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Perceptions, concerns and reported behaviours in response to the first wave of the coronavirus disease 2019 pandemic across metropolitan, regional, rural and remote Australian communities

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Abstract

Objective: To investigate coronavirus disease 2019 community transmission concerns and adherence to social distancing and hygiene practices across metropolitan, regional, rural and remote areas in Australia.

Design: Cross-sectional online survey of Australian adults conducted between April and May 2020 through convenience snowball sampling.

Setting: A range of locations across all states and territories of Australia.

Participants: Six hundred and seventy-seven Australian adults, of which 78.8% lived outside of a metropolitan area.

Main outcome measures: Perceived threat of coronavirus disease 2019; social distancing guidelines and adherence; infection concerns; hygiene practices; frequency of leaving the house; impact of coronavirus disease 2019 on day-to-day life.

Results: Almost all respondents perceived the threat of the coronavirus disease 2019 pandemic was serious. There were high levels of support for the Australian Government's social distancing guidelines, although the perception that social distancing guidelines in participants' communities were 'too strict' increased with remoteness area classification. Most respondents reported adherence with Australian Government social distancing guidelines. There was an association between remoteness and risk perception, with non-metropolitan respondents more likely to feel safe when leaving the house. However, there was no association between geographical remoteness and self-reported adherence with Australian Government social distancing guidelines.

Conclusions: This study provides an important initial insight into Australian perceptions and behaviours relating to the coronavirus disease 2019 pandemic, and how perceptions and behaviours varied by geographical remoteness. The geographical remoteness of communities should be considered by policy makers to ensure effective communication with the Australian public regarding coronavirus disease 2019 and ongoing adherence with preventative health behaviours.

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1 | INTRODUCTION

1.1 | World Health Organisation and global response to COVID-19

The novel coronavirus disease 2019 (COVID-19) is a highly infectious, severe respiratory disease, which was first detected in December 2019 in the city of Wuhan in the Hubei province of mainland China.[1] On 30 January 2020, the World Health Organisation (WHO) Emergency Committee (International Health Regulations [2005] Emergency Committee) reached a consensus that the outbreak constituted a 'Public Health Emergency of International Concern'. The resulting Situation Report[2] outlined strategic objectives for the response including widespread rapid identification, contact tracing, diagnosis and management of cases, infection prevention and control in health care and community settings, implementation of health measures for travellers, awareness-raising in the population and risk communication.

Coronavirus disease 2019 was declared a global pandemic by the WHO on 11 March 2020.[3] By the end of June 2020, there were over 10 million confirmed cases and over 500 000 reported deaths worldwide, with 7767 confirmed cases and 104 recorded deaths in Australia.[4]

In the absence of a vaccine and readily available treatments, the COVID-19 pandemic saw governments implement a range of public health strategies to reduce community transmission. The most significant of these strategies was the establishment of social distancing regulations and restrictions on gatherings that were enforced to varying degrees in different countries.[5] This occurred in addition to widespread public health promotion campaigns regarding hygiene practices and the importance of social distancing.

1.2 | Australian federal, state and territory governments' public health responses to COVID-19

The first confirmed cases of COVID-19 in Australia occurred on 25 January 2020, with one case in Victoria and 3 in New South Wales.[6] The first recorded COVID-19 death in Australia occurred on 1 March.[7] By 12 March, all Australian states and territories reported confirmed cases of COVID-19, with a national total of 122.[8] The Australian

What is already known on this subject:

- Studies of past infectious diseases outbreaks found that willingness to comply with risk-reducing behaviours was linked with perceived proximity to and severity of the disease, personal risk of contracting the illness and perceived efficacy of recommended preventative behaviours
- There is a lack of literature on how geographical remoteness influences coronavirus disease 2019 risk perception, and if any differences translate into variability to preventative health behaviours

What this study adds:

- Respondents reported high levels of support for the Australian Government guidelines and high levels of self-reported adherence with those guidelines, despite increasing perceptions of guidelines being too strict as geographical remoteness increased
- Although there was an association between geographical remoteness and risk perception, the findings indicate that, overall, geographical remoteness was not a strong predictor of self-reported adherence with coronavirus disease 2019 preventative behaviours. Importantly, self-reported support and adherence were the same for metropolitan and non-metropolitan respondents, regardless of the presence of coronavirus disease 2019 cases in their communities at the time
- The findings suggest that the impact of geographical remoteness on motivating factors for adherence with preventative health behaviours during a pandemic warrants further investigation

