermore, individuals with a low self-perceived risk of infection tend to regard vaccination as unnecessary as the risk of even mild adverse effects are believed to outweigh the benefits of vaccination (Trent, Salmon & MacIntyre 2021). It is often believed among vaccine hesitant individuals that good hygiene and social distancing can make vaccination unnecessary (Dubé et al. 2013). As such, vaccine hesitancy is likely amplified by the misinformation and myths surrounding vaccination (Seale et al. 2021).

Studies also showed misinformation was more prevalent among culturally and linguistically diverse (CALD) groups, particularly among those who are male or have a lower education level (Pickles et al. 2021). Inadequate health literacy, lower education and socioeconomic status, and being younger than 60 years of age are also reported to be significantly associated with a reluctance to be vaccinated (Dodd et al. 2021). Furthermore, acceptance towards COVID-19 vaccination differed greatly between Aboriginal and Torres Strait Islander respondents (68.1%) and non-Indigenous respondents (80.9%), as well as those who held private health insurance (83.5%) versus those who did not (76.3%) (Seale et al. 2021). Several studies suggested that people with low socio-economic status or from CALD backgrounds are more likely to be disadvantaged by the various factors that lead to health inequity, resulting in negative attitudes towards vaccines as well as lower vaccination rates among these people (Dyda et al. 2015; Seale et al. 2021).

3.2. Logistical Barriers

Studies undertaken in NSW indicate several logistical barriers that prevent people experiencing disadvantage from accessing vaccination programs. Evidence shows that about

50% of under-vaccination is due to lack of access (Chow et al. 2017), and in a 2016 study of HPV vaccine coverage in NSW, most reasons given by parents for non-vaccination of their children were related to logistical issues (Staples et al. 2016).

Lack of preparedness and coordination was found to be a significant logistical barrier to vaccination, especially for disadvantaged people in NSW. A 2017 study reviewed pandemic preparedness plans issued by the NSW public sector at the time of the influenza pandemic in 2009 (Itzwerth, Moa & Macintyre 2018). Although these plans have since been altered, and despite the existence of relevant research that could better inform these plans, the study found that many plans appeared to be premised on assumptions that were unsubstantiated and not supported by contemporary literature. The lack of a well-constructed pandemic preparedness plan exacerbates existing logistical issues, and makes it harder for groups experiencing disadvantage to receive vaccinations. A 2012-13 study of migrants and refugees living in Australia found that poor refugee service coordination and lack of support for immunisation delivery within the primary healthcare sector was a significant contributing factor to under-vaccination among migrants and refugees (Kpozehouen et al. 2016).

Furthermore, attempts to vaccinate elderly adults in NSW, particularly before the whole-of-life Australian Immunisation Register (AIR) was created in 2016, similarly demonstrate a failure of coordination (Macintyre et al. 2016). Prior to the creation of the AIR, elderly adults often had multiple vaccine providers, and no historical record of vaccines, meaning that it was logistically difficult to track which vaccines had been given (Macintyre et al. 2016). Thus, the AIR is important to reducing these logistical issues. However, a lack of clinical trial data for elderly adults, low levels of mobility, and a focus on paediatric immunisation are all logistical barriers that remain (Macintyre et al. 2016). These logistical barriers compound what are often significant physical accessibility and mobility barriers for the elderly adult population in Australia (Macintyre et al. 2016).

Cost has additionally been a significant barrier to vaccination, an issue that has been met with attempts to provide financial incentives for vaccination, particularly for disadvantaged people. An Australian study concluded that financial barriers to vaccination are significant, particularly for older adults who, unlike children, are not covered by vaccine funding or subsidy programs (Macintyre et al. 2016). A separate study conducted in Sydney, targeting people who inject drugs, offered participants $30 AUD cash following receipt of the final 2 doses of the hepatitis B virus vaccine. The study found that the per-dose financial incentive condition was a factor that significantly increased the likelihood of series completion (Topp et al. 2013). Notably, independent of treatment, Indigenous participants were significantly less likely to receive all three doses of vaccine. Outside of Australia, a study undertaken of girls aged 12-18 in schools

in Flanders, Belgium, in 2007 and 2009 produced similar results. Under the Belgian non-school-based vaccination system – comparable to the Australian system of vaccinating adults – removing out-of-pocket costs of the vaccination process using small financial incentives was significant in increasing HPV vaccination initiation among the target group, although this effect was varied in size (Lefevere et al. 2016). Additionally, a 2012-13 study of migrants and refugees living in Australia also concluded that catch-up vaccines for recently arrived migrants and refugees for all age groups would be helpful in mitigating this logistical barrier to vaccination (Kpozehouen et al. 2016).

