A cross-sectional health literacy profile of Australian regional adults using the Health Literacy Questionnaire©

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Abstract

Objective: Health literacy is the resources and abilities required to make and enact health decisions. This study aimed to describe the health literacy of a diverse cross-section of adults in regional Victoria.

Methods: Participants were recruited from two primary care clinics differing in socioeconomic scope and through non-clinical recruitment via the town's largest football club. Health Literacy Questionnaire© measured nine distinct scales, and comprehensive demographic data were also collected. Effect-sizes and regression were used for health literacy comparison between groups.

Results: In this sample of 351 adults, health literacy strengths were observed in Scale 1: 'Feeling understood and supported by healthcare providers' (*mean* 3.29/4 ±0.5) and Scale 9: 'Understanding health information well enough to know what to do' (*mean* 4.10/5 ±0.6). Challenging areas were Scale 5: 'Appraising health information' (*mean* 2.88/4 ±0.5) and Scale 7: 'Navigating the healthcare system' (*mean* 3.84/5 ±0.6). After adjustment, living alone predicted lower scores across most scales.

Conclusions: This study showed greater health literacy barriers experienced by certain groups, particularly those who live alone and those who weren't clinically recruited.

Implications for public health: These findings have implications for further research into addressing health literacy barriers in marginalised individuals and non-clinical settings. Results from this study may inform interventions which address identified barriers.

Key words: health literacy, community health, primary health

Introduction

Health literacy is a vitally important determinant of individual and community health.[1,2] Described by Dodson and colleagues, health literacy is the characteristics and resources needed to make, and act upon, decisions that affect health.[3] Beyond a person's reading and writing abilities in clinical environments (also known as functional health literacy),[4] health literacy incorporates the role of practitioner engagement, social support for health, access to health-supporting resources and information systems.[5] Therefore, when health literacy is adequately assessed in an individual, lower scores in certain areas can represent systemic barriers to optimal health rather than representative of individual deficit.[3] In Australia, groups with low health literacy include people who live alone, people with comorbidities, Indigenous populations, people of a lower socio-economic status and culturally and linguistically diverse populations.[6–8]

Health literacy serves as a useful tool for understanding individual or population health. Firstly, suboptimal health literacy has been associated with poorer behavioural outcomes, including less consumption of fruit and vegetables,[9] poorer quality of overall diet and less daily physical activity.[10] This extends to poorer overall health status, quality of life, higher likelihood of hospitalisation and increased

mortality.[1,2] In Fan et al's[2] 2021 meta-analysis, lower health literacy scores correlated with higher mortality risk, an association which may have been underestimated due to the narrow measurement of resources and characteristics which determine an individual's health literacy.[2,3] This association can also be utilised as a means of change; Heine et al's meta analysis found that health literacy interventions conducted in low and middle-income countries were an effective method of improving chronic disease self-management behaviours.[11] In Aaby et al's 2017 study of Danish adults with cardiovascular disease, the relationship between these behaviours and one's health literacy appeared to stem largely from understanding health information enough to know what to do and engaging with practitioners.[10]

It is important to understand how interaction with clinical environments influences health literacy. For example, primary care clinics are spaces where an innumerable receipt of health information, practitioner support and referral to other health services occur, meaning the unique support needs of their clientele, and how the service responds to these, may differ.[12–16] Though a high proportion of Australians attend at least one primary care service annually, this access is not universal.[17,18] Many Australians experience barriers to sufficient access, including temporal, geographic and financial, and little data is available about engagement with these services beyond length and broad type of usage[18]. While increasing attention has been paid to health literacy's complex relationship with disadvantage, little is known about how a health service's response to this disadvantage may influence the health literacy of their consumers.[14–16,19] Given the well-established links between access to primary care and health outcomes,[20] extending this understanding to engagement with primary care may highlight barriers which can be addressed through the Optimising Health Literacy and Access (OpHeLiA) process.[3]