Government subsequently established a National Cabinet on 13 March to coordinate the COVID-19 pandemic response in Australia.[9]

On 19 March, the Prime Minister announced Australia's border closed to all but Australian citizens and residents, with returning travellers required to self-quarantine for

14 days upon arrival.[10] States and territories implemented a range of new public health regulations to slow the spread of the disease. These included 1.5 m social distancing between individuals, urging workers to work from home if able. Non-essential businesses were ordered to close from 25 March. By the end of March, most indoor and outdoor gatherings were restricted to 2 people, with states and territories enforcing strict social distancing guidelines and penalties for people leaving home for non-essential reasons.[11]

1.3 | Study context

When this study commenced in April 2020, COVID-19 restrictions on gatherings were in place in all Australian states and territories. The majority of identified positive cases were in major Australian cities, while most regional, rural and remote areas had recorded no COVID-19 cases.[12] In Queensland, for example, 45 out of 77 local government areas had no COVID-19 cases, all of which were located outside of metropolitan areas.[13] While regional, rural and remote Australia experienced fewer COVID-19 cases, health services in these locations had reduced capacity to respond to COVID-19 outbreaks.[14]

Also at this time, significant public health awareness campaigns were being undertaken to reduce disease spread, including social distancing guidelines and hygiene practices such as increased handwashing. While there was some variation in stringency between states and territories regarding restricted numbers in gatherings, public health orders within states and territories were applied consistently within those jurisdictions. Uniform restrictions were applied in capital cities and in regional, rural and remote communities, where there were few or no recorded cases.

Studies of past infectious disease outbreaks found that willingness to adhere to risk-reducing behaviours was linked to perceived immediacy and severity of the disease, personal risk of contracting the illness and perceived efficacy of recommended preventative behaviours.[15-18] A 2009 Australian study of community perceptions of personal risk and opinions on health authorities' responses relating to the 2009 H1N1 pandemic reported low-risk perception levels about the H1N1 virus, yet general support of the government's ability to handle the pandemic.[19]

At the time data were collected for this study, there were no published studies relating to Australian public perceptions of the COVID-19 pandemic, although several have since been published.[20-22] Nevertheless, no research since has examined public perceptions of this pandemic in regional, rural or remote areas of Australia, or compared perceptions in these areas with those of people living in metropolitan areas. Therefore, it is important to establish whether perceptions and concerns relating to COVID-19 differ for Australians living in regional, rural and remote communities, and if any differences translate into variations in adherence to preventative health behaviours.

1.4 | Study aim

The aim of this study was to investigate and compare COVID-19 community transmission perceptions and concerns and adherence to social distancing and hygiene practices across metropolitan, regional, rural and remote areas in Australia.

2 | METHODS

2.1 | Sample and setting

Between 29 April 2020 and 15 May 2020, a cross-sectional online survey was undertaken by Australian residents aged 18 years and older using the Qualtrics online platform. Convenience snowball sampling was used to invite Australians to participate in the survey. The survey was promoted through the authors' affiliate organisations and linked networks (eg community organisations, health services and organisations, and Australian University Departments of Rural Health) through email, social media channels (eg Facebook, Twitter, LinkedIn), social media electronic mailing lists and online newsletters.

2.2 | Main study variables

Geographical remoteness was determined by cross-referencing postcodes with the Modified Monash Model (MMM) for remoteness classification. The MMM considers geographical remoteness, as defined by the Australian Bureau of Statistics, and town size to classify geographical areas into 7 remoteness categories: metropolitan (MMM 1); regional centres (MMM 2); large rural towns (MMM 3); medium rural towns (MMM 4); small rural towns (MMM 5); remote communities (MMM 6); and very remote communities (MMM 7).[23]

The questionnaire consisted of demographic questions (including geographical remoteness) and items related to perceptions, concerns and behaviours relating to the COVID-19 pandemic. All questions were developed by the research team by consensus across a number of broad themes: perceived threat of COVID-19; social distancing

guidelines and adherence; infection concerns; hygiene practices; changes in frequency of leaving the house; and impact of COVID-19 on daily life. The questionnaire contained a combination of Likert scale responses, frequency responses and free-text responses. A 4-point Likert scale was used to measure level of agreement (strongly disagree to strongly agree), and a 3-point scale was used to measure frequency (more, the same, less). Due to the combined urgency of examining perceptions and behaviours in response to a fast-evolving pandemic and the narrow window of opportunity to collect data during the height of government restrictions, the questionnaire was not pilot tested.

