Achieving COVID-19 vaccination equity in South Eastern Metropolitan Victoria, Australia: a population-based study

Evelyn Wong,[a,b,*] Brett Sutton,[b,c] Tom McLaughlin,[a] Catherine McGrath,[a] Mohana Baptista,[a,b] Andrew Stripp,[a,b] and Rhonda L. Stuart[a,b]

[a]Monash Health, Victoria, Australia
[b]Faculty of Medicine, Nursing and Health Sciences, Monash University, Victoria, Australia
[c]Department of Health, Victoria, Australia

The Lancet Regional Health - Western Pacific 2023;39: 100900
Published Online 15 September 2023
https://doi.org/10.1016/j.lanwpc.2023.100900

Summary

Background We describe COVID-19 first and second vaccine uptake across Local Government Areas (LGAs) in Victoria using southeast metropolitan Melbourne catchment as a case study. We explore key policy and implementation strategies that contributed to equitable uptake.

Methods Population level data within the South East Public Health Unit (SEPHU) was used to compare trends in COVID-19 vaccination first and second dose uptake for each of the 11 LGAs in year 2021. Changes in vaccination uptake over the year were reviewed against social and public health measures used during the COVID-19 pandemic in Victoria and strategies in the SEPHU vaccination program.

Findings By September 2021, 57% of the eligible population in the least disadvantaged LGA, Bayside, had received their second dose vaccination compared to 32% in the most disadvantaged LGA, Greater Dandenong. By end of 2021, the gap had narrowed with 95% in Bayside and 92% in Greater Dandenong having received their second dose. The increase in vaccination uptake for both LGAs was bimodal. Government policies on vaccine eligibility and the opening of mass vaccination sites preceded the first peak in vaccination uptake. Strong community engagement, addressing misinformation, providing culturally appropriate vaccination services and mass outbreaks preceded the second peak in vaccination uptake.

Interpretation Vaccine equity across culturally and economically diverse populations can be achieved through a combination of robust, targeted community engagement, mass deployment of appropriate workforce, vaccination services tailored to cultural needs and sensitivities and accessibility to mass vaccination sites on a backdrop of statewide policies that incentivise vaccination.

Funding None.

Keywords: COVID-19; Vaccination; Public health; Policy; Vaccination program; Vaccine uptake; Motivation

Introduction

The COVID-19 vaccination program targeting severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) commenced in February 2021 in Victoria, Australia. The Commonwealth and State and Territories governments in Australia had shared and separate responsibilities in the provision of COVID-19 vaccines. The Australian Government was responsible for regulation, procurement, storage and transport to specified sites within States and Territories, setting funding policy including prioritisation, administering to residential aged care residents and staff, provision of vaccines to general practitioners, data collection, monitoring and communication. States and Territories were responsible for ensuring qualified and trained workforce to deliver vaccines and providing vaccination sites that complied with safety, ethical and reporting obligations.[1] There were common challenges in the roll out of the novel COVID-19 vaccine globally relating to availability, accessibility, acceptability and reports of inequitable uptake across populations with lower uptake particularly in socioeconomically disadvantaged groups.[2–7]

Throughout 2020 and the first half of 2021, Victoria's strategy was local elimination and aggressive suppression of SARS-CoV-2 through public health measures

*Corresponding author. 246 Clayton Road, Clayton, Victoria, 3168, Australia.
E-mail address: Evelyn.Wong@monashhealth.org (E. Wong).

Research in context

Evidence before this study

Literature searched prior to undertaking this study included searching PubMed, Medline and Google Scholar for articles with search terms, 'COVID-19' and 'vaccinations' and 'geographical variations' or 'diversity'. We also searched for 'behavioural science' and 'vaccinations' or 'mandates'. For policy changes, we searched online for 'COVID-19' and 'policies' or 'mandates' and 'Victorian Chief Health Officer Directions'. We were able to find studies that reported on geographical variations or ethnic diversity related to differences in uptake of COVID-19 vaccination. Separately we were also able to find literature that investigated motivational factors for vaccination uptake. We were unable to find prior studies that investigated the contributions of policy or vaccination program implementation on uptake of vaccination.