However, the effectiveness of financial incentives to overcome the barrier of cost is often significantly mitigated by other existing barriers to access. In a study of Indigenous adult vaccination coverage for influenza and pneumococcal disease, despite the influenza vaccine being nationally funded in 2010, the only increase in influenza coverage for Indigenous adults was in the 18-49-year age group (Webster et al. 2019). These findings imply that while financial incentives to compensate adults for the time and effort taken to get the vaccine are often effective in targeted communities, the lack of a system that promotes awareness of vaccination programs is a leading cause of under-vaccination among Indigenous adults. In a 2020 study of the major barriers to vaccination being faced by Indigenous adults, 17% of those surveyed reported difficulty in accessing the vaccine, but 53% noted that they had not received a reminder from a health official to get the vaccine (Menzies et al. 2020). In an attempt to address this issue, in 2010-2014, designated 'Aboriginal Immunisation Officers' in the Hunter New England Local Health District (HNELHD) gave telephone calls to the families of all Indigenous infants notifying them of their first scheduled vaccinations. This strategy was found to have provided 'accelerated benefit' to increasing vaccine coverage among Indigenous children in HNELHD (Cashman et al. 2016). The need for reminder notification systems reinforces the importance of logistically sound and pre-emptive pandemic preparedness planning.

3.3. Awareness-Based Barriers

Overall, in recent studies of vaccine uptake in NSW, awareness has been a significant barrier to vaccination, particularly for disadvantaged groups. In a 2014 study in NSW, of those surveyed, 79.4% of participants had no knowledge of the pertussis adult booster vaccine, indicating low awareness about pertussis vaccination, with the study suggesting the implementation of awareness programs around pertussis vaccines. (Ridda, Gao & Macintyre 2014). Additionally, among students at UNSW surveyed in early 2014, awareness of

vaccination recommendations was a significant predictor of the likelihood of influenza vaccination for a given student (Walker, Newall & Heywood 2016).

Among migrant and refugee communities, awareness was often inhibited by language barriers and the lack of culturally appropriate resources being shared with these communities. In a 2020 study of online vaccination-related resources in Australia, the average score for 'cultural appropriateness' was 79%, with a range of 29-100%, and where cultural appropriateness was assessed according to criteria developed by the Centre for Culture, Ethnicity and Health (CEH) in Victoria (Abdi, Murphy & Seale 2020). Abdi, Murphy and Seale (2020) suggested engagement with migrant communities to improve the cultural appropriateness and accessibility of online vaccination resources, in order to increase awareness of vaccines.

Aboriginal and Torres Strait Islander people also experience suboptimal awareness of vaccination programs. Of 53 Aboriginal and Torres Strait Islander women that took part in a cross-sectional survey in 2015, 21 (which is less than half) reported being offered the opportunity to take the influenza vaccine during pregnancy. Information offered to these women by healthcare workers was found to be insufficient to allow them to make an informed choice with regards to the vaccination (O'Grady et al. 2015).

There also appear to be significant problems with lack of awareness among healthcare practitioners. In a 2014 study of general practitioners in South-Western Sydney, few of those surveyed reported that they had confidence in their knowledge about the influenza vaccine, and most felt that they required more information about the vaccine (Maher et al. 2014). A separate study in 2016 of paediatricians in Sydney found that their knowledge of guidelines and recommendations concerning vaccinations was less than optimal, with 45% of those surveyed reporting their use of local hospital guidelines to determine whether or not to deliver influenza vaccines, even though these did not actually exist at the time of the survey (Newcombe et al. 2016). The same study suggested interventions in the form of improving education of doctors, increasing the availability of vaccines in outpatient clinics and implementing automated reminder systems. Focusing on workers in residential aged care facilities (RACF) in Sydney, Huhtinen et al. (2018) found that RACF workers often held misconceived views with regards to the influenza vaccine, including finding that 46% of staff surveyed were sceptical of the vaccine. Huhtinen et al. (2016) recommended the implementation of targeted education on influenza vaccines, and the role of infection control in influenza outbreak management.

