Frequent Hospital Users with Limited English are Vulnerable to COVID-19 Misinformation: Results from A Cross-sectional Survey

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Abstract

Background

Successful public health responses to pandemics rely on individuals being able to access, clearly understand and easily interpret relevant information about symptoms, prevention, testing and containment strategies. Accessing and interpreting information during the pandemic has been difficult for many populations, particularly those experiencing social or economic disadvantage. The aim of this study was to understand how a population of frequent hospital users originating, from a disadvantaged population, have accessed and interpreted information during the COVID pandemic in Melbourne.

Methods

Cross sectional telephone survey of 200 frequent hospital users (115 with limited English proficiency) informed by the World Health Organisation’s “Rapid, simple, flexible behavioural insights on COVID-19”. Primary outcome measures included knowledge of symptoms, preventive strategies, government restrictions aimed at containment, and belief in misleading information. Secondary outcome measure was perceived trustworthiness of information which was measured using content analysis of open-ended questions.

Results

Overall, the survey participants had poor understanding of misleading information (69%). 41.2% were unable to accurately identify symptoms, while 35.8% were unable to identify preventative strategies. Just under 1/3 (30.2%) were unable to describe government restrictions. English-speaking participants were almost three times (OR 2.69, 95%CI 1.47; 4.91) more likely to have adequate knowledge about symptoms, were twice as likely to understand local restrictions (OR 2.10 95%CI 1.06; 4.19) and were 11 times more likely to recognise information that was misleading or incorrect (OR 11.52 95%CI 5.39; 24.60) than those with limited English. 50% of those surveyed stated that they trusted all information that they read or heard, with on 20% stating that they were uncertain or untrusting of some information.

Conclusion

Limited English proficiency was strongly associated with inadequate knowledge of COVID-19 and much greater likelihood of believing widely circulating misinformation. In order to reduce transmission, morbidity and mortality associated with COVID-19, health authorities must tailor health messaging to disadvantaged populations to ensure they have adequate access, and understanding, of the information.

Background

Successful public health responses to pandemics rely on individuals being able to access, clearly understand and easily interpret relevant information about symptoms, prevention, testing and containment strategies. However, many in the Australian population have inadequate health literacy (1)
and face major challenges in accessing and understanding trustworthy health information (2). Inadequate health literacy is more prevalent in disadvantaged communities impacted by lower levels of educational attainment, low income and unemployment, and large populations of people from culturally and linguistically diverse backgrounds (3-5). Population-based surveys have identified that lower health literacy is associated with less knowledge and understanding of public health messages about COVID-19 (3, 6) and less adherence to preventive behaviours (7, 8).

Worldwide we have seen disadvantaged communities suffering higher than average COVID-19 morbidity and mortality (9-12), in part because of higher rates of transmission due to poverty and large household sizes, and insecure employment with a high exposure risk (13-15). In Australia, the impact of the pandemic has been greatest in communities where structural inequalities and social and economic disadvantage have been greatest (16).

High-frequency hospital users with chronic and complex health conditions are also at increased risk of serious morbidity and mortality if they contract COVID-19 (17, 18). When high-frequency hospital users originate from a disadvantaged community group such as those with limited English proficiency or socioeconomic disadvantage, the risk posed by COVID-19 may be exacerbated significantly.

Despite this greater burden of COVID-19 among vulnerable groups, there is limited evidence for where such communities source their information and how they understand and apply it to prevent the spread of COVID-19. In Australia, one qualitative study conducted among Ezidi refugees found that government information was seen as unhelpful and inappropriate (19). There is a similar lack of evidence for lower socioeconomic groups, although in an Australian national survey in 2020, lower education was associated with higher belief in misinformation (20). Understanding how vulnerable populations have accessed and interpreted information during the pandemic in Australia is essential for health authorities to be able to target communication approaches so that they are equitable and accessible to all. The aim of this research was to understand how high-frequency hospital users originating from a disadvantage community accessed and interpreted information during the COVID pandemic in Melbourne in 2020.