Added value of this study

We demonstrated for the first time the narrowing of the COVID-19 vaccine equity gap across geographical areas in southeast Melbourne with contrasting socioeconomic and cultural profiles and reported on policy and vaccination program strategies that likely impacted on the rate of change in vaccine uptake resulting in this narrowing of an equity gap. This is particularly relevant as elsewhere, globally, vaccination inequity had previously been reported with significantly lower uptake in relatively more disadvantaged populations. Our study further reported on the two phases of acceleration in vaccine uptake, the first in the first six months of 2021 when COVID-19 vaccines first became available, and Victoria was experiencing low numbers of COVID-19 cases. The second phase of acceleration in vaccine uptake was likely driven by multiple factors which enabled accessibility, availability, acceptability and motivational factors such as mass outbreaks from the Delta variant. This study highlights the importance of considering behavioural science frameworks such as the Capability-Opportunity-Motivation-Behaviour (COM-B) model when tailoring vaccination services that achieve vaccination equity across geographical areas, the importance of strong community engagement as well as co-designing to address barriers to vaccination uptake.

Implications of all the available evidence

Our study demonstrates the importance of strong community engagement to address barriers to vaccination uptake particularly in communities with relatively high disadvantage and cultural diversity. It further demonstrates the importance of co-designing vaccination programs with community leaders to ensure the acceptability and accessibility of vaccination. These principles and practices of deep engagement and co-designing can be applied to tackle health inequities in other areas of healthcare provision. Future analyses using a behavioural science framework to understand the impact of capability, opportunity and motivational factors may strengthen mass vaccination programs with equitable outcomes.

including travel restrictions, mandatory hotel quarantine for international arrivals required by the Australian Government, case and close contact isolation or quarantine and social measures such as state-wide stay-at-home policies to restrict non-essential movements.[8,9] This strategy bought Victoria time to increase immunity to SARS-CoV-2 through mass vaccination programs. In the latter half of 2021, Victoria introduced vaccination requirements initially targeting industry groups with the greatest risk of exposure or transmission to priority populations such as healthcare workers and residential aged care workers. The mandate was expanded later more broadly to other workers and finally to patrons attending entertainment and hospitality venues.[10] Similar policies were implemented nationally and globally.[11–13] While vaccine mandates have been found to be associated with a surge in vaccination uptake,[12] behavioural science models provide a framework to increase acceptance sustainably, taking into account context-specific barriers to vaccination uptake.[14]

Recognising the need for place-based public health management of SARS-CoV-2 to enable partnerships with grassroot organisations tailoring services to priority populations, the Victorian Government set up Local Public Health Units (LPHUs) in Victoria at the end of 2020. These comprised three metropolitan and six regional LPHUs, of which the South East Public Health Unit (SEPHU) (led by Monash Health) covers 11 Local Government Areas (LGAs) in southeast metropolitan Melbourne. With a population of 1.8 million, it is one of the largest LPHUs. There is significant socioeconomic and cultural diversity within the SEPHU catchment: Greater Dandenong LGA is the most disadvantaged LGA by Socio-Economic Indexes for Areas (SEIFA) in metropolitan Melbourne with over 60% of its population born outside of Australia; and Bayside LGA is the least disadvantaged by SEIFA in metropolitan Melbourne with over 70% of the population being Australian-born. Despite these marked differences in cultural and socioeconomic profiles, Victoria achieved substantial geographical equity across the state for COVID-19 first doses with all regional LGAs achieving over 95% coverage.[15]

We describe the COVID-19 first and second dose vaccination uptake and compare these rates across geographical areas in Victoria, Australia, known to have contrasting demographic and socioeconomic profiles. We also explore the impact of public health policies and vaccination implementation strategies on vaccination uptake.

Methods

Using an ecological study design, we used population level COVID-19 vaccination data to describe the trends and rates of change in uptake of the first and second COVID-19 vaccines in SEPHU catchment against Victorian public health and social measures deployed to curb the spread of SARS-CoV-2 and strategies in the SEPHU COVID-19 vaccination program implementation. Demographic profile for the population in Victoria and SEPHU catchment were obtained from the Australian Bureau of Statistics (ABS) 2016 Census of Population and Housing.[16]