The available literature interrogates several structural factors contributing to lack of awareness. The most significant structural factors appear to be lack of reliable public

information, and misrepresentation by the media. Royle and Lambert (2015) posit that with improved quality of life and reduced exposure to disease in Australia, public knowledge about diseases and their consequences has decreased, while simultaneously, concerns relating to vaccines have increased. This study recommends the sharing of detailed information about both diseases and vaccines, both to immunisation providers and the general community (Royle & Lambert 2015). In a content analysis of 131 Australian print media news stories relating to HPV vaccination published between October 2006 and December 2009, Robbins et al. (2011) found that information provided by the media was incomplete, and educational interventions would be recommended to fill these gaps. This additional information was suggested to include information about HPV vaccination, as well as male vaccination (Robbins et al. 2011).

Methods to increase awareness of vaccines have been tested. These have been largely concerned with increasing patient awareness, rather than practitioner awareness. In a 2015 experiment implemented by the Sydney Sexual Health Centre, patients who were sent SMS in 2009 to remind them to take their 2nd and 3rd doses of the hepatitis B virus vaccine, 54% received 2 doses and 24% received 3 doses, compared to 56% and 30% respectively for subjects surveyed in 2007 who did not receive the SMS. This experiment suggested that SMS reminders did not increase the likelihood of taking 2nd or 3rd doses of the vaccine in the population (McIver et al. 2015). McIver et al. (2015) instead recommend the use of clinician prompts and multiple recall interventions. Notably, however, there were limitations to this study including the use of a before-and-after evaluation design rather than a randomised control trial, and the possibility that phone numbers had been changed in between texts being sent. Additionally, in a 2020 study of Australian infants and young children there did appear to be a statistically significant improvement in on-time vaccination amongst infants who received SMS reminders alone or in combination with a personalised calendar (Menzies et al. 2020). However, impact was limited to participants who had received one or more previous doses late and only for doses taken at the 12-month schedule point. Menzies at al. (2020) conclude that these systems are more effective in situations where there are lower levels of pre-existing compliance.

Lack of awareness is ultimately a problem that is being faced by both patients and practitioners, with lack of practitioner awareness having the potential to adversely impact the vaccination levels of people experiencing disadvantage, and as such, both groups need to be targeted in order to address this barrier.

3.4. Service System Issues

Service systems are a central part of the implementation of vaccination programs and the provision of vaccine-related healthcare. As such, flaws and limitations within service systems can lead to barriers to vaccination. The literature reflects these service system barriers in three key themes: the relationship between service systems and the provision of culturally appropriate care; the need for representative information and data; and the role of service systems in incentivising and facilitating the uptake of vaccinations.

Five studies (Seale et al. 2016; Mahimbo et al. 2017; Abdi, Murphy & Seale 2020; Karki et al. 2016, Kpozehouen et al. 2016) identified barriers to refugees and immigrants navigating service systems, including: poorer access to services due to language barriers; assumptions from providers about individuals' vaccination history; and provider-level misunderstandings. These barriers occurred in the context of, among other things, travel medicine (Seale et al. 2016), vaccine scheduling and catch up (Mahimbo et al. 2017, Kpozehouen et al. 2016), information about vaccines (Abdi, Murphy & Seale 2020) and vaccine surveillance (Karki et al. 2016).

Several studies examined the provision of vaccination to Aboriginal and Torres Strait Islander people. McHugh et al. (2020) addressed the lack of culturally appropriate antenatal care for pregnant Indigenous women, noting the importance of including Indigenous people in service system design. McBain-Rigg and Veitch (2011) identified the cultural barriers to vaccination for Aboriginal people living in Mount Isa, suggesting that interpersonal rapport between providers and patients is particularly important for improving experiences of health systems for Aboriginal patients. Cashman et al. (2016) suggested that the employment of Aboriginal Immunisation Officers could help refer Indigenous patients to cultural appropriate services and improve vaccination coverage.