**Methods**

**Design, Setting and Sample**

In Australia, the largest outbreak of COVID-19 in 2019 was in Melbourne, accounting for 75% of all Australian cases (n = 20,345 on 4th December), and 90% of all deaths (n=820). In response to rising COVID-19 case numbers, stage 3 restrictions were imposed on the 8th of July 2021 which was extended to stage 4 restrictions on 2nd of August. Cases in Victoria peaked on the 5th of August, when 725 new cases were reported in the State over a 24-hour period. This study was conducted from the 6th of July to the 24th of August 2020 during the peak of the 2019 pandemic in Melbourne. Importantly, it is the same population that has been impacted by rising cases in 2021, with approximately 75% of all cases located in Melbourne’s north as we approach the peak of the wave in October 2021.
Northern Health (NH) is the major provider of hospital care in Melbourne's north. Residents in the area are culturally and linguistically diverse, speaking more than 100 languages. The area has lower levels of income, educational attainment and health literacy and higher rates of unemployment than Victorian state averages (5, 21, 22), and the highest population of recently arrived refugees (23). The catchment covers about 10% of Victoria's population, however 1/3 of Victoria's COVID-19 cases were located in this area at the peak of the pandemic.

We conducted a cross sectional survey using structured interviews with a sample of Australian-born and limited-English proficiency patients from migrant and refugee backgrounds with complex and chronic conditions, who had a history of frequent hospital care at NH. We selected our study sample from the top 5000 most frequent users of inpatient care identified by a case-finding algorithm developed by the Victorian Department of Health and Human Services (24). The algorithm uses the following risk factors (criterion) to predict a future risk of hospitalisation over the next 12 months; age, number of unplanned admissions in the past 6 months, number of emergency department visits in the past 3 months, hospital stay caused by selected progressive conditions and co-morbidities (such as asthma, kidney disease, COPD, heart disease, rheumatoid arthritis), smoking status, and place of residence (aged care or private residence). Each criterion provides a weighted value risk of future admissions and is triggered once a points threshold is reached. The model has been found to accurately identify patients who will be admitted three or more times in the following 12 months 32% of the time (24). The patients in this study were all identified as at risk of future admissions and were considered to have the highest overall complexity of all patients attending NH for treatment.

**Measures**

Primary outcome measures included knowledge of symptoms, preventive strategies, government restrictions, and belief in misleading information. Our secondary outcome measure was perceived trustworthiness of information which was measured using content analysis of open-ended questions. To measure these outcomes we adapted the World Health Organisation (WHO) “Rapid, simple, flexible behavioural insights on COVID-19” survey with additional researcher generated questions to fit the local context (25). The WHO survey was developed from validated instruments to monitor knowledge, risk perceptions, preventive behaviour and trust in populations to inform pandemic outbreak response (25).

Sources of information were measured using the question ‘tell me about where you have looked for information since the COVID-19 pandemic began?’. Respondents were provided eight response options (internet, television, radio, newspaper, family/friends, religious/groups, GP/health professional, other) and were then asked to elaborate on their response to provide specific sources in an open response format (e.g., if using the internet, was it government websites, social media sites). Perceived trustworthiness was measured using the open-ended question ‘how much do you trust the information you have been reading?’

Knowledge of symptoms was measured using 10 binary response (True/False and don’t know) items, to the question ‘which of the following can be symptoms of COVID-19?’. We defined adequate knowledge of
symptoms as knowledge of all three common COVID-19 symptoms as identified by the WHO (sore throat, dry cough and fever). 'Don’t know' responses were considered inadequate knowledge and were coded along with incorrect responses for these items.

Knowledge of preventive strategies was assessed using 15 binary response (True/False and don’t know) items in response to the question ‘which of the following are effective measures to prevent the spread of COVID-19?’ We defined adequate knowledge of preventive strategies as able to identify at least 80% of the 15 strategies on the WHO survey correctly (79% and below was considered inadequate knowledge of preventive strategies). ‘Don’t know’ responses were considered inadequate knowledge and were coded as incorrect responses for these items. In addition, we looked at knowledge of misleading information about preventing COVID-19 and defined this as correctly recognising that three or more of garlic, antibiotics, fluvax, disinfecting postage or herbal remedies were not preventive strategies.