2.3 | Data analysis

Statistical analysis was undertaken using IBM SPSS Statistics v25.

Data cleaning was conducted to correct postcode errors using suburb information provided and to convert age data from free text to numerical variables. After initial analysis, several variables were collapsed to increase the sensitivity of further analysis. Age was grouped into decades, and Modified Monash Model (MMM) categories were collapsed into the following 4 categories: metropolitan (MMM 1), regional (MMM 2-3): rural (MMM 4-5) and remote (MMM 6-7).[24] Four-point Likert scales were collapsed into dichotomous variables representing either agreement or disagreement with statements.

Sample characteristics and level of agreement with study items were summarised with descriptive statistics. Categorical variables were summarised as proportions and expressed as percentages. Associations between proportions for independent samples were assessed using chi-square (χ^2) tests, with Yates Continuity Corrections for associations between 2 variables when each have no more than 2 categories.[25]

Univariate and multivariate logistic regressions were conducted to further understand associations between geographical remoteness and perceptions and behaviours relating to COVID-19, while adjusting for potential confounding factors. Hierarchical logistic regression models were developed as necessary to test for goodness-of-fit. However, as they did not detect significant shared goodness-of-fit in models, simple multivariate regressions are presented. For all regression models reported, the strength of goodness-of-fit for multivariate models was measured using the Cox and Snell pseudo R-Square statistic.[26]

Two-sided hypothesis tests with a significance level of 0.05 were used throughout. Although the conventional 5% level of statistical significance was used, P values are reported in full, unless they were less than $P < .001$.

2.4 | Ethics approval

The study was approved by a University of Queensland Human Research Ethics Committee (2020000800).

3 | RESULTS

3.1 | Sample characteristics

A total of 677 online questionnaires were completed. The majority of respondents resided in the state of Queensland (78%) and in regional centres (MMM 2) (41.5%). 78.8% of respondents resided outside metropolitan areas (MMM 2-7), compared with approximately 30% of the Australian population.[27] Table 1 summarises respondent characteristics. It indicates that females were over-represented (82.1%) compared with data from the 2016 Australian Census (50.7%).[28] In addition, the majority of survey respondents (64.9%) reported a Bachelor degree educational qualification or above, which is significantly greater than in the Australian population aged 15 years and older (22.0%).[28]

3.2 | Association between geographical remoteness and respondent characteristics on perceptions and behaviours relating to COVID-19

Most respondents (93.8%) reported taking the threat of COVID-19 seriously, with at least 80% agreement to 11 out of 16 questions regarding perceptions and behaviours relating to COVID-19, regardless of geographical remoteness (Table 2). Overall, there was no significant association between geographical remoteness and self-reported changes to hygiene practices or in the frequency of leaving the house to go to the shops (Table 2).

Perceived level of personal safety when leaving the house was used as a proxy variable for perceived personal risk of contracting COVID-19. Table 3 shows that respondents in remote regions (MMM 6-7) were less likely to not feel safe when leaving the house than other respondents; a result reinforced after controlling for other factors (adjusted odds ratio [AOR] = 0.30, 95% confidence interval [CI] 0.10-0.86, Table 3). However, there was no difference between respondents from metropolitan (MMM 1), regional (MMM 2-3) and rural (MMM 4-5) regions in relation to this question. Respondents with a chronic health condition or weakened immune system were more likely to report not feeling safe in relation to COVID-19 when leaving the house (AOR = 2.12, 95% CI 1.30-3.45, Table 3) and respondents with a Bachelor degree qualification

TABLE 1 Respondent characteristics by geographical remoteness, as categorised by MMM remoteness classifications[a] (N = 677)