The OpHeLiA process is a three-phase approach to addressing issues of equity and access in a local context. Developed by Osborne and colleagues in Australia, the process has been applied to traditionally 'hard-to-reach' populations including migrants and middle aged men,[21] and has been utilised to address specific issues including chronic disease prevention and eHealth.[22,23] Briefly, phase one involves identifying local strengths and needs through data collection, phase two responds to this data by co-designing an intervention with local stakeholders, and phase three implements and iteratively improves the intervention.[3]

This study aims to conduct phase one of the OpHeLiA process by describing the health literacy profile of patients attending socio-economically opposed clinics within the same city, as well as adults sampled from a non-clinical setting.

Methods

Study design

This cross-sectional study provides data informing the first step in the Optimising Health Literacy and Access (OpHeLiA) process, described in detail elsewhere.[3,5] In short, the OpHeLiA process involves health literacy data collection in a population of interest. This data is then used for the subsequent OpHeLiA steps of planning, delivering and evaluating interventions which address health literacy barriers experienced by the target population.[3] In this case, the population of interest are community-dwelling adults of Geelong, Victoria, with diverse demographic and clinical engagement profiles.

Participants

Consenting adult participants were recruited from Geelong, Victoria; a regional Australian city with an approximate population of 250,000.[24] Geelong is Victoria's largest regional city, situated approximately one hour from the metropolitan capital, Melbourne.[24] To capture individuals at all levels of primary care engagement, two clinical and one non-clinical site were chosen as recruitment settings. The first of the clinical sites was Kardinia Health (KH), a large multidisciplinary primary care clinic, situated in the second-most disadvantaged Index of Relative Socio-economic Advantage and Disadvantage (IRSAD) quintile, but closely surrounded by suburbs of more advantaged quintiles. The second site was Corio Medical Clinic (CMC), similarly sized and staffed to KH, but positioned in, and surrounded by, areas of the most-disadvantaged IRSAD quintile.[24,25] CMC bulk-billed at the time of this study, differing to KH's mixed-billing system. As a contrasting non-clinical site, the membership fanbase of Geelong's largest professional sports team, henceforth referred to as Geelong Football Club (GFC) was chosen, with an email database of 8,757 adults predominantly from the Geelong region.[26,27]

Recruitment

To encourage diverse participation, inclusion criteria were deliberately kept broad: over 18 years of age and able to give informed consent. Over a 24-month period spanning 2018-19, different recruitment strategies were utilised at each setting, adapting to their available resources. KH used systematic sampling of patient email addresses through practice management software, where 458 patients were purposively sampled for equal age representation and invited to participate. A goal of 50 participants was set at Corio Medical Clinic (CMC) and these were recruited over a six-week period. This clinic did not collect patient email addresses; and so, paper-based opt-in recruitment was used. This involved reception staff offering survey copies to patients, who could then complete a hard copy or expression-of-interest in digital participation, and submit to a locked box. At GFC, anticipated difficulties in recruiting supporters at football matches (i.e. noise, distraction) prevented physical recruitment. Therefore, the club permitted the research team to send one email, containing a participation link, to the membership's email base of 18+ year olds. To incentivise participation, 10x randomly drawn $50 gift cards were offered to participants at each setting.

Measure

Health literacy was measured using the Health Literacy Questionnaire© (HLQ©). The HLQ© is a validated instrument developed to deliver a multi-dimensional understanding of health literacy strengths and weaknesses in a population, ultimately providing sufficient health literacy data to enable planning and implementation of OpHeLiA intervention(s) based on results.[5] This 44-item questionnaire assesses nine health literacy competencies:

- Feeling understood and supported by healthcare providers
- Having sufficient information to manage health
- Actively managing health

- Social support for health
- Appraisal of health information
- Ability to actively engage with healthcare providers
- Navigating the healthcare system
- Finding good health information
- Understanding health information enough to know what to do.