COVID-19 vaccination data

Aggregated vaccination data was provided by the Australian Government, derived from the Australian Immunisation Register (AIR). Under the Australian Immunisation Register Act 2015, all vaccination providers must report all COVID-19 vaccinations to AIR.[17,18] The register contains personal data including name, address, date of birth, gender and vaccine information including brand name, dose number, batch number and date vaccine was given. Aggregated data is then provided to Local Public Health Units via a Common Data Layer with the capability to filter data by sex, 5-year age groups and geographical areas such by LGAs. From the data source, we extracted the estimated proportion of those aged over 16 years old who received their first and second COVID-19 vaccination in the year 2021 per week by LGA within the SEPHU catchment. The denominator was the estimated LGA 15 years and over population taken from the ABS 2016 Census Estimated Resident Population 2019.[19] The Australian Government acknowledged that given the ABS population estimates are only in five-year age groupings, a reference population of 15 years and above will be result in slight underestimates of the percentage of 16+ year olds who have been vaccinated. Vaccination data was not provided as a proportion of those eligible at any given time. The weekly change in proportion who had received their first and second dose vaccination was calculated and uptake of vaccination and the rate of changes graphed to study the trends in year 2021.

Victorian state public health measures and policies

An online search for publicly available Victorian Department of Health policies and public health orders identified key approaches, strategies and announcements in relation to social and public health measures implemented during the COVID-19 pandemic. In 2021, the majority of public health measures were implemented through Chief Health Officer Directions and from December 2021, through Pandemic Orders, enabled by Victoria's Public Health and Wellbeing Act 2008.[20] The public health measures included case and contact management, stay-at-home orders and vaccination mandates. A timeline for these key measures and trends of COVID-19 vaccination uptake was created, noting mass outbreaks and increase in case numbers that led to changes in the Victorian Government's strategy in managing the COVID-19 pandemic.

South East Public Health Unit (SEPHU) vaccination program

SEPHU commenced planning for the first COVID-19 vaccination in mid-December 2020, forming a SEPHU collaborative of 38 organisations to incorporate representations across geographical areas, priority populations and multi-disciplinary expertise. We reviewed meeting minutes, status reports and spoke to key personnel in the leadership team to extract milestone events in the vaccination program implementation. This enabled us to develop a timeline of key implementation pivots such as the opening of mass vaccination clinics, the roll-out of regular community engagement sessions particularly with leaders in priority populations and the enablers to increase access and availability of vaccines.

Role of the funding source

No funding was received for this study.

Results

Population demographic profile

The SEPHU catchment, containing 11 LGAs in south east metropolitan Melbourne, spans a large geographical area with significant variation across socioeconomic metrices. Greater Dandenong LGA is the most disadvantaged LGA and Bayside LGA the least disadvantaged LGA in Melbourne, measured by SEIFA.[21] Greater Dandenong LGA had an estimated population size in 2020 of just over 165,000 and Bayside LGA, approximately 105,000. 24% of Bayside LGA were age over 65 years old compared to 14% in Greater Dandenong LGA and 15% in all of Victoria. The population in Greater Dandenong were the most culturally and linguistically diverse in the SEPHU catchment, with 62% born overseas and 68% speaking a language other than English at home. This is in contrast to Bayside LGA where 27% of the population were born overseas and only 15% spoke a language other than English at home. As a reference point, 30% of the population in Victoria were born overseas and 28% spoke a language other than English at home.

First and second COVID-19 vaccination uptake trend in 2021

By July 2021, in Bayside LGA, 51% of 16 years and above population had received their first vaccination dose compared to 27% in Greater Dandenong LGA. The Victorian average for first dose uptake in the same age group at that time was 37%. By September 2021, 57% of Bayside LGA's population aged 16 years and above had received their second dose vaccination compared to 32%

in Greater Dandenong. The average second dose uptake in Victoria for the same age group at that time was 43%. Despite this lag, by end of December 2021, the vaccination equity gap had narrowed with 96% in Bayside and 94% in Greater Dandenong having received their first dose and 95% in Bayside and 92% in Greater Dandenong having received their second dose (Fig. 1). By the end of 2021, across Victoria, on average 95% of the population aged 16 years and above had received their first dose and 94% their second dose.

Weekly change in COVID-19 vaccination uptake in relation to public health measures and vaccination program strategies

The distribution of rate changes in vaccination uptake of the first and second COVID-19 vaccination was bimodal, with the first peak occurring between the end of May and early June 2021 and the second peak in early to mid-September 2021 for the first dose uptake (Fig. 2). The first peak was higher than the second peak for Bayside LGA (6.8% cf. 5.2%) whereas in Greater Dandenong LGA, the first peak was the lower of the two (4.1% cf. 8.1%). The two peaks in second dose uptake for Bayside LGA occurred in mid-August and mid-October 2021 at 5.8% for both. In Greater Dandenong, there was an increase of 2% in uptake in late June 2021 compared to an increase of 10.5% in mid-October 2021.