Demographic characteristics	Geographical remoteness classifications					
	MMM1 metropolitan n (%)	MMM2-3 regional n (%)	MMM4-5 rural n (%)	MMM6-7 remote n (%)	Total n (%)	χ^2
Sex						8.49*
Female	119 (83.2)	251 (78.0)	102 (86.4)	82 (89.1)	554 (82.1)	
Male	24 (16.8)	71 (22.0)	16 (13.6)	10 (10.9)	121 (17.9)	
Age						20.42
18-24	11 (7.7)	21 (6.6)	3 (2.5)	6 (6.5)	41 (6.1)	
25-34	32 (22.4)	51 (15.9)	18 (15.3)	20 (21.7)	121 (18.0)	
35-44	34 (23.8)	85 (26.6)	24 (20.3)	18 (19.6)	161 (23.9)	
45-54	33 (23.1)	81 (25.3)	30 (25.4)	22 (23.9)	166 (24.7)	
55-64	22 (15.4)	53 (16.6)	27 (22.9)	23 (25.0)	125 (18.6)	
65+	11 (7.7)	29 (9.1)	16 (13.6)	3 (3.3)	59 (8.8)	
Highest level of education						19.93**
Year 12 or below	12 (8.4)	34 (10.6)	20 (16.9)	17 (18.5)	83 (12.3)	
Certificate/Diploma	25 (17.5)	69 (21.4)	31 (26.3)	29 (31.5)	154 (22.8)	
Bachelor degree and above	106 (74.1)	219 (68.0)	67 (56.8)	46 (50.0)	438 (64.9)	
Identifies as Aboriginal or Torres Strait Islander	2 (1.4)	5 (1.6)	3 (2.6)	5 (5.4)	15 (2.2)	5.54
Has health or medical condition	59 (41.3)	127 (39.4)	46 (39.0)	44 (47.8)	276 (40.9)	2.30
Personal knowledge of a positive COVID-19 case	11 (7.7)	38 (11.8)	11 (9.3)	5 (5.4)	65 (9.6)	4.24
Aware of reported COVID-19 cases in their community	56 (50.5)	243 (80.5)	50 (45.0)	29 (31.9)	378 (61.5)	98.00***

Note: *<.05; **<.01; ***<.001.

Abbreviations: COVID-19, coronavirus disease 2019; MMM, Modified Monash Model.

[a]Based on relationships to MMM classification status, outlined in text.

TABLE 2 Responses by geographical remoteness, as categorised by MMM remoteness classifications (N = 677)

	Geographical remoteness classifications					
	MMM1 metropolitan n (%)	MMM2-3 regional n (%)	MMM4-5 rural n (%)	MMM6-7 remote n (%)	Total n (%)	χ^2
Perceived threat of COVID-19						
The threat of COVID-19 in Australia is serious	136 (95.1)	302 (93.8)	110 (93.2)	85 (92.4)	633 (93.8)	0.80
Social distancing guidelines and adherence						
The Australian Government social distancing guidelines are strict enough	123 (86.0)	283 (88.2)	97 (82.2)	86 (93.5)	589 (87.4)	6.39
The Australian Government social distancing guidelines in my community are too strict	6 (4.2)	34 (10.6)	13 (11.0)	14 (15.2)	67 (10.0)	8.34*
Everyone must practice social distancing to slow the spread of COVID-19	136 (95.1)	314 (97.8)	115 (97.5)	87 (94.6)	652 (96.7)	3.97
Social distancing guidelines have lowered the risk of infection in my community	137 (95.8)	312 (97.5)	110 (93.2)	86 (93.5)	645 (95.8)	5.53
I am currently following the Australian Government's social distancing guidelines	137 (95.8)	314 (97.5)	115 (97.5)	88 (95.7)	654 (96.9)	1.57
People in my community are currently following the Australian Government guidelines	114 (79.7)	249 (77.6)	87 (73.7)	68 (73.9)	518 (76.9)	1.85
Infection concerns						
I am concerned I could contract COVID-19	63 (44.1)	145 (45.0)	61 (51.7)	35 (38.0)	304 (45.0)	3.99
I could contract COVID-19 if people do not follow guidelines	118 (82.5)	270 (84.1)	100 (84.7)	77 (83.7)	565 (83.8)	0.28
I feel safe from contracting COVID-19 when leaving the house (risk perception proxy variable)	117 (86.0)	280 (88.3)	93 (81.6)	85 (94.4)	575 (87.5)	8.10*
There is a high risk of infection in my community	60 (42.0)	95 (29.5)	33 (28.0)	28 (30.4)	216 (32.0)	8.43*
Hygiene practices						
Since the COVID-19 pandemic I clean and disinfect more often	73 (51.0)	169 (52.5)	63 (53.4)	49 (53.3)	354 (52.4)	0.18
Since the COVID-19 pandemic I wash my hands more often	119 (83.2)	255 (79.2)	96 (81.4)	70 (76.1)	540 (80.0)	2.07