The first 23 items are concerned with individual health literacy and answered on a Likert scale of 1-4, where 1 is "strongly disagree" and 4 is "strongly agree". The remaining 21 questions focusing on healthcare system literacy are measured on a Likert scale of 1-5, where 1 is "cannot do/always difficult" and 5 is "always easy". These items are then grouped by category and averaged, providing nine scores in the aforementioned health literacy competencies between 1 and 4 for individual health literacy, or 1 and 5 for health system literacy. The HLQ© also asks if (and how) participants received help in completing the questionnaire.

Demographic information was collected using self-report, including age, sex, education level, employment status, Aboriginal/Torres Strait Island origin, birth country, language spoken at home, health care and health insurance status, and whether the individual had attended hospital in the 12 months prior to participation.

Data collection

Participants at KH and GFC were emailed a unique link to complete the survey online. While CMC participants also had this option, use of hard copy questionnaires was also utilised due to lack of available email database. This enabled participation of individuals who otherwise may not have completed the questionnaire due to lack of internet access; this is more prevalent in CMC's surrounds (22.5% of households)[28] than KH (16.3% of households).[29] Online survey data was collected in Qualtrics software (Qualtrics, Sydney, Australia), where hard copies and verbally completed surveys were also inputted by the research team.

Data analysis

Statistical analyses were undertaken using Stata 17 software (Statacorp, Texas). HLQ© scores were analysed with the pre-existing OpHeLiA template guide, which recommends using Cohen's-d effect sizes to determine whether statistically significant HLQ© scores exist between demographic groups.[3,5] Effect sizes were defined as: <0.20-0.50=small, 0.50-0.80=medium and >0.8=large.[14] This was supplemented by linear regressions, where HLQ© scores were analysed as the main variable, the demographic variable of interest as the main exposure variable and other demographic characteristics as confounding variables. For the purposes of effect size analysis, age was analysed in two groups of adults under and over 65 years of age, and site of recruitment was analysed in two groups: clinical and non-clinical (i.e. KH and CMC samples will be combined for effect size analysis). The expectation maximization (EM) algorithm was to be used for HLQ© scales missing 2-3 responses, depending on the number of questions in the scale. However, only two data points, from separate participants and separate items, from the 15,000 data points collected were missing. Thus, use of the EM was not required. Results are expressed as Mean ± SD unless stated otherwise.

Results

Over a period of eight weeks in 2018, KH acquired 103 responses (response rate 22%), GFC acquired 223 responses over four weeks (response rate 2.5%), and CMC acquired 25 responses over eight weeks in 2019 (50% of interested patients), making a total of 351 study participants. Demographic characteristics of participants are presented in Table 1. Mean participant age was 54.6 years (SD 14.9), ranging from 18–89 years old. Approximately one third (n=95, 32.7%) of participants were over 65 years of age. Female participants were more common (n=204, 58.1%), as were those born in Australia (n=306, 87.4%), those who spoke English at home (n=348, 99.15%) and did not live alone (n=284, 81%). Approximately half the participants were engaged in paid work (n=188, 53.5%), and two-thirds (n=241, 68.6%) held a tertiary qualification. Most commonly reported long-term conditions were depression/anxiety (n=93, 26.5%), back pain (n=82, 23.4%), arthritis (n=79, 22%) and asthma (n=60, 17.1%). Patients from KH sub-sample were significantly older, and participants from CMC were significantly more likely to require help completing the survey (p<0.05, results not shown).

HLQ© scores are presented in Table 2. The highest mean score in HLQ© scales 1-5 (Individual health literacy, scored 1-4) was observed for Scale 1 'Feeling understood and supported by healthcare providers' (3.29 ± SD 0.54). Scale 5 'Appraisal of health information' demonstrated the lowest mean score (2.88 ± SD 0.52). The highest mean score of scales 6–9 (Healthcare system literacy, scored 1–5) was observed for Scale 9 'Understand health information enough to know what to do' (4.1 ± SD 0.57). The lowest mean score of scales 6–9 was in Scale 7 'Navigating the healthcare system' (3.84 ± SD 0.61).