There were four exceptions to staying home that applied during stage 3 and stage 4 restrictions. These were; attending essential work, seeking or providing care, exercising, and purchasing groceries or pharmaceuticals. Information about restrictions was widely publicised, however many of our sample were not working and so the work-related exception did not apply. We therefore considered adequate knowledge as being able to name three of four exemptions for leaving home (excluding attending essential work).

To understand trust in information, we asked participants the open-ended question “how much do you trust the information you are finding”. We categorised responses to pre-formulated coding rules as “believes or trusts everything”, “partially believes and this may depend on the source”, “don’t know if I can trust” and “don’t trust anything”.

Sociodemographic variables collected through self-report included age, gender, level of educational attainment, employment status, country of birth, primary language spoken at home, number of years in Australia, living arrangements, and household income.

**Survey administration procedure**

The survey was administered by phone, and all participants provided verbal consent to participate as per the ethics protocol. Stratified random sampling was used to select patients across English and the top 10 other language groups in the region (Arabic, Italian, Assyrian, Turkish, Greek, Macedonian, Mandarin, Persian, Vietnamese, Hindi, and Punjabi), age, and gender. If a patient declined participation, the next patient on the random sample list was approached, until 200 participants were recruited. We aimed to recruit a minimum 50% with limited English proficiency. Patients were excluded if they were unable to provide informed consent or spoke a language other than English or those in the top 10. Interpreters were made available for all individuals where English was not the preferred language.

**Ethical Approval**
This project was approved by the Northern Health Human Research Ethics Committee (LNR 64196). The committee included consumer representatives who provided feedback on the interview questions and on study methods.

**Statistical analysis**

Data on sources of information reported across categories were reported as proportions. Participants could choose more than one source. Content analysis was conducted on free text responses to describe specifics of information sources, as well as the perceived trustworthiness. Codes were created using common sources of information and levels of trust which were pre-formulated as coding rules(27). Two researchers independently applied the coding to each open-ended question. We aimed to have 100% agreement between researchers, so where differences in coding occurred, these were discussed until agreement was found or a third researcher was consulted. Sources of accessed information and determination of trustworthiness were expressed as proportions. Given the total sample size of 200, the margin of error for a proportion estimate was calculated at +/- 6.2% as a worse-case scenario, with a sub-group of 50 cases having a margin of error of +/- 14%.

We used logistic regression to explore the associations between age (≥65 vs. < 65 years), gender (female vs. male), primary language (English vs. other), living alone (vs. with others), education (completed vs. did not complete high school), and different knowledge-related outcomes, which included knowledge of symptoms, knowledge of preventive strategies, knowledge of government restrictions, and misleading information. Univariate models were first conducted first followed by multivariate models, with the latter including only those variables found to be significant at p-value ≤ 0.05 in univariate models. Odds ratios (OR) are presented with 95% Confidence Intervals (CI). Data were analysed using Stata version 15.

**Results**

A total of 272 patients were invited to participate in the interviews before a sample size of 200 was achieved (response rate 74%). Mean age was 66.5 years (SD 15.6, range 22-99 years), with 97 (48.5%) respondents female. More than two-thirds of participants did not complete high school, and most were on very low incomes. Only 13 (6%) participants were currently working. Study participants were culturally diverse, with 115 (58%) speaking a primary language other than English (interviewed using interpreters) and 152 (76%) born overseas. Over one-third of participants (n=74) lived in multi-generation households (Table 1).