(Continues)

TABLE 2 (Continued)

	Geographical remoteness classifications					
	MMM1 metropolitan n (%)	MMM2-3 regional n (%)	MMM4-5 rural n (%)	MMM6-7 remote n (%)	Total n (%)	χ^2
Leaving the house						
Reduced the number of times leaving the house during the COVID-19 pandemic	85 (59.4)	176 (54.7)	73 (61.9)	32 (34.8)	366 (54.2)	18.38***
Since the COVID-19 pandemic I go to the shops less often	125 (87.4)	286 (89.1)	103 (87.3)	79 (85.9)	593 (88.0)	0.86
Impact of COVID-19						
The impact of the COVID-19 pandemic response on my day-to-day life is medium to large	118 (82.5)	263 (81.7)	92 (78.0)	66 (71.7)	539 (79.9)	5.32

Note: *$P < .05$; **$P < .01$; ***$P < .001$.

Abbreviations: COVID-19, coronavirus disease 2019; MMM, Modified Monash Model.

or above were less likely to not feel safe in relation to COVID-19 when leaving the house (AOR = 0.44, 95% CI 0.21-0.93, Table 3).

Analysis was also conducted to investigate an association between feelings of safety from COVID-19 when leaving the house and engaging in preventative health behaviours. Respondents who reported not feeling safe from contracting COVID-19 when leaving the house were more likely to report increased frequency of handwashing ($\chi^2(1) = 12.70$, $P = <.001$), cleaning and disinfecting ($\chi^2(1) = 21.29$, $P = <.001$) and reduced frequency of going to shops ($\chi^2(1) = 6.36$, $P = .012$). However, there was no association between feelings of safety when leaving the house and frequency of leaving the house more generally ($\chi2(1) = 0.74$, $P = .390$).

Table 4 shows that respondents living in remote regions (MMM 6-7) were less likely to reduce the number of times they left the house during the COVID-19 pandemic (AOR = 0.33, 95% CI 0.18-0.59), after controlling for other factors. However, there was no statistically significant difference between respondents in metropolitan (MMM 1), regional (MMM 2-3) and rural (MMM 6-7) regions. Similarly, females were more likely to reduce the number of times they left the house (AOR = 2.36, 95% CI: 3.63-11.54, Table 4) and respondents who were not aware of any COVID-19 cases in their community were less likely to reduce the number of times they left the house (AOR = 0.68, 95% CI: 0.47-0.99).

Overall, when adjusting for other factors, respondents living in regional (MMM 2-3) and rural regions (MMM 4-5) were less likely to perceive that there was a high risk of infection in their community compared to those living in metropolitan (MMM 1) areas (AOR = 0.55, 95% CI 0.35-0.86, and AOR = 0.57, 95% CI: 0.33-0.98, respectively, Table 5).

With regard to the association between geographical remoteness and support for social distancing guidelines, while Table 2 indicates an association between geographical remoteness and agreement that Australian Government social distancing guidelines were too strict in the respondent's community, Table 6 shows that, after adjusting for potentially confounding factors, respondents living in regional (MMM 2-3), rural (MMM 4-5) and remote (MMM 6-7) locations were more likely to perceive that Government social distancing guidelines were too strict in their community compared to their metropolitan (MMM 1) counterparts (AOR = 3.24, 95% CI: 1.26-8.35; AOR = 3.49, 95% CI: 1.23-9.69; and AOR = 4.87, 95% CI: 1.66-14.28, respectively). The strength of goodness-of-fit for all multivariate models (Tables 3-6), measured using the Cox and Snell pseudo R-Square statistic, was low.[26]

TABLE 3 Factors associated with not feeling safe in relation to COVID-19 when leaving the house (N = 655)