Comparison of demographic HLQ© scores, effect sizes and adjusted co-efficients are presented in Table 3. While significant differences were observed between sub-groups, effect sizes (ES) were small (-0.41 to 0.32), with the exception of the impact that living alone had on Scale 4 'Social support for health' (0.28 lower than those living with others, p<0.0001, ES=-0.57). Though smaller ES were observed (-0.41 to -0.14), living alone also predicted significantly lower scores in Scale 2 'Having sufficient information to manage health', Scale 4 'Social support for health' and Scale 9 'Understanding health information enough to know what to do'. After adjusting for covariates, living alone also became an independent predictor for Scale 5 'Appraising health information'. No significant differences between CMC and KH (clinical settings) were observed, though largest differences were in Scale 4 'Social support for health' (KH: 3.08 ± 0.56, CMC: 3.21 ± 0.50) and Scale 9 'Understanding health information enough to know what to do' (KH: 4.19 ± 0.55, CMC: 3.98 ± 0.71) (Table 4). Otherwise, differences were more apparent between CMC/KH combined (clinical settings) and GFC (non-clinical setting).

Each HLQ© scale had at least one independent predictor; the scales with the most predictors were Scale 5 'Appraising health information' and Scale 9 'Understanding health information enough to know what to do'; each predicted by female sex, tertiary education and not living alone. Higher scores in Scale 6 'Ability to actively engage with healthcare providers' and Scale 7 'Navigating the healthcare system' were both predicted by being recruited from a clinical site. Higher scores in Scale 7 'Navigating the healthcare system' were also observed in lower education and one or no illness groups. After adjusting for confounding variables (age, education, employment, recruitment setting, long term conditions and living alone), female sex

Table 1: Demographic characteristics of sample (n=351).					
Characteristic n (%)	**KH**	**CMC**	**GFC**	**Total**	**Missing**
Female	66 (64.1%)	16 (64.0%)	122 (54.7%)	204 (58.3%)	0
65 years or older	17 (16.5%)	8 (32.0%)	70 (31.4%)	95 (32.7%)	0
Lives alone	17 (16.5%)	7 (28.0%)	43 (19.3%)	67 (19%)	0
Completed high school or less	37 (35.9%)	11 (44.0%)	62 (27.8%)	110 (31.3%)	0
Born in Australia	88 (85.4%)	18 (75.0%)	200 (89.7%)	306 (87.4%)	1
Speaks English at Home	102 (99.0%)	24 (96.0%)	222 (99.6%)	348 (99.2%)	0
Aboriginal and/or Torres Strait Islander	5 (4.9%)	4 (1.8%)	0 (0.0%)	9 (2.1%)	0
Private Health Insurance	50 (48.5%)	8 (32.0%)	175 (80.7%)	233 (67.5%)	6
Health Care Card	55 (53.4%)	17 (68.0%)	56 (25.8%)	128 (37.1%)	6
Emergency presentation in last 12 months	26 (25.2%)	9 (36.0%)	32 (14.8%)	67 (19.4%)	6
Health Conditions					
2 or more long term conditions	50 (48.5%)	18 (72.0%)	147 (65.9%)	133 (37.9%)	0
Arthritis	22 (21.3%)	11 (44.0%)	47 (21.1%)	79 (22.5%)	0
Back pain	26 (25.2%)	9 (36.0%)	47 (21.1%)	82 (82%)	0
Heart condition	11 (10.6%)	7 (28.0%)	26 (11.7%)	42 (12%)	0
Asthma	17 (16.5%)	13 (52.0%)	30 (13.5%)	60 (17.1%)	0
Cancer	3 (2.9%)	1 (4.0%)	13 (5.8%)	12 (3.4%)	0
Depression/anxiety	44 (42.7%)	13 (52.0%)	36 (16.1%)	93 (26.5%)	0
Diabetes	11 (10.6%)	8 (32.0%)	18 (8.1%)	37 (10.6%)	0
Stroke	1 (0.9%)	1 (4.0%)	1 (0.5%)	3 (0.9%)	0
Other	33 (32.0%)	5 (20.0%)	50 (22.4%)	94 (26.8%)	0
None	23 (22.3%)	1 (4.0%)	76 (34.1%)	100 (28.5%)	0