Table 1. Descriptive characteristics of sample (n=200). Data are shown as n (%) unless otherwise specified
| Mean age in year (SD)      | 66.5 (15.6) |
|---------------------------|------------|
| Age group, years          |            |
| 18-40                     | 14 (7.0)   |
| 41-55                     | 36 (18.0)  |
| 56 - 70                   | 62 (15.6)  |
| 71-98                     | 88 (22.1)  |
| Gender                    |            |
| Female                    | 97 (48.5)  |
| Male                      | 103 (51.5) |
| Highest level of education|            |
| Did not complete high school | 135 (67.50) |
| Completed high school     | 25 (12.5)  |
| Trade certificate/ Technical and further education (TAFE) qualification | 14 (7.0) |
| Diploma or bachelor degree | 19 (9.5)   |
| Masters or doctoral degree | 6 (3.0)    |
| Household income          |            |
| <$35,000                  | 163 (81.5) |
| 35,000 - 50,000           | 9 (4.5)    |
| >$50,000                  | 12 (6.0)   |
| Rather not say            | 16 (8.0)   |
| Living arrangements       |            |
| Lives alone               | 33 (16.5)  |
| Lives with partner        | 23 (11.5)  |
| Lives with partner and children | 61 (30.5) |
| Lives in multigeneration household* | 74 (37) |
| Lives with others (flatmates) | 6 (3.0)   |
| Other                     | 3 (1.5)    |
| Born in Australia         | 48 (24)    |
| Primary language          |            |
| Language                                      | Count (Percent) |
|----------------------------------------------|-----------------|
| Arabic                                       | 26 (13)         |
| Assyrian Neo-Aramaic/ Chaldean Neo-Aramaic   | 9 (4.5)         |
| English                                      | 85 (42.5)       |
| Greek                                        | 16 (8.0)        |
| Italian                                      | 19 (9.5)        |
| Macedonian                                   | 7 (3.5)         |
| Mandarin                                     | 5 (2.5)         |
| Persian (excluding Dari)                     | 7 (3.5)         |
| Punjabi / Hindi                              | 7 (3.5)         |
| Turkish                                      | 12 (6.0)        |
| Vietnamese                                   | 7 (3.5)         |
| Currently working                            | 16 (8.0)        |
| Inadequate knowledge **                     |                 |
| Symptoms (n = 194)                           | 80 (41.2)       |
| Prevention (n = 190)                         | 68 (35.8)       |
| Stage 3 or 4 local restrictions (n = 182)    | 55 (30.2)       |
| Misinformation (n = 190)                     | 131 (69.0)      |

*Defined as adults with one or more children, living with ageing parents or grandchildren

**Inadequate knowledge defined as follows: Symptoms = unable to identify all three common symptoms (sore throat, fever, dry cough); Prevention = recognises 79% or less preventive strategies correctly; Stage 3 or 4 local restrictions = unable to name 2 out of 3 local restrictions (excluding work-related reasons; only includes people not currently working); Misinformation = states that 3 or more of garlic, antibiotics, fluvax, disinfecting postage, or herbal remedies are preventive strategies.

Figures 1 and 2 provide an overview of information sources and perceptions of trust according to primary language spoken. The most cited source of information was television (n=144, 72%) followed by the internet (n=84, 42%). Content analysis of the free text responses of specific sources of information (data not shown) found that for those sourcing their information on the television, 83 (58%) watched free to air privately owned television stations (channel 7, 9 and 10), while 36 (25%) sought their information from overseas news outlets from their country of origin. For those using the internet, 48 (56%) relied on Facebook and other forms of social media including YouTube and WeChat. In terms of trustworthiness
of the information, 45% of respondents said they trust everything, 34% reported partially trusting information depending on the source, and 19% said they were uncertain about the information or that they didn't trust anything. Those who were interviewed in either Punjabi, Hindi, Vietnamese or Chinese languages were the most trusting of information with 72% identifying that they believe everything.

Overall, 41.2% of this population had inadequate symptom knowledge, 35.8% had inadequate preventive strategy knowledge, 30.2% had inadequate knowledge of restrictions, and 69% were not able to adequately recognise misleading information (Table 1). Table 2 presents demographic and other predictors of adequate symptom knowledge, preventive strategies, local restrictions and misleading information. In univariate logistic regression, being aged ≥65years was associated with less ability to recognise misinformation (OR 0.28, 95%CI 0.28;0.97), compared to younger participants. Having adequate English proficiency was associated with almost a 3 times greater knowledge of symptoms (OR 2.69, 95%CI 1.47; 4.91), and greater knowledge of local restrictions (OR 2.10, 95%CI 1.06; 4.19) compared to those with limited proficiency. Participants with adequate English were also 11 times more likely to recognise misinformation about preventive strategies that do not work than those with limited English proficiency (OR 11.52, 95% CI 5.39; 24.60). Completion of high school was associated with greater likelihood of having adequate knowledge of symptoms (OR 2.13, 95%CI 1.12;4.07).