An emergent theme within the literature was that cultural barriers within Australian service systems are multi-scalar. On an interpersonal level, a lack of knowledge about cultural inclusion generated problems (McBain-Rigg & Veitch 2011; Seale et al. 2016, McHugh et al. 2020), which were magnified by system-wide failures in representative information gathering and monitoring (Mahimbo et al. 2018; Kpozehouen et al. 2016).

Several papers have observed that a lack of information are barriers to vaccine coverage among disadvantaged communities (McHugh et al. 2020; Sullivan et al. 2020, Karki et al. 2016). Mahimbo et al. (2017) provide a valuable case study of the importance of information gaps in creating barriers to vaccination. The paper, which performed qualitative interviews on

providers' perspectives on catch up vaccines for refugees, pointed to issues with national coordination, a lack of knowledge about individuals' immunisation status, and a lack of referral to healthcare upon resettlement. Key issues referred to in interviews with providers included deficits in nation-wide funding for refugee catch-up and a lack of guidance or training for providers working with refugees (Mahimbo et al. 2017).

The imperative for a national register of adult vaccination was a common recommendation among papers discussing this barrier (Mahimbo et al. 2017; MacIntyre et al. 2014; Kpozehouen et al. 2016). A whole-of-life register now exists, the Australian Immunisation Register, which the aforementioned studies suggest could lead to better coordination of data, identification of disadvantaged groups, and tracking of individuals' vaccination histories.

Finally, the literature stressed not only the role of service systems at large, but also of individual providers in encouraging patients to access vaccines. Studies recommended the use of reminders and alerts (Leask 2011; Maher et al. 2014) along with interpersonal reminders from providers (Wiley et al. 2014; Leask 2011) as successful interventions to improve patient uptake of vaccines. Systems could also be developed in a way which mitigated a lack of access, for instance through opportunistic vaccination strategies, like home vaccination (Thomas et al. 2018).

Overall, in dealing with the barriers to vaccination faced by disadvantaged communities, service systems must be conscious of diversity, coordinate information to allow for effective outreach, and interact with patients effectively to promote vaccination.

4. Discussion

This study sought to perform a literature review of barriers to accessing vaccination within the Australian healthcare system. The study was performed with a view to further understanding the barriers to adult vaccination, especially in the context of the COVID-19 pandemic, which disproportionately affects adults.

In the course of reviewing the available literature, four key barriers emerged: attitudinal, logistical, awareness, and service systems barriers. Each of the four barriers intersected with issues of cultural exclusion, with individuals from culturally and linguistically diverse backgrounds being particularly likely to face barriers to vaccination. Consequently, a key insight to be gained from the study is the importance of engaging with the multiplicity of intersecting forms of social disadvantage.

Regarding attitudinal barriers to vaccination, our findings emphasised the heterogeneity of reluctant and refusal attitudes towards vaccination. Anti-vaxxer beliefs, which involve an intractable opposition to vaccination, do pose threats to public health by undermining vaccine uptake. However, anti-vaxxers are a minority of vaccine-hesitant individuals, with a recent study identifying that only 37% of Australians who are unwilling to receive the COVID-19 vaccine outright rejected the vaccine, with a majority instead expressing feelings of uncertainty (Lim & Scott 2021). Our findings also indicate that vaccine hesitancy was more common among disadvantaged individuals, for example those from culturally and linguistically diverse and less educated backgrounds (Pickles et al. 2021). This heterogeneity and intersectionality should be considered in shaping how policy solutions address the task of changing patients' attitudes and countering misinformation.

Given the primary cause of under-vaccination is a lack of access (Chow et al. 2017), logistical barriers to receiving healthcare are clearly important. Our findings identified two key logistical issues with vaccination programs in Australia, including: poor coordination of vaccination programs and the cost of receiving vaccines. We identified the case study of older Australians being excluded by poorly coordinated vaccine programs (Macintyre et al. 2014). The insight highlighted by this portion of our research is the necessity of eliminating logistical difficulties in encouraging vaccine uptake.

Awareness was found to be a clear indicator for vaccine uptake, with one study finding that 79.4% of its participants demonstrated low awareness about pertussis vaccination (Ridda, Gao & Macintyre 2014). Gaps in awareness could occur on two levels: first, when patients themselves lack knowledge about vaccination programs; second, when healthcare providers have misconceptions about the provision of vaccines to patients (Maher et al. 2014). The dominant causes of the former scenario were cultural and linguistic barriers to communication and problematic messaging about vaccination in the media (Robbins et al. 2011). The literature recommended greater training and clearer provision of information to healthcare as an approach to the latter scenario.