Victorian health policies preceding the first peak of both first and second dose uptake were the initial prioritisation in late February of vaccinations to be available to aged care residents, and front-line healthcare and aged care workers. This eligibility was extended to all those aged 40 years and above by mid-May (Fig. 2). All COVID-19 vaccinations were provided free of charge with eligibility criteria set by the Commonwealth government.[22] COVID-19 case numbers were low in the first half of 2021 with significant periods of no local transmission and with few social restrictions. The SEPHU vaccination program's focus leading to the first peak of vaccination uptake increase was on mass vaccination centres with the first opening at the beginning of May. These mass vaccination centres concentrated on where the population were more socioeconomically disadvantaged. Furthermore, in May, SEPHU commenced weekly drop-in information sessions that were attended by a SEPHU nurse vaccinator and the vaccination team. These drop-in sessions involved community champions and bicultural workers and focussed on vaccination questions. Community champions were individuals with credibility and local knowledge from community groups such as culturally and linguistically diverse communities, faith groups, sporting organisations, social clubs, council leaders and business leaders who worked in partnership with SEPHU to support messaging on COVID-19 testing and vaccination within their networks and provided valuable feedback to inform engagement strategies and activities.

Prior to the second July peak in vaccination uptake, Victoria experienced COVID-19 outbreaks, initially

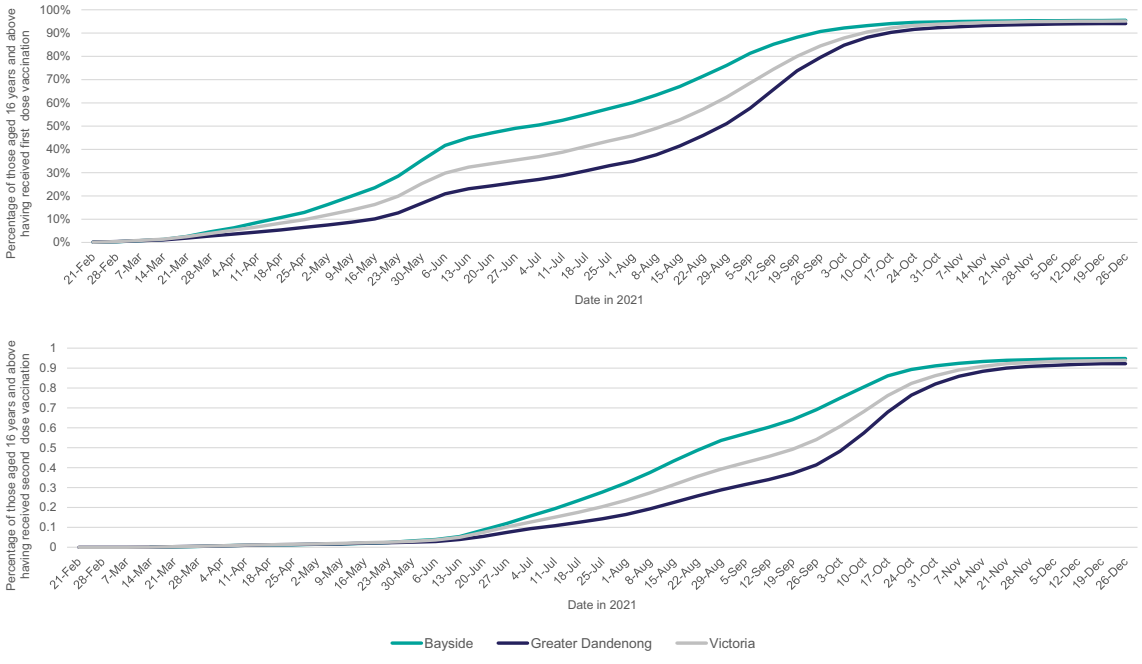

Fig. 1: Trend in first and second COVID-19 vaccination dose uptake for those aged 16 years and above in Bayside Local Government Area, Greater Dandenong Local Government Area and Victoria in year 2021.