also predicted higher scores in Scale 8 'Ability to find good health information', and Scale 3 'Ability to actively manage health'.

Overall, the demographic characteristic most predictive of HLQ© scale scores was not living alone (five of nine scales), followed by being recruited from a clinical site (three of nine scales). Age was not an independent predictor for any HLQ© scales.

Discussion

This study describes the health literacy strengths and challenges of a regional Victorian population from varying recruitment settings. Health literacy barriers were observed in finding and appraising the quality of health information, as well as navigating the healthcare system. These findings are consistent with previous Australian studies concerned with health literacy, suggesting that this sample population from Victoria's largest regional city experience similar strengths and difficulties as the broader Australian population.[6,14,15,19] However, this similarity should be interpreted cautiously, given the small cross-section of the population studied.

These results illuminate a number of local characteristics which may benefit from a responsive OpHeLiA intervention. Firstly, associations between living alone and lower health literacy were found in this study, which interestingly spanned beyond dimensions of social support. Previous research has established a poorer quality of life and higher mortality in those who live alone, with several broad social factors affecting someone's living status.[30] Furthermore, those with a chronic disease often rely on precarious routines of self-management with little decision-making support, meaning a health-literacy intervention, such as those identified in Heine et al's meta-analysis, may be particularly beneficial for people living alone.[11,31]

Although consistent with other literature, difficulties appear more pronounced in our living alone group than previous studies.[6,14,15,19] Fewer health literacy disparities were observed between those who do and don't live alone in Hosking et al.'s 2018 sample of 713 women from the same geographic area as the present study.[15] Furthermore, the Australian Bureau of Statistics' health literacy survey of 5,790 Australian adults showed lowest HLQ© scores in people who live

Table 2: HLQ(c) scores in whole sample (n=351).			
Scale	**Mean (SD) Median (IQR)**		**Min**	**Max**
1 Feeling understood and supported by healthcare providers	3.29 (0.5)	3.25 (0.75)	1.0	4.0
2 Having sufficient information to manage my health	3.07 (0.5)	3.00 (0.50)	1.5	4.0
3 Actively managing my health	3.03 (0.5)	3.00 (0.60)	1.2	4.0
4 Social support for health	3.10 (0.5)	3.00 (0.60)	1.4	4.0
5 Appraisal of health information	2.88 (0.5)	3.00 (0.60)	1.2	4.0
6 Ability to actively engage with healthcare providers	4.02 (0.6)	4.00 (0.80)	2.0	5.0
7 Navigating the healthcare system	3.84 (0.6)	3.83 (0.67)	1.8	5.0
8 Ability to find good health information	3.94 (0.6)	4.00 (0.60)	2.2	5.0
9 Understand health information enough to know what to do	4.10 (0.6)	4.00 (0.80)	1.6	5.0