	Unadjusted OR	Adjusted OR
Age		
18-24	REF	REF
25-34	1.09 (0.34-3.58)	1.59 (0.45-5.61)
35-44	1.60 (0.52-4.92)	2.25 (0.67-7.59)
45-54	1.15 (0.37-3.58)	1.28 (0.38-4.28)
55-64	1.42 (0.45-4.49)	1.50 (0.44-5.07)
65+	0.83 (0.21-3.29)	0.70 (0.16-2.99)
Sex (Female)	1.94 (0.94-3.99)	1.99 (0.94-4.21)
Highest level of education		
Year 12 or below	REF	REF
Certificate/Diploma	0.76 (0.36-1.60)	0.62 (0.28-1.40)
Bachelor degree and above	0.61 (0.32-1.17)	0.44 (0.21-0.93)*
Geographical location by remoteness classifications		
Metropolitan	REF	REF
Regional	0.81 (0.45-1.47)	0.90 (0.47-1.69)
Rural	1.39 (0.71-2.74)	1.39 (0.68-2.85)
Remote	0.36 (0.13-1.10)	0.30 (0.10-0.86)*
Has chronic health condition/ weakened immune system	1.91 (1.20-3.05)**	2.12 (1.30-3.45)**
Whether aware of any COVID-19 cases in community		
Yes	REF	REF
No	1.10 (0.67-1.83)	1.09 (0.62-1.93)
Unsure	1.66 (0.78-3.54)	1.57 (0.69-3.57)

Note: Cox and Snell R Square = .046.

Abbreviations: COVID-19, coronavirus disease 2019; OR, odds ratio.

*$P < .05$; **$P < .01$; ***$P < .001$.

TABLE 4 Factors associated with reducing the number of times leaving the house during the COVID-19 pandemic (N = 673)

	Unadjusted OR	Adjusted OR
Age		
18-24	REF	REF
25-34	1.44 (0.71-2.93)	1.70 (0.79-3.68)
35-44	1.20 (0.61-2.39)	1.26 (0.60-2.64)
45-54	1.10 (0.56-2.18)	1.12 (0.54-2.33)
55-64	1.10 (0.54-2.23)	1.14 (0.54-2.40)
65+	2.21 (0.97-5.02)	2.39 (1.00-5.71)
Sex (female)	1.96 (1.31-2.92)**	2.36 (1.54-3.63)***
Highest level of education		
Year 12 or below	REF	REF
Certificate/ Diploma	1.03 (0.60-1.76)	0.92 (0.51-1.65)
Bachelor degree and above	0.79 (0.49-1.27)	0.60 (0.35-1.03)
Geographical location by remoteness classifications		
MMM 1 metropolitan	REF	REF
MMM 2-3 regional	0.82 (0.55-1.23)	0.76 (0.49-1.18)
MMM 4-5 rural	1.11 (0.67-1.82)	1.01 (0.60-1.71)
MMM 6-7 remote	0.36 (0.21-0.63)***	0.33 (0.18-0.59)***
Has chronic health condition/ weakened immune system	1.23 (0.90-1.67)	1.35 (0.97-1.87)
Aware of any COVID-19 cases in community		
Yes	REF	REF
No	0.71 (0.51-0.99)*	0.68 (0.47-0.99)*
Unsure	1.06 (0.61-1.84)	0.84 (0.46-1.54)

Note: Cox and Snell R Square = .075.

Abbreviations: COVID-19, coronavirus disease 2019; MMM, Modified Monash Model; OR, odds ratio.

*$P < .05$; **$P < .01$; ***$P < .001$.

4 | DISCUSSION

Findings from this study suggest that respondents recognised the threat and severity of the COVID-19 pandemic. They were supportive of, and reported adherence to, government-recommended preventative health measures and guidelines, regardless of remoteness. The findings highlight that respondents across all remoteness classification locations engaged in preventative health behaviours such as increasing hand washing, cleaning and disinfecting and reducing the number of times they left their house, irrespective of the presence or absence of COVID-19 cases in their communities. Despite high self-reported adherence, less than half of respondents reported concerns about contracting COVID-19, and only a third perceived there was a high risk of infection in their community.