Variables that were statistically significant in univariate logistic regression were entered into multivariate models (Table 3). The association seen between proficient English and greater knowledge of symptoms remained significant after inclusion of education in the model (adjusted OR 2.64, 95%CI 1.42; 4.89), and for recognition of misinformation after inclusion of age in the model (adjusted OR 11.55, 95%CI 5.36, 24.87).

Table 2: Association between demographic variables and adequate knowledge of symptoms, preventive strategies, local restrictions exemptions and misinformation using univariate logistic regression
| Predictor                          | Adequate knowledge of symptoms (n=193) | Adequate knowledge of preventive strategies (n=190) | Adequate knowledge of three local restrictions (n=182)* | Adequate recognition of misinformation (n=190) |
|-----------------------------------|----------------------------------------|----------------------------------------------------|-------------------------------------------------------|-----------------------------------------------|
|                                   | **OR 95%CI**                           | **OR 95%CI**                                       | **OR 95%CI**                                          | **OR 95%CI**                                  |
| Female vs. Male                   | 0.86 [0.48;1.52]                       | 1.23 [0.68; 2.24]                                  | 1.27 [0.67; 2.40]                                     | 0.83 [0.45;1.54]                               |
| Age ≥ 65 vs. age < 65             | 0.74 [0.42; 1.32]                      | 0.88 [0.48; 1.59]                                  | 0.60 [0.31; 1.18]                                     | **0.52 [0.28; 0.97]**                          |
| Primary language English vs other | **2.69 [1.47; 4.91]**                  | 0.58 [0.32; 1.05]                                  | **2.10 [1.06; 4.19]**                                 | **11.52 [5.39; 24.60]**                        |
| Living alone vs. with others      | 1.42 [0.64; 3.13]                      | 0.78 [0.36; 1.70]                                  | 0.90 [0.38; 2.14]                                     | 1.95 [0.90, 4.26]                              |
| Completed high school vs. not     | **2.13 [1.12; 4.07]**                  | 0.76 [0.40; 1.42]                                  | 1.41 [0.69; 2.88]                                     | 1.66 [0.87; 3.12]                              |

*Conducted only in participants who are not working or who are retired

Adequate knowledge of symptoms defined as knowledge of all three common COVID-19 symptoms as identified by the World Health Organisation (WHO) (sore throat, dry cough and fever)

Adequate knowledge of preventive strategies defined as able to identify at least 80% of the 15 strategies on the WHO survey correctly

Adequate knowledge of local restrictions defined as being able to correctly name 2 out of 3 exemptions for leaving home (excluding work-related reasons).

Adequate recognition of misinformation defined as reports ≤2 of garlic, antibiotics, fluvax, disinfecting postage, or herbal remedies as being preventive strategies.

**Table 3: Association between demographic variables and adequate knowledge of symptoms, preventive strategies, local restrictions exemptions, and misinformation using multivariate logistic regression**
### Predictor Results

| Predictor                  | Adequate knowledge of symptoms (n=193) | Adequate knowledge of preventive strategies (n=190) | Adequate knowledge of three local restrictions (n=182) | Adequate recognition of misinformation (n=190) |
|----------------------------|----------------------------------------|-----------------------------------------------------|-----------------------------------------------------|------------------------------------------------|
| **OR 95%CI**               | **OR 95%CI**                           | **OR 95%CI**                                        | **OR 95%CI**                                        | **OR 95%CI**                                    |
| Female vs. Male            | -                                      | -                                                   | -                                                   | -                                               |
| Age ≥ 65 vs. age < 65      | -                                      | -                                                   | -                                                   | 0.51 [0.25, 1.06]                               |
| Primary language English vs. other | 2.64 [1.42; 4.89]                      | -                                                   | -                                                   | 11.55 [5.36, 24.87]                             |
| Living alone vs. with others | -                                      | -                                                   | -                                                   | -                                               |
| Completed high school vs. not | 1.92 [0.99; 3.74]                      | -                                                   | -                                                   | -                                               |

1 Only primary language and completed high school included in the model; 2 Only primary language included in the model; 3 Only age and primary language included in the model.

