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I know what you did last summer: a cross-sectional study of personal COVID-19 risk reduction strategies used by Victorian adults, December 2021–January 2022

Wai Chung Tse,[1,†,*] Aimée Altermatt,[1,†] Freya Saich,[1] Anna L. Wilkinson,[1,2] Katherine Heath,[1] Kathryn Young,[1] Alisa Pedrana,[1,2] Sophie Hill,[3] Lisa Gibbs,[4] Mark Stoové,[1,2] Katherine B. Gibney,[5] Margaret Hellard[1,2]

[1]Disease Elimination Program, Burnet Institute, Melbourne, VIC, 3004, Australia
[2]School of Public Health and Preventive Medicine, Monash University, Melbourne, VIC, 3004, Australia
[3]Centre for Health Communication and Participation, La Trobe University, Victoria, 3086, Australia
[4]Melbourne School of Population and Global Health, University of Melbourne, Melbourne, VIC, 3000, Australia
[5]Department of Infectious Diseases, University of Melbourne, At the Peter Doherty Institute for Infection and Immunity, VIC, 3000, Australia

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Abstract

Objective: We describe COVID-19 risk reduction strategies adopted by Victorian adults during December 2021–January 2022, a period of high COVID-19 infection and limited government mandated public health measures.

Methods: In February 2022, participants of a Victorian-based cohort study (Optimise) completed a cross-sectional survey on risk reduction behaviours during December 2021–January 2022. Regression modelling estimated the association between risk reduction and demographics.

Results: A total of 556 participants were included (median age 47 years; 75% women; 82% in metropolitan Melbourne). Two-thirds (61%) adopted at least one risk reduction behaviour, with uptake highest among younger participants (18–34 years; adjusted relative risk (aRR): 1.20, 95% confidence interval [CI]: 1.01, 1.41) and those with a chronic health condition (aRR: 1.17, 95% CI: 1.02, 1.35).

Conclusions: Participants adopted their own COVID-19 risk reduction strategies in a setting of limited government restrictions, with young people more likely to adopt a risk reduction strategy that did not limit social mobility.

Implication for public health: A public health response to COVID-19 that focusses on promoting personal risk reduction behaviours, as opposed to mandated restrictions, could be enhanced by disseminating information on and increasing availability of effective risk reduction strategies tailored to segments of the population.

Key words: public health, COVID-19, harm reduction

Prior to the widespread uptake of vaccines in June 2021,[1] Australia's response to COVID-19 was characterised by mandated public health measures including stay-at-home orders, test, trace, isolate and quarantine (TTIQ) strategies, mask wearing and social distancing. Near the end of 2021, following the widespread roll-out of vaccines, most state/territory governments reduced mandated public health measures and shifted towards a response characterised as "living with COVID." However, a new Omicron variant emerged in December 2021 that proved to be more transmissible and better at evading previous exposure- and vaccination-acquired immunity to SARS-CoV-2.[2,3] This resulted in a wave of infection across much of Australia.

Victoria—Australia's second most populous state—experienced its highest weekly number of reported positive COVID-19 tests to date in January 2022, with over 660,000 positive COVID-19 tests recorded[4]; January 2022 saw three times more positive tests than the previous 12-month period. Despite this, the Victorian Government did not impose any additional public health measures, opting instead to retain mandated third dose vaccine boosters in some sectors, and recommending people work from home.[5]

To inform responses to potential future COVID-19 infection waves, understanding how individuals adapted their social behaviour in the

[†]Joint first author.
*Correspondence to:
e-mail: WaiChung.Tse@burnet.edu.au.

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context of limited public health mandates and a new wave of COVID-19 infections is crucial. Previous evidence suggests that increased levels of infection in the community were associated with increased risk perception and subsequent adoption of personal risk reduction techniques.[6–8] Further, understanding differences in behaviour between groups could help to tailor public health messaging aimed at increasing the adoption of risk reduction and consequently reducing transmission. We describe risk reduction strategies adopted by Victorian adults during the Omicron BA.1 epidemic wave, with a focus on how these strategies differed between age groups.