These findings are consistent with recently published Australian[20,21] and international[22] surveys of Australian adults, which reported similar trust in government and high adherence with COVID-19 preventative and avoidance behaviours such as hygiene practices and self-isolation during the first wave of the COVID-19 pandemic. However, unlike these studies, our research showed no significant differences in self-reported hygiene practices across different geographical remoteness regions. The perception that the Australian Government guidelines were too strict, though, increased with geographical remoteness (4.2% in metropolitan communities, 10.6% in regional communities, 11.0% in rural communities and 15.2% in remote communities). In addition, respondents from

TABLE 5 Factors associated with perceived high risk of infection in respondent's community (N = 673)

	Unadjusted OR	Adjusted OR
Age		
18-24	REF	REF
25-34	0.74 (0.36-1.55)	0.71 (0.32-1.54)
35-44	0.53 (0.26-1.10)	0.53 (0.25-1.14)
45-54	0.71 (0.35-1.45)	0.71 (0.34-1.50)
55-64	1.08 (0.52-2.22)	1.11 (0.53-2.36)
65+	0.63 (0.27-1.47)	0.70 (0.29-1.69)
Sex (female)	0.82 (0.54-1.24)	0.78 (0.50-1.20)
Highest level of education		
Year 12 or below	REF	REF
Certificate/Diploma	1.15 (0.64-2.07)	1.27 (0.67-2.35)
Bachelor degree and above	1.30 (0.77-2.19)	1.47 (0.83-2.60)
Geographical location by remoteness classifications		
MMM 1 metropolitan	REF	REF
MMM 2-3 regional	0.58 (0.38-0.87)**	0.55 (0.35-0.86)**
MMM 4-5 rural	0.54 (0.32-0.91)*	0.57 (0.33-0.98)*
MMM 6-7 remote	0.61 (0.35-1.05)	0.66 (0.37-1.19)
Has chronic health condition/weakened immune system	1.34 (0.97-1.86)	1.33 (0.95-1.88)
Whether aware of any COVID-19 cases in community		
Yes	REF	REF
No	0.83 (0.58-1.18)	0.73 (0.49-1.08)
Unsure	1.37 (0.78-2.40)	1.03 (0.56-1.88)

Note: Cox and Snell R Square = .037.

Abbreviations: COVID-19, coronavirus disease 2019; MMM, Modified Monash Model; OR, odds ratio.

*$P < .05$; **$P < .01$; ***$P < .001$.

TABLE 6 Factors associated with perception that Australian Government social distancing guidelines were too strict in own community (N = 671)

	Unadjusted OR	Adjusted OR
Age		
18-24	REF	REF
25-34	0.80 (0.26-2.43)	0.87 (0.27-2.82)
35-44	0.86 (0.30-2.48)	0.99 (0.32-3.06)
45-54	0.88 (0.31-2.52)	0.92 (0.31-2.80)
55-64	0.56 (0.18-1.77)	0.56 (0.17-1.85)
65+	0.52 (0.13-2.08)	0.49 (0.12-2.07)
Sex (female)	0.81 (0.43-1.51)	0.70 (0.36-1.35)
Highest level of education		
Year 12 or below	REF	
Certificate/Diploma	0.89 (0.37-2.13)	0.88 (0.36-2.19)
Bachelor degree and above	0.90 (0.42-1.92)	0.99 (0.43-2.29)
Geographical location by remoteness classifications		
MMM 1 metropolitan	REF	REF
MMM 2-3 regional	2.69 (1.10-6.55)*	3.24 (1.26-8.35)*
MMM 4-5 rural	2.81 (1.03-7.63)*	3.49 (1.23-9.92)*
MMM 6-7 remote	4.07 (1.50-11.02)**	4.87 (1.66-14.30)**
Has chronic health condition/weakened immune system	0.91 (0.54-1.52)	0.91 (0.53-1.56)
Whether aware of any COVID-19 cases in community		
Yes	REF	REF
No	1.36 (0.80-2.33)	1.50 (0.81-2.79)
Unsure	1.39 (0.58-3.29)	2.36 (0.91-6.11)

Note: Cox and Snell R Square = .025.

Abbreviations: COVID-19, coronavirus disease 2019; MMM, Modified Monash Model; OR, odds ratio.

*$P < .05$; **$P < .01$; ***$P < .001$.

regional, rural and remote communities were less likely to perceive a high risk of infection in their community and those from remote communities less likely to perceive not feeling safe when leaving the house compared to those residing in metropolitan areas. Therefore, the study findings indicate that even though geographical remoteness was associated with risk perception, it was not a strong predictor of self-reported adherence with COVID-19 preventative behaviours.