Our findings on service systems highlighted the importance of robust sets of data on vaccination within vulnerable populations, such as refugees. Common flaws included a lack of knowledge of vaccine catch-up programs and a lack of coordination across multiple service systems. Additionally, consciousness of cultural diversity was found to be lacking in service provision (Seale et al. 2016; Mahimbo et al. 2017; Abdi, Murphy & Seale 2020; Karki et al. 2016; Kpozehouen et al. 2016). Recommendations to overcoming the flaws within service systems focused on service providers building rapport and communication with their patients in addition to improved monitoring and management of vaccine schedules on a national level.

One of the main contributions provided by this research is a synthesis of the wide-ranging barriers to accessing vaccination facing disadvantaged communities. Many papers have focused on individual case studies and the specific barriers faced within them, or have performed literature reviews on a specific type of barrier. This paper, in addition to focusing largely on adult vaccination, notes the ways in which several types of barriers may overlap and interact. This is an important consideration in tailoring policy solutions to these complex, multi-causal problems.

Most of the major limitations of this study arose as a result of the time pressures faced by the researchers. While we initially hoped to complete a full PRISMA analysis of the available literature, we unfortunately had weeks, rather than months, to complete the study, and instead chose to adapt elements of the PRISMA process to conduct a quicker review of the available literature. We were conscious of the need to apply consistent inclusion and exclusion criteria and follow a rigorous process within our review, which could have been more thorough had the duration of the review been longer.

As a strategy to shorten the duration of the review, we have mainly included research which occurred within Australia. While this means the research included in this paper is highly relevant to an Australian context, further research could investigate similar issues in comparable nations like Canada and the UK.

A further limitation of this review is the minimal literature available on religious barriers to vaccination. Despite initially intending to investigate religious barriers, there was insufficient research on this issue to include it in this study. Further research is needed to generate conclusions about the role of religion in vaccination accessibility.

Appendix

Table 2

Database search strategy

No.	Keyword/Search term
1	Vaccin* or vaccination or ~vaccine
2	Immun* or immuni$ation
3	~equity or ~inequity
4	barrier* or ~barrier
5	"systematic review"
6	NSW or New South Wales
7	**1 or 2 and 3 and 4 and 5 and 6**
8	attitud* or belief* or hesitan* or refus*
9	logistic* or mobil*
10	aware* or know*
11	service* or administ*
12	cultur* or religio*
13	**7 and 8**
14	**7 and 9**
15	**7 and 10**
16	**7 and 11**
17	**7 and 12**
18	Austral* or "New Zealand" or Canada or UK or "United Kingdom"
19	**13 or 14 or 15 or 16 or 17**
20	**18 and 19**

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Comment from Academic Supervisor

The academic supervisor for this paper, Dr Aditi Dey, comments as follows:

> Thank you for giving me the opportunity to supervise Elinor Stephenson, Kitae Yoo and Anna-Sophia Zahar. The students were highly motivated to complete this project despite two previous students dropping out of the project after a couple of weeks into their project. They have demonstrated perseverance, diligence and a willingness to learn and adapt as the project progressed. All three students were undergraduate students and had limited previous knowledge and experience in undertaking a comprehensive literature review. They also did not have any previous knowledge or experience regarding immunisation and related issues. They took on this challenge and learnt how to undertake a comprehensive literature review in a content area unfamiliar to them. They also learnt how to effectively use a reference management tool (EndNote) for this comprehensive literature review. They worked effectively as a team to deliver the report within expected timelines. I highly commend the group on this achievement.
>
> The original research was undertaken by the students keeping to the brief provided by NCOSS. A systematic approach to literature review was undertaken by the students drawing on key aspects of PRISMA (preferred reporting items for systematic reviews and meta-analysis). However, due to time limitations only key selected studies were included in the review. With increasing number of publications since this review was conducted, there is value in conducting further research in the near future. I am happy to be available to provide NCOSS with further clarifications or advice on the paper or area of research. They may contact me initially via email (aditi.dey@health.nsw.gov.au).