Methods

The Optimise Study (Optimise) was a longitudinal cohort and social networks study (September 2020–August 2022) that aimed to assess the impact of COVID-19 and associated public health restrictions on segments of the community; a detailed description is available elsewhere.[9,10] To achieve this aim, we targeted sampling to participants considered at increased risk of (1) contracting COVID-19; (2) developing severe COVID-19; or (3) experiencing unintended consequences of COVID-19 restrictions were intentionally oversampled, and participants were recruited through flyers, social media, industry and community-based groups. Between 11 and 19 February 2022, these key participants were invited to complete a cross-sectional survey on risk reduction strategies utilised between December 2021 and January 2022 (survey in Supplementary Table 1).

The outcome for this study was adoption of risk reduction, that is, participants' uptake of strategies that could reduce the risk of COVID-19 acquisition or transmission. Participants were classified as adopting risk reduction strategies if they responded "yes" to doing at least one of the following in the lead-up to a significant cultural event (question 9, Supplementary Table 1) such as Christmas, New Year or Chinese New Year: ensuring a negative COVID-19 test result, strictly isolating for several days before the event, reducing social activity for several days before the event, avoiding large gatherings prior to attending the event, or changing event plans to reduce the risk of COVID-19 transmission. Age was determined by month and year of birth (provided at baseline) and categorised into three groups, representing potential target populations for health promotion interventions: 18–34 years, 35–54 years and 55 years or older.

Statistical analysis

Participants were excluded if age was missing, chronic health condition at baseline was "don't know" or "prefer not to say," or gender was "nonbinary," "other" or "prefer not to say" (due to insufficient data in strata to preserve participants' anonymity and support regression modelling). A generalised linear model (modified Poisson regression with robust standard errors[11]) estimated the association between risk reduction and demographics (age, gender, country of birth) and covariates specific to participation in Optimise (time in study and recruitment method to address the potential bias of a cohort effect caused by long-term participation in a COVID-19 study and volunteer bias), reported as an adjusted relative risk (aRR) with 95% confidence intervals (CI). Additional descriptive analyses were undertaken to explore the frequency of other nonevent specific risk reduction strategies (e.g. avoiding some situations/settings and taking a rapid antigen test [RAT] before gatherings) and differences between age groups assessed with χ^2 test. Data analysis was performed using R software, version 3.6.3 (https://cran.r-project.org/).

Results

A total of 697 people were invited to the survey, representing the entire active Optimise study cohort at that time, of whom 577 (83%) responded and 556 met the criteria for inclusion in the study. Participants' median age was 47 years (interquartile range (IQR) 32, 62), most (75%) were women and most (82%) lived in metropolitan Melbourne (Table 1).

Of the 556 participants, 61% reported adopting at least one and 40% at least two risk reduction strategies in the lead up to a significant cultural event during summer 2021–2022. Distribution of total number of risk reduction strategies used by participants can be found in Supplementary Figure 2. Participants aged 18–34 years were more likely to adopt risk reduction strategies compared to those aged 55 years or older (aRR 1.2; 95% CI: 1.0, 1.4). Those with a chronic health condition were 1.17 (95% CI: 1.02, 1.35) times more likely to adopt risk reduction strategies compared to participants without a chronic health condition. Participants in regional Victoria were less likely (aRR 0.78; 95% CI: 0.62, 0.97) to adopt risk reduction strategies compared to people living in metropolitan Melbourne (Table 1). Further descriptive analysis suggests that the frequency of avoiding indoor gatherings, avoiding crowded places, asking others to take a RAT before a social gathering and undertaking COVID-19 testing differed by age group (Supplementary Table 2). Younger participants (aged 18–34) were less likely to avoid indoor gatherings and crowded spaces but engaged in more testing compared to older participants (aged 55+).

Discussion

We surveyed Victorians about their behaviour during the wave of COVID-19 experienced in Australia in December 2021–January 2022 and found that most participants adopted risk reduction strategies to reduce their COVID-19 acquisition and transmission risk prior to significant social and cultural events. Importantly, participants adopted risk reduction when government public health restrictions were limited, indicating a likely association between social behaviour and perceived risk (indicated through publicly available information such as daily number of people testing positive). As governments transition from public health mandates to individual responsibility to prevent COVID-19, these findings provide evidence for the willingness of community members to protect themselves and others from COVID-19. Further, there were differences in the adoption of risk reduction between groups, suggesting that segmenting public health messaging may increase the effectiveness of strategies that should be promoted.