Other characteristics were associated with COVID-19 perceptions and behaviours; however, these characteristics were not consistent across analyses. For example, females reported reducing the number of times that they left the house during the COVID-19 pandemic, and respondents with a Bachelor degree educational qualification or above had greater perceived safety in relation to

COVID-19 after adjusting for other factors (including geographical remoteness). Although these findings were not the focus of the study, they are supported by the literature from previous disease outbreaks, where protective behaviours were influenced by a range of demographic and attitudinal factors.[15]

4.1 | Limitations

This study has several limitations. First, due to the rapidly evolving nature of the pandemic, the survey was developed by the investigators and is not based on

validated measures. Similarly, due to time constraints, the online survey was not pilot tested. Nevertheless, the findings from this study align with those from similar studies conducted during the early phase of the COVID-19 pandemic.[20-22]

It is acknowledged that mask-wearing guidelines came into effect after the study was conducted, so adherence with this measure was not included in the survey or relevant to the context, in which the survey was conducted. Second, sampling bias resulting from non-probability convenience sampling might have compromised the generalisability of the findings. The sample is not representative of the most recent Australian population census[28] as women and respondents with a tertiary education qualification were over-represented. As such, the study findings should be treated as indicative. However, regional, rural and remote respondents were over-sampled and this allowed for exploration of the influence of geographical remoteness on COVID-19 perceptions and behaviours.

In addition, the survey did not collect information about employment status and is therefore unable to comment on the impact of employment on behaviours associated with leaving the house. Finally, the study might be subject to recall or social desirability bias because it relies on self-reported perceptions and behaviours related to COVID-19. However, recall bias might have been minimised because the survey was administered during the period of COVID-19 Government restrictions. Social desirability might have also been minimised because the survey was anonymous and survey questions were not of a sensitive nature.

4.2 | Implications and recommendations

Although findings are indicative, this study has implications for future public health messaging and communication in relation to COVID-19 for regional, rural and remote Australians. While this sample reported high adherence with Australian Government guidelines, there were several differences in COVID-19 perceptions across metropolitan, regional, rural and remote communities. Particularly, important was the perception that Australian Government guidelines were too strict in non-metropolitan regions. As such, it appears that motivating factors behind this adherence might vary by geographical remoteness: this warrants further investigation. It is recommended that further studies use a qualitative approach to explore the motivating factors behind adherence with COVID-19 protective behaviours in metropolitan, regional, rural and remote communities to better understand the factors that drive

COVID-19 perceptions and behaviours across these different remoteness classifications. Greater understanding of the underlying motivations behind COVID-19 protective behaviours could then be used to inform public health messaging and communication to ensure that it is targeted and appropriate, regardless of geographical remoteness and the presence (or absence) of COVID-19 cases in the community. As this study was conducted in the first wave of the COVID-19 pandemic, it is important to monitor attitudes to adherence and hygiene behaviours and perceptions of safety around COVID-19 in regional, rural and remote regions as the pandemic progresses and vaccination rates increase. We do not know of any studies that have done so, though it would seem imperative that this information be available for current and future pandemic responses.

5 | CONCLUSION

This study provides an important initial insight into Australian perceptions and behaviours relating to the COVID-19 pandemic, and how perceptions and behaviours varied across metropolitan, regional, rural and remote regions in Australia. Overall, there were high levels of support for the Australian Government guidelines in relation to COVID-19 and high levels of self-reported adherence with the guidelines across all geographic remoteness regions. Respondents living outside metropolitan areas, however, reported lower levels of perceived risk relating to COVID-19, suggesting other reasons for adherence than the generally accepted presence of disease in the community and perceived severity of the disease.[15-18]

Geographical remoteness is therefore a factor that should be considered by policymakers to ensure effective communication with the Australian public regarding COVID-19 and ongoing support for and adherence with preventative health behaviours.

CONFLICT OF INTEREST
None.

AUTHOR CONTRIBUTIONS
GA: conceptualization; formal analysis; investigation; methodology; project administration; writing-original draft. CW: formal analysis; investigation; project administration;

writing-original draft. GB: conceptualization; formal analysis; investigation; methodology; writing-original draft. NC: conceptualization; investigation; methodology; writing-original draft. TF: formal analysis; investigation; writing-review & editing.

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