Adequate knowledge of symptoms defined as knowledge of all three common COVID-19 symptoms as identified by the World Health Organisation (WHO) (sore throat, dry cough and fever)

Adequate knowledge of preventive strategies defined as able to identify at least 80% of the 15 strategies on the WHO survey correctly

Adequate knowledge of local restrictions defined as being able to correctly name 2 out of 3 exemptions for leaving home (excluding work-related reasons).

Adequate recognition of misinformation defined as reports ≤2 of garlic , antibiotics, fluvax, disinfecting postage, or herbal remedies as being preventive strategies.

**Discussion**

This study was conducted in a hard-to-reach, disadvantaged population with complex and chronic conditions who are among Australia’s most vulnerable citizens and who live in areas with the highest rates of COVID-19 in Australia. The study population included a large proportion of limited or non-English speaking respondents. We identified high rates of inadequate knowledge of symptoms, preventive strategies and restrictions, particularly from participants with limited English proficiency. Those with
limited English were also 11 times less likely than those with English to believe misinformation around preventive strategies for COVID-19. There was a high level of uncertainty and mistrust of information and its trustworthiness which varied across language groups. We found that even when adjusted for age and education, speaking a primary language other than English was associated with having less knowledge of COVID-19 symptoms compared to participants who spoke English. Being aged 65 years and over was associated with having less knowledge of misinformation compared to younger participants.

Access to timely and accurate information from a trustworthy source is essential during a pandemic. Good communication strategies can alleviate population fears and dispel misleading information and ambiguities that may lead to the adoption of practices that lack an evidence base and that put individuals and communities at risk. Health and risk communication theories have long recognised the importance of testing messages with diverse groups of people to ensure that the information has been translated in the way that it was intended(27). Provision of timely, accurate and culturally appropriate translated materials on COVID-19 was a challenge during the first and second pandemic waves in Melbourne. Information aimed at early detection, prevention, and containment of further spread of the virus changed daily and there was little opportunity to check that messages were understood accurately by all intended audiences. Our findings suggest that those with limited English were very vulnerable to misleading information, and that there was inadequate dispelling of this information by trustworthy sources. In August 2020, the Refugee Council of Australia identified that both national and state government translated coronavirus information was 'nonsensical'(28) while there were additionally multiple reports of available information often not being up to date or culturally appropriate. Along with being disproportionally at risk of contracting COVID-19, refugees and asylum seekers experience additional vulnerabilities around their ability to trust information provided by figures of authority(29). As most trustworthy information is provided by government sources, and much of it was not accurately translated, this may have further disadvantaged vulnerable communities and placed them at greater risk of contracting and spreading the virus.

To keep the whole population safe and reduce the spread of infection, governments and leaders need to understand much more about what influences individual and collective behaviours. Learnings from the 2009/2010 Australian influenza epidemic demonstrated that there was not enough research available on the complex interplay of rapidly changing epidemiology, media attention, control measures, risk perception, and public health behaviours associated with pandemics(30). The WHO survey used in this study was specifically designed to gain insight into these issues, and its application may assist to address some of these research gaps. This study has provided some new insight into relationships between demographics, knowledge, protective behaviours, perceptions, and trust in Australia. This contextually relevant knowledge on how communities are sourcing and interpreting information may help governments and health communicators to provide appropriate and equitable messaging on response measures and to address misleading information as it emerges(31).

**Conclusion**
Within a vulnerable population with complex and chronic conditions, speaking a language other than English was found to expose participants to greater risks due to inadequate knowledge. To reduce transmission, morbidity and mortality associated with COVID-19, health authorities must tailor health messaging and education to those hardest to disadvantaged communities in order to reduce disparities in health outcomes.

Declarations

Ethics approval and consent to participate

This study was approved by the NH Human Research Ethics Committee (LNR 64196). All participants were interviewed by telephone and provided verbal consent, which was documented at the time on a verbal consent form signed by the consenting researcher. This method was approved by the NH HREC and was in line with COVID-19 risk reduction strategies. Participants will be provided with a summary of results as part of NH's annual research report.