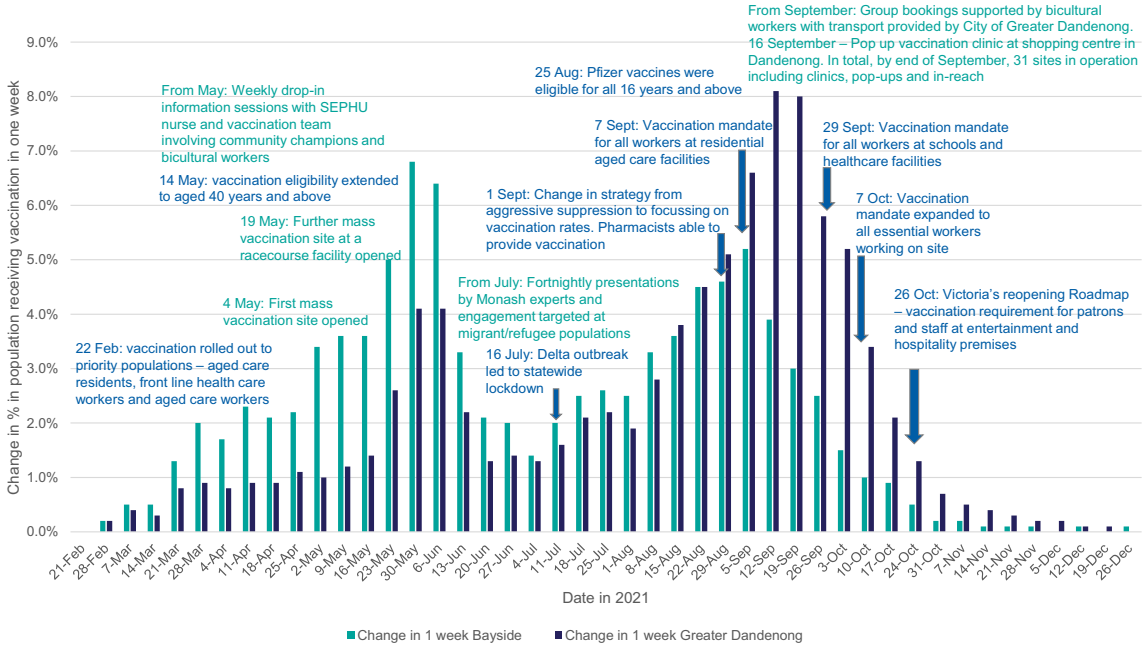

Fig. 2: Weekly change in first dose vaccination uptake in Bayside Local Government Area and Greater Dandenong Local Government Area with milestone events in vaccination implementation program and Victorian health policies in year 2021.

brought on by the Delta variant. The outbreaks stemmed initially from cases in New South Wales where there was a breach in quarantine of international arrivals. Of note, on 24 July 2021, the Australian Technical Advisory Group on Immunisation (ATAGI) issued a statement that 'individuals aged 18 years and above in greater Sydney should consider getting vaccinated with any available vaccine including COVID-19 Vaccine AstraZeneca'. In their statement, ATAGI reaffirmed that 'in a large outbreak, the benefits of the COVID-19 Vaccine AstraZeneca are greater than the risk of rare side effects for all age groups', referencing warnings of the possibility of thrombosis with thrombocytopenia syndrome. The outbreaks in July led to state-wide stay-at-home public health orders in Victoria and only essential workers who could not work from home were permitted to leave home to attend work.[23] The Delta outbreak occurred around the same time vaccination uptake began to increase leading to the second peak for both Bayside and Greater Dandenong LGAs (Fig. 2). By September, as case numbers continued to increase substantially, Victoria's strategy pivoted from aggressive suppression to incentivising vaccination by tying easing of stay-at-home restrictions to vaccination rates.[24] A fortnight preceding the peak increase in vaccination rates in Greater Dandenong LGA, public health orders were implemented requiring all workers at residential aged care facilities to receive their first dose of COVID-19 vaccination by mid-September.[24] Further vaccination mandates were implemented after the second peak in increase in vaccination uptake that initially included healthcare workers, workers at schools, and any worker authorised to work on site during stay-at-home orders. Finally, as part of *Victoria's Roadmap* to ease restrictions, all workers and patrons at entertainment and hospitality venues were also required to be vaccinated as a condition of work or entry to those premises.[25] Victoria's Roadmap aligned with the Australia's national plan for a progressive reopening with increased capacity limits across various settings in relation to vaccination coverage of the community at that time. The reopening plan were based on public health advice at the relevant time including epidemiological evidence and legal advice on compatibility with Victoria's Charter for Human Rights and Responsibilities.