Table 3: Mean HLQ© score (SD), effect size (95% CI) and adjusted co-efficient (95% CI) for demographic groups.										
		Scale 1: Feeling understood and supported by healthcare providers	Scale 2: Having sufficient information to manage my health	Scale 3: Actively managing my health	Scale 4: Social support for health	Scale 5: Appraisal of health information	Scale 6: Ability to actively engage with healthcare providers	Scale 7: Navigating the healthcare system	Scale 8: Ability to find good health information	Scale 9: Understand health information enough to know what to do
		Mean Score (+SD)								
		Score Range 1-4				Score Range 1-5				
Sex	Male	3.32 (0.51)	3.05 (0.50)	2.97 (0.56)	3.13 (0.50)	**2.79 (0.56)**	4.02 (0.63)	3.82 (0.59)	**3.86 (0.59)**	**4.00 (0.56)**
	Female	3.27 (0.57)	3.08 (0.49)	3.06 (0.52)	3.08 (0.53)	**2.95 (0.48)****	4.02 (0.65)	3.86 (0.62)	**4.00 (0.57)***	**4.18 (0.56)****
Effect size		0.09 (-0.12, 0.30)	-0.07 (-0.28, 0.15)	-0.16 (-0.37, 0.05)	0.11 (-0.11, 0.32)	**-0.31 (-0.53, -0.10)**	-0.01 (-0.22, 0.20)	-0.07 (-0.28, 0.14)	**-0.25 (-0.47, -0.04)**	**-0.33 (-0.54, -0.11)**
Adjusted co-efficient (95% CI)		-0.02 (-0.14, 0.09)	0.05 (-0.06, 0.16)	**0.14 (0.02, 0.25)***	-0.02 (-0.13, 0.09)	**0.21 (0.09, 0.32)****	0.02 (-0.12, 0.16)	0.05 (-0.08, 0.18)	**0.16 (0.03, 0.28)***	**0.21 (0.09, 0.33)****
Age (years)	<65	3.26 (0.57)	3.05 (0.50)	2.99 (0.56)	3.08 (0.54)	2.87 (0.53)	3.99 (0.66)	3.82 (0.64)	3.96 (0.60)	4.13 (0.56)
	>65	3.38 (0.47)	3.11 (0.47)	3.11 (0.48)	3.16 (0.45)	2.89 (0.50)	4.11 (0.59)	3.91 (0.50)	3.89 (0.53)	4.05 (0.59)
Effect size for ±65 years old		-0.23 (-0.46, 0.01)	-0.11 (-0.35, 0.12)	-0.22 (-0.45, 0.02)	-0.16 (-0.40, 0.08)	-0.04 (-0.27, 0.20)	-0.19 (-0.43, 0.04)	-0.15 (-0.38, 0.09)	0.12 (-0.11, 0.36)	0.14 (-0.10, 0.38)
Adjusted co-efficient (95% CI)		0.08 (-0.06, 0.23)	0.10 (-0.04, 0.23)	0.11 (-0.03, 0.26)	0.10 (-0.03, 0.24)	-0.01 (-0.15, 0.12)	0.14 (-0.03, 0.31)	0.12 (-0.04, 0.28)	-0.02 (-0.18, 0.14)	-0.02 (-0.17, 0.13)
Employed	Yes	**3.21 (0.58)**	3.06 (0.51)	3.00 (0.57)	3.08 (0.53)	2.84 (0.54)	**3.95 (0.65)**	3.79 (0.63)	3.94 (0.59)	4.12 (0.55)
	No	**3.39 (0.48)****	3.08 (0.48)	3.06 (0.50)	3.13 (0.51)	2.92 (0.50)	**4.10 (0.63)***	3.90 (0.58)	3.94 (0.57)	4.09 (0.59)