Consent for publication

Not applicable.

Availability of data and materials

De-identified participant data from this research will be shared upon reasonable request with the corresponding author.

Competing interests

All authors have completed the Unified Competing Interest form (available on request from the corresponding author) and declare: no support from any organisation for the submitted work; no financial relationships with any organisations that might have an interest in the submitted work in the previous three year, no other relationships or activities that could appear to have influenced the submitted work.

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Authors contributions

This study was conceptualised by RLJ, AB and BO. RLJ, AB, PP and MT developed the analytical strategy and overall methodology and all co-authors contributed to designing the study. RLJ, AB, MT and MK contributed to the development of the protocol and RLJ and MK applied for research funding. RLJ and AB
designed data collection tools and defined the sampling criteria. Survey data collection was co-ordinated by CB, RLJ, and conducted by CB, RLJ, NC, HM, YC, and EZ co-ordinated all interpreting support. Analysis of quantitative data was conducted by PP, MT, AS, RLJ, and AG. RLJ, CH, AB, BC and AT conducted the qualitative analysis of interview questions - these authors have access and verify the underlying data. RLJ, AB, CH, YC, TH, BO, KS, MK wrote the first draft of the manuscript and all authors contributed to and revised all sections of the manuscript and are guarantors. All authors have read, revised and approved the final manuscript.

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References

1. Barber M, Staples M, Osborne R, Clerehan R, Elder C, Buchbinder R. Up to a quarter of the Australian population may have suboptimal health literacy depending upon the measurement tool: results from a population-based survey. Health Promotion International. 2009; 24(3), 252-261.
2. Paakkari L, Okan O. COVID-19: health literacy is an underestimated problem. The Lancet Public Health. 2020;5(5):e249.
3. McCaffery K, Dodd RH, Cvejic E, Ayre J, Batcup C, Isautier JM, et al. Disparities in COVID-19 related knowledge, attitudes, beliefs and behaviours by health literacy. medRxiv. 2020.
4. Park S, Lee H, Kang M. Factors affecting health literacy among immigrants-systematic review. European Journal of Public Health. 2018;28(suppl_4):cky214. 83.
5. Jessup RL, Osborne RH, Beauchamp A, Bourne A, Buchbinder R. Health literacy of recently hospitalised patients: a cross-sectional survey using the Health Literacy Questionnaire (HLQ). BMC health services research. 2017;17(1):52.
6. Okan O, Bollweg TM, Berens E-M, Hurrelmann K, Bauer U, Schaeffer D. Coronavirus-related health literacy: A cross-sectional study in adults during the COVID-19 infodemic in Germany. International Journal of Environmental Research and public health. 2020;17(15):5503.
7. A comparative analysis of analgesic efficacy of ultrasound and shock wave therapy in the treatment of patients with inflammation of the attachment of the plantar fascia in the course of calcaneal spurs. Archives of Orthopaedic and Trauma Surgery. 1289;136(9):1289-96.
8. Gautam V, Dileepan S, Rustagi N, Mittal A, Patel M, Shafi S, et al. Health literacy, preventive COVID 19 behaviour and adherence to chronic disease treatment during lockdown among patients registered at primary health facility in urban Jodhpur, Rajasthan. Diabetes & Metabolic Syndrome: Clinical Research & Reviews. 2021;15(1):205-11.
9. Karmakar M, Lantz PM, Tipirneni R. Association of social and demographic factors with COVID-19 incidence and death rates in the US. JAMA network open. 2021;4(1):e2036462-e.

10. Hawkins RB, Charles E, Mehaffey J. Socio-economic status and COVID-19–related cases and fatalities. Public Health. 2020;189:129-34.

11. Mena GE, Martinez PP, Mahmud AS, Marquet PA, Buckee CO, Santillana M. Socioeconomic status determines COVID-19 incidence and related mortality in Santiago, Chile. Science. 2021;372(6545).

12. Liu B, Spokes P, He W, Kaldor J. High risk groups for severe COVID-19 in a whole of population cohort in Australia. BMC infectious diseases. 2021;21(1):1-9.