Younger Victorians were more likely to adopt strategies to mitigate the risk of attending gatherings and crowded places than older Victorians. These strategies included asking others to take a RAT before gatherings, taking RATs themselves, reducing their social activity before a significant cultural event or changing event plans to reduce the risk of COVID-19 acquisition or transmission. This contrasts with older people who more frequently chose to avoid gathering and high-risk settings altogether, while also reporting lower rates of testing than younger people. During future COVID-19 waves, government messaging should focus on providing younger

Table 1: Generalised linear model (Poisson distribution) for any risk-reduction behaviour before events, N=556, Optimise participants, Victoria, Australia, February 2022.

Variable	Total N=556 n (%)	Any risk reduction n=339 (61%)	No risk reduction n=217 (39%)	Unadjusted relative risk N=556	Unadjusted p-value	Adjusted relative risk N=556	Adjusted p-value
Age (years)							
18–34	167 (30)	116 (69)	51 (31)	1.19 (1.02, 1.39)	0.0263	1.20 (1.01, 1.41)	**0.0348**
35–54	190 (34)	107 (56)	83 (44)	0.97 (0.81, 1.15)	0.6939	0.97 (0.81, 1.15)	0.7109
55+	199 (36)	116 (58)	83 (42)	ref	-	ref	-
Gender							
Women	419 (75)	265 (63)	154 (37)	1.17 (0.99, 1.39)	0.0703	1.16 (0.97, 1.38)	0.1006
Men	137 (25)	74 (54)	63 (46)	ref	-	ref	-
Region in Victoria							
Regional Victoria	101 (18)	49 (49)	52 (51)	0.76 (0.62, 0.94)	0.0117	0.78 (0.62, 0.97)	**0.0233**
Metropolitan Melbourne	450 (82)	287 (64)	163 (36)	ref	-	ref	-
Country of birth							
Overseas	188 (34)	113 (60)	75 (40)	0.98 (0.85, 1.13)	0.7663	0.99 (0.85, 1.14)	0.8531
Australia	368 (66)	226 (61)	142 (39)	ref	-	ref	-
Healthcare worker							
Yes	128 (23)	79 (62)	49 (38)	1.02 (0.87, 1.19)	0.8423	1.00 (0.85, 1.17)	0.9843
No	428 (77)	260 (61)	168 (39)	ref	-	ref	-
Chronic health condition							
Yes	210 (38)	136 (65)	74 (35)	1.10 (0.97, 1.26)	0.1465	1.15 (1.00, 1.33)	**0.0482**
No	346 (62)	203 (59)	143 (41)	ref	-	ref	-
Recruitment method							
Seed	305 (55)	186 (61)	119 (39)	1.00 (0.88, 1.14)	0.9947	0.98 (0.85, 1.12)	0.7437
Other	251 (45)	153 (61)	98 (39)	ref		ref	
Months in Optimise study (median, (IQR))	11 (6, 14)	10 (6, 14)	11 (6, 14)	1.00 (0.99, 1.01)	0.9623	1.00 (0.98, 1.01)	0.8138

Covariates: Gender, country of birth, time in study, recruitment method.
Months in Optimise study: Number of months since recruitment into the Optimise Study.
Recruitment method: Whether participants were recruit via responding to advertising ("seed") or referral from their social networks ("other").
*Bolded p-values represent <0.05.
Ref—reference category.

populations with information about how to minimise risk while participating in social activities, while also facilitating free or low-cost access to the tools needed to reduce risk. This could involve providing clear age-appropriate messaging to younger people on evidence-based risk reduction strategies that reduce infection and transmission risk while allowing continued engagement in social activities. For example, RATs could be made freely accessible and public health campaigns could include simple messages encouraging young people to stay safe, protect others and still have fun. Complementary to this, however, is to ensure older people, those with chronic health conditions, and those in regional areas are supported to adopt risk reduction that suits their needs, such as increasing access to assisted testing, strategies to plan for outdoor or online gatherings, smaller gatherings and navigating mask use at gatherings.