Prior to the acceleration in vaccination uptake in Greater Dandenong LGA, SEPHU placed emphasis on community engagement, co-designing vaccination programs with community leaders and enabling accessibility and availability. From July, Monash Health experts in infectious diseases, epidemiology, vaccination and obstetrics ran fortnightly sessions targeting community members from migrant or refugee and asylum seeker backgrounds. These sessions were tailored to individual groups by ethnicity, sex and age groups to ensure culturally appropriate messaging and exchange of information. Engagement sessions included presentations from experts as well as responses to requests from multicultural groups for targeted and in-language sessions supported by interpreters, enabling in depth

bi-directional communication. SEPHU continued to expand their vaccination clinics to include pop-up clinics in areas with extensive outbreaks and/or low vaccination rates such as at schools and shopping centres where there was high visibility. These clinics accepted walk-ins without appointments, had bicultural workers, private cubicles and extended opening hours, all aimed at providing culturally safe environments and enabling accessibility. In early September, bicultural workers supported group bookings and assisted with transport provided by Greater Dandenong Council. By the end of September, there were 31 vaccination sites including single or multi-day pop-up clinics in operation each week in the SEPHU catchment. This period of enhanced vaccination service for priority populations coincided with the second peak in vaccination uptake in Greater Dandenong LGA (Fig. 2). General practitioners who expressed interest in administering COVID-19 vaccines were able to do so from March 2021. Over the rest of 2021, more general practitioners became eligible to administer the vaccines. From September 2021, pharmacists were also able to provide COVID-19 vaccinations, thereby increasing accessibility and availability.

Discussion

We describe the narrowing of the COVID-19 vaccine equity gap across geographical areas in southeast Melbourne with contrasting socioeconomic and cultural profiles. We also report on policy and strategies that likely impacted on the rate of change in vaccine uptake. In the first six months following the roll-out of the COVID-19 vaccine in Australia, there was a difference of approximately 25-percentage points in vaccine coverage between geographical areas, with lower coverage in areas of most disadvantage compared to areas of least disadvantaged. This level of vaccine inequity is consistent with international experience. Perry et al. reported a 20.2 percentage points difference between ethnic groups in Wales in April 2021,[7] while Agaku et al. reported a 19.3 percentage point difference in those who had received two COVID-19 vaccination doses between metropolitan statistical areas in the United States of America.[2] Similar variations in COVID-19 vaccination coverage between geographical areas and ethnic groups were also reported in parts of Europe and Canada.[3,26]

Our study further reported on the two phases of acceleration in vaccine uptake, the first in the first six months of 2021 when COVID-19 vaccines first became available, and Victoria was experiencing low numbers of COVID-19 cases. The second phase of acceleration in vaccine uptake was likely driven by multiple factors which enabled accessibility, availability, acceptability and motivational factors such as mass outbreaks from the Delta variant and vaccination mandates.

The strategies and the implementation approach by SEPHU involving strong community engagement and tailoring services to priority populations are consistent with strategies proposed in behavioural science frameworks such as the Capability-Opportunity-Motivation-Behaviour (COM-B) model.[14,27,28] Viewed from the perspective of the COM-B model, the COVID-19 vaccination program implemented by SEPHU addressed the barriers commonly experienced by priority populations, particularly where there is wide cultural diversity with mistrust of authority and misinformation, economic disadvantage as a barrier to access and lower educational attainment with associated lower health literacy.[5,29] SEPHU's drop-in sessions with bicultural workers and community champions as well as presentations by experts targeted at specific gender, age and cultural groups provided increase in capability and motivation. Mass vaccination sites without booking requirements, pop-up clinics, group booking with supported transport provision all provided greater opportunities to get vaccinated. The COVID-19 Delta variant outbreaks and subsequent stay-at-home restrictions and vaccination mandates likely provided additional incentives to be vaccinated. While it is not possible to measure the direct impact of mass outbreaks on an individual's decision to be vaccinated, Sauch Valmaña et al. have reported common reasons for vaccination as fear of infection of family and fear of self-infection at a time when the Delta variant was expanding in Spain.[30] As most of the vaccination mandates in Victoria were introduced after the second peak in vaccination uptake, this suggests that vaccination mandates were a lesser factor in driving vaccination uptake. Central to SEPHU's vaccination program was working with community leaders to address misinformation, providing appropriately tailored information on vaccine safety and providing culturally appropriate vaccination sites. The Australian and Victorian governments supported these strategies through free vaccinations and expanding the availability of vaccine providers to include pharmacists, Aboriginal and Torres Strait Islander health worker and medical practitioners.