13. Keys C, Nanayakkara G, Onyeyekwe C, Sah RK, Wright T. Health inequalities and ethnic vulnerabilities during COVID-19 in the UK: a reflection on the PHE Reports. Feminist Legal Studies. 2021;29(1):107-18.

14. Karaye IM, Horney JA. The impact of social vulnerability on COVID-19 in the US: an analysis of spatially varying relationships. American journal of preventive medicine. 2020;59(3):317-25.

15. O’Sullivan D, Rahamathulla M, Pawar M. The impact and implications of COVID-19: An Australian perspective. The International Journal of Community and Social Development. 2020;2(2):134-51.

16. Duckett SJ, Sutton B. On entering Australia’s third year with COVID-19. Med j Aust. 2021.

17. Hashim MJ, Alsuwaidi AR, Khan G. Population risk factors for COVID-19 mortality in 93 countries. Journal of epidemiology and global health. 2020;10(3):204.

18. Jordan RE, Adab P, Cheng K. Covid-19: risk factors for severe disease and death. British Medical Journal Publishing Group; 2020.

19. Healey SJR, Ghafournia N, Massey PD, Taylor K, Andrich K, Harrison J, et al. Ezidi Voices: The Communication of COVID-19 Information Amongst a Refugee Community in Rural Australia-a Participatory Study. 2021.

20. Pickles K, Cvejic E, Nickel B, Copp T, Bonner C, Leask J, et al. COVID-19 misinformation trends in Australia: prospective longitudinal national survey. Journal of medical Internet research. 2021;23(1):e23805.

21. Australian Bureau of Statistics. Socioeconomic Index for Areas. 2016 Available at:http://www.abs.gov.au/websitedbs/censushome.nsf/home/seifa2016. Accessed September 2021.

22. Jessup RL, Osborne RH, Beauchamp A, Bourne A, Buchbinder R. Differences in health literacy profiles of patients admitted to a public and a private hospital in Melbourne, Australia. BMC health services research. 2018;18(1):134.

23. Department of Home Affairs. Settlement Reports. Available at: https://datagovau/data/dataset/settlement-reports. 2021. Accessed July 2021.

24. Government. VS. HealthLinks Chronic Care evaluation: Summary of implementation and outcomes for 2016-17. 2017. Available at: https://www2healthvicgovau/about/publications/ResearchAndReports/healthlinks-chronic-care-evaluation-summary-2016-17. Accessed September 2021.
25. World Health Organization. Survey tool and guidance: rapid, simple, flexible behavioural insights on COVID-19: 29 July 2020. 2020.

26. World Health Organization. Coronavirus disease (COVID-19). 2020 Available at: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/question-and-answers-hub/q-a-detail/coronavirus-disease-covid-19#:~:text=symptoms Accessed July 2021.

27. Fischhoff B. Baruch Fischhoff: the importance of testing messages. World Health Organization Bulletin of the World Health Organization. 2020;98(8):516-7.

28. Dalzell S. Government coronavirus messages left 'nonsensical' after being translated into other languages. ABC, 2020 Available at: https://www.abc.net.au/news/2020-08-13/coronavirus-messages-translated-to-nonsense-in-other-languages/12550520 Accessed July 2021.

29. Alemi Q, Stempel C, Siddiq H, Kim E. Refugees and COVID-19: achieving a comprehensive public health response. Bulletin of the World Health Organization. 2020;98(8):510.

30. Reintjes R, Das E, Klemm C, Richardus JH, Keßler V, Ahmad A. “Pandemic public health paradox”: time series analysis of the 2009/10 influenza A/H1N1 epidemiology, media attention, risk perception and public reactions in 5 European countries. PloS one. 2016;11(3):e0151258.

31. Betsch C, Wieler LH, Habersaat K. Monitoring behavioural insights related to COVID-19. The Lancet. 2020;395(10232):1255-6.

**Figures**

![Figure 1](image_url)
Use of information sources by language group

![Bar chart showing trust in information by language group]

**Figure 2**

Trust in information by language group

n = 183. Data shown as percentage.