Limitations

Optimise was not designed to be a representative sample of the Victorian population, with deliberate oversampling from key groups at greater risk of contracting COVID-19 or being negatively impacted by the unintended consequences of the COVID-19 policy response.[9] As such their behaviour may not fully represent all Victorians. Responses may also be subject to recall bias or social desirability bias. In addition, we classified people as having adopted risk reduction if they did at least one of the five risk reduction strategies. This may be an overestimation of risk reduction strategies adopted given that sampling was based on the nadir of responses.

Conclusions

The majority of people in our study adopted risk reduction strategies to reduce their COVID-19 transmission and acquisition risk prior to significant social and cultural events during a wave of COVID-19 infection with difference between subgroups of participants. As governments move away from prescribed public health measures to individuals taking responsibility for reducing their risk of infection, there remains an important role for government in providing clear, evidence-based messaging to help people reduce their COVID-19 risk that is tailored towards subgroups.

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Ethics approval

Ethics approval for Optimise was provided by the Alfred Human Research Ethics Committee, Approval Number 333/20.

Conflicts of interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Wai Chung Tse reports was provided by Burnet Institute.

Author ORCIDs

Wai Chung Tse https://orcid.org/0000-0002-2068-883X
Aimée Altermatt https://orcid.org/0000-0003-3617-2413
Alisa Pedrana https://orcid.org/0000-0002-1998-5722
Sophie Hill https://orcid.org/0000-0002-1715-5338

References

1. Australian Government. *Vaccination numbers and statistics Australian government department of health and aged care*. Available from: https://www.health.gov.au/initiatives-and-programs/covid-19-vaccines/numbers-statistics; 2022.
2. Liu L, Iketani S, Guo Y, Chan JFW, Wang M, Liu L, et al. Striking antibody evasion manifested by the omicron variant of SARS-CoV-2. *Nature* 2022;**602**(7898):676–81.
3. Chen J, Wang R, Gilby NB, Wei G-W. Omicron variant (B.1.1.529): infectivity, vaccine breakthrough, and antibody resistance. *J Chem Inf Model* 2022;**62**(2):412–22.
4. Our World in Data. *Cumulative confirmed COVID-19 deaths - Australia our world in data*. Available from: https://ourworldindata.org/explorers/coronavirus-data-explorer?facet=none&pickerSort=desc&pickerMetric=location&Metric=Confirmed+deaths&Interval=Cumulative&Relative+to+Population=false&Color+by+test+positivity=false&country=~AUS; 2022.
5. *Keeping victorian workers in key sectors safe*. Premier of Victoria; 2022 [press release].
6. Schneider CR, Dryhurst S, Kerr J, Freeman ALJ, Recchia G, Spiegelhalter D, et al. COVID-19 risk perception: a longitudinal analysis of its predictors and associations with health protective behaviours in the United Kingdom. *J Risk Res* 2021;**24**(3–4):294–313.
7. Cipolletta S, Andreghetti GR, Mioni G. Risk perception towards COVID-19: a systematic review and qualitative synthesis. *Int J Environ Res Publ Health* 2022;**19**(8).
8. Rosi A, van Vugt FT, Lecce S, Ceccato I, Vallarino M, Rapisarda F, et al. Risk perception in a real-world situation (COVID-19): how it changes from 18 to 87 years old. *Front Psychol* 2021;**12**.
9. Heath K, Altermatt A, Saich F, Pedrana A, Fletcher-Lartey S, Bowring AL, et al. Intent to be vaccinated against COVID-19 in Victoria, Australia. *Vaccines* 2022;**10**(2):209.
10. Nguyen T, Thomas AJ, Kerr P, Stewart AC, Wilkinson AL, Nguyen L, et al. Recruiting and retaining community-based participants in a COVID-19 longitudinal cohort and social networks study: lessons from Victoria, Australia. *BMC Med Res Methodol* 2023;**23**(1):54.
11. Zou G. A modified Poisson regression approach to prospective studies with binary data. *Am J Epidemiol* 2004;**159**(7):702–6.

Appendix A Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.anzjph.2023.100068.