This study's strength was the completeness of the vaccination data due to the regulatory requirement that all vaccine providers must enter the details of everyone receiving a COVID-19 vaccine onto the national electronic register. This included demographic details, details on vaccination dose and date of receipt. Our study was further strengthened by the availability of public health orders online that reflected the Victorian Department of Health policies to manage the COVID-19 pandemic. We had access to all records of SEPHU's vaccination program as majority of the authors were part of the leadership team that informed the strategy and led the community engagement. Our study was however limited by our reliance on

estimated resident population size from the 2016 ABS Census. This did not account, therefore, for changes to population size due to migration, birth or death or the decrease in international student cohorts during 2020–2022 when international travel was restricted. Reductions in true population size in 2021 relative to the estimates from 2016 may have led to an underestimation of vaccine coverage. However, it is unlikely that such underestimation of vaccine coverage would negate the narrow vaccine equity gap we have described. As the vaccination coverage data was not available as a proportion of those eligible at a point in time and as older age groups were prioritised for vaccination, it is likely that the initial gap between Bayside and Greater Dandenong was driven by the earlier eligibility in Bayside with an older population on average than Greater Dandenong. The ecological study design limited our ability to conclude on the causality and the size of impact from individual policies or strategies on vaccine uptake.

Conclusion

This study demonstrates the importance of strong community engagement to address barriers to vaccination uptake particularly in communities with relatively high disadvantage and cultural diversity. It further demonstrates the importance of co-designing vaccination programs with community leaders to ensure the acceptability and accessibility of vaccination. These principles and practices of deep engagement and co-designing can be applied to tackle health inequities in other areas of healthcare provision. Future analyses using a behavioural science framework to understand the impact of capability, opportunity and motivational factors may strengthen mass vaccination programs with equitable outcomes.

Contributors

EW—lead author, formulated research question, methodology, undertook data analysis, interpreted data and authored first draft of manuscript and revised drafts following co-author contributions.

BS—contributed to research question, method, data interpretation, framing of paper particularly with respect to discussion. Contributed to writing of manuscript.

TM—contributed to data collection with regards to vaccination program timeline and writing of manuscript.

CM—contributed to data collection with regards to vaccination program timeline and writing of manuscript.

MB—provided access to population health data, contributed to data collection, reviewed and commented on manuscript.

AS—executive sponsor of vaccination program, reviewed and commented on manuscript.

RS—contributed to data collection with regards to information on vaccination program, reviewed and commented on manuscript.

Data sharing statement

Demographic data for the population in Victoria and SEPHU catchment were obtained from the Australian Bureau of Statistics (ABS) 2016 Census of Population and Housing, accessed on November 11, 2022 https://www.abs.gov.au/.

Aggregated daily COVID-19 vaccination data was provided by the Australian Government, derived from the Australian Immunisation Register (AIR), and accessed on November 11, 2022. Monthly COVID-19 vaccination data by LGA is available from: https://www.health.gov.au/resources/collections/covid-19-vaccination-geographic-vaccination-rates-lga.

Declaration of interests

TM is a Board Director of Enliven Victoria, a charity organisation which provides engagement services for the South East of Melbourne.

No other authors have conflicts of interest to declare.

Acknowledgements

None.

References

1 Australian Government. *Australian COVID-19 vaccination policy*. 2020.
2 Agaku IT, Adeoye C, Long TG. Geographic, occupational, and sociodemographic variations in uptake of COVID-19 booster doses among fully vaccinated US adults, December 1, 2021, to January 10, 2022. *JAMA Netw Open*. 2022;5(8):e2227680.
3 Faes C, Molenberghs G, Hens N, et al. Geographical variation of COVID-19 vaccination coverage, ethnic diversity and population composition in flanders. *Vaccine X*. 2022;11:100194.
4 Guay M, Maquiling A, Chen R, et al. Measuring inequalities in COVID-19 vaccination uptake and intent: results from the canadian community health survey 2021. *BMC Public Health*. 2022;22(1):1708.
5 Kuehn M, LaMori J, DeMartino JK, et al. Assessing barriers to access and equity for COVID-19 vaccination in the US. *BMC Public Health*. 2022;22(1):2263.
6 Mody A, Bradley C, Redkar S, et al. Quantifying inequities in COVID-19 vaccine distribution over time by social vulnerability, race and ethnicity, and location: a population-level analysis in St. Louis and Kansas City, Missouri. *PLoS Med*. 2022;19(8):e1004048.
7 Perry M, Akbari A, Cottrell S, et al. Inequalities in coverage of COVID-19 vaccination: a population register based cross-sectional study in Wales, UK. *Vaccine*. 2021;39(42):6256–6261.
8 Victorian Department of Health COVID-19 writing group. Population-based analysis of the epidemiological features of COVID-19 epidemics in Victoria, Australia, January 2020 - March 2021, and their suppression through comprehensive control strategies. *Lancet Reg Health West Pac*. 2021;17:100297.
9 Victorian Department of Health. *Victorian COVID-19 public health Directions*; 2021. http://www.austlii.edu.au/au/legis/vic/covid-19_dir. Accessed April 10, 2023.
10 Independent Pandemic Management Advisory Committee. *Review of COVID-19 mandatory vaccination orders in Victoria*. 2022.
11 Attwell K, Rizzi M, McKenzie L, et al. COVID-19 vaccine Mandates: an Australian attitudinal study. *Vaccine*. 2022;40(51):7360–7369.
12 Karaivanov A, Kim D, Lu SE, Shigeoka H. COVID-19 vaccination mandates and vaccine uptake. *Nat Human Behav*. 2022;6(12):1615–1624.
13 Mello MM, Opel DJ, Benjamin RM, et al. Effectiveness of vaccination mandates in improving uptake of COVID-19 vaccines in the USA. *Lancet*. 2022;400(10351):535–538.
14 Vallis M, Bacon S, Corace K, et al. Ending the pandemic: how behavioural science can help optimize global COVID-19 vaccine uptake. *Vaccines (Basel)*. 2021;10(1):7.
15 Australian Government. *Local government area (LGA) geographic vaccine rates*. 2021.
16 Australian Bureau of Statistics. *Census DataPacks*; 2021. https://www.abs.gov.au/census/find-census-data/datapacks. Accessed April 27, 2023.
17 Australian Government. *Australian immunisation register act 2015*. Australia. 2021.
18 Department of Health and Aged Care. *Using the Australian immunisation register*; 2023. https://www.health.gov.au/topics/immunisation/immunisation-information-for-health-professionals/using-the-australian-immunisation-register. Accessed April 26, 2023.
19 Australian Government. *COVID-19 vaccination – local government area (LGA) – 28 August 2021*. 2021.

20 The Victorian Government. *Public health and wellbeing act 2008. 46.* 2023.
21 Australian Bureau of Statistics. *Census of population and housing: socio-economic indexes for areas (SEIFA), Australia, 2016*; 2018. https://www.abs.gov.au/ausstats/abs@.nsf/Lookup/by%20Subject/2033.0.55.001~2016~Main%20Features~SEIFA%20Basics~5. Accessed April 27, 2023.
22 Australian Government. *COVID-19 vaccination - Australia's COVID-19 vaccine national roll-out strategy*. Australian Government; 2021.
23 Premier of Victoria. *Statement from the premier*. The Victorian Government; 2021.
24 Premier of Victoria. *Slowing the spread and keeping our state safe*. The Victorian Government; 2021.
25 The Victorian Government. *Victoria's Roadmap - delivering the nationa plan*. 2021.
26 Government of Canada. *COVID-19 vaccination in Canada*; 2021. https://health-infobase.canada.ca/covid-19/vaccination-coverage/archive/2021-12-24/index.html#a5. Accessed April 28, 2023.
27 Michie S. Encouraging vaccine uptake: lessons from behavioural science. *Nat Rev Immunol*. 2022;22(9):527–528.
28 Michie S, van Stralen MM, West R. The behaviour change wheel: a new method for characterising and designing behaviour change interventions. *Implement Sci*. 2011;6(1):42.
29 Dada D, Djiometio JN, McFadden SM, et al. Strategies that promote equity in COVID-19 vaccine uptake for black communities: a review. *J Urban Health*. 2022;99(1):15–27.
30 Sauch Valmaña G, Fuster-Casanovas A, Ramírez-Morros A, et al. Motivation for vaccination against COVID-19 in persons aged between 18 and 60 years at a population-based vaccination site in manresa (Spain). *Vaccines (Basel)*. 2022;10(4):597.