Effect Size		**-0.35 (-0.56, -0.14)**	-0.05 (-0.26, 0.16)	-0.11 (-0.32, 0.10)	-0.10 (-0.31, 0.11)	-0.15 (-0.36, 0.06)	**-0.22 (-0.43, -0.01)**	-0.18 (-0.39, 0.03)	0.01 (-0.20, 0.22)	0.05 (-0.16, 0.26)
Adjusted co-efficient (95% CI)		0.13 (0.00, 0.26)	0.00 (-0.12, 0.12)	0.06 (-0.08, 0.19)	0.03 (-0.10, 0.15)	0.12 (0.00, 0.25)	0.09 (-0.07, 0.24)	0.08 (-0.07, 0.22)	0.03 (-0.11, 0.17)	0.01 (-0.12, 0.15)
Education	High School, trade or TAFE	**3.34 (0.54)**	3.07 (0.52)	3.01 (0.55)	3.09 (0.54)	2.84 (0.51)	4.04 (0.68)	3.85 (0.63)	**3.88 (0.57)**	**4.05 (0.58)**
	Tertiary	**3.23 (0.55)***	3.07 (0.45)	3.05 (0.53)	3.11 (0.49)	2.93 (0.53)	3.99 (0.59)	3.83 (0.58)	**4.03 (0.58)***	**4.18 (0.53)***
Effect size		**0.21 (0.00, 0.43)**	-0.01 (-0.22, 0.20)	-0.06 (-0.28, 0.15)	-0.03 (-0.24, 0.19)	-0.17 (-0.38, 0.04)	0.08 (-0.13, 0.29)	0.02 (-0.19, 0.23)	**-0.25 (-0.47, -0.04)**	**-0.24 (-0.45, -0.03)**
Adjusted co-efficient (95% CI)		-0.05 (-0.16, 0.07)	0.02 (-0.09, 0.13)	0.05 (-0.08, 0.17)	0.03 (-0.09, 0.14)	**0.12 (0.01, 0.24)***	-0.02 (-0.16, 0.13)	0.02 (-0.12, 0.16)	**0.17 (0.04, 0.30)****	-0.09 (-0.32, 0.14)
Sub-sample	Clinical	**3.40 (0.50)**	3.11 (0.47)	2.98 (0.56)	3.11 (0.55)	2.86 (0.56)	**4.13 (0.68)**	**3.93 (0.64)**	4.01 (0.61)	4.15 (0.59)
	Non-	**3.23 (0.56)****	3.05 (0.51)	3.05 (0.53)	3.10 (0.50)	2.89 (0.49)	**3.96 (0.61)***	**3.79 (0.58)***	3.90 (0.56)	4.08 (0.55)
Effect size		**0.32 (0.10, 0.54)**	0.11 (-0.10, 0.33)	-0.14 (-0.35, 0.08)	0.02 (-0.19, 0.24)	-0.07 (-0.28, 0.15)	**0.27 (0.05, 0.49)**	**0.23 (0.02, 0.45)**	0.18 (-0.03, 0.40)	0.12 (-0.09, 0.34)
Adjusted co-efficient (95% CI)		**-0.15 (-0.27, -0.03)***	-0.07 (-0.18, 0.04)	0.07 (-0.05, 0.19)	-0.03 (-0.14, 0.09)	0.07 (-0.05, 0.19)	**-0.19 (-0.34, -0.04)****	**-0.16 (-0.30, -0.03)***	-0.11 (-0.24, 0.02)	-0.06 (-0.19, 0.06)
Long term conditions	0 or 1 illnesses	**3.22 (0.55)**	3.10 (0.47)	3.02 (0.60)	3.13 (0.47)	2.85 (0.53)	4.06 (0.63)	**3.91 (0.57)**	3.99 (0.57)	4.14 (0.56)
	2 or more	**3.37 (0.53)***	3.03 (0.52)	3.03 (0.47)	3.07 (0.57)	2.91 (0.51)	3.98 (0.66)	**3.77 (0.64)***	3.88 (0.59)	4.07 (0.57)
Effect size		**-0.27 (-0.48, -0.06)**	0.14 (-0.07, 0.35)	0.00 (-0.21, 0.21)	0.12 (-0.09, 0.33)	-0.12 (-0.33, 0.08)	0.11 (-0.10, 0.32)	**0.24 (0.03, 0.45)**	0.19 (-0.02, 0.40)	0.14 (-0.07, 0.35)
Adjusted co-efficient (95% CI)		0.10 (-0.01, 0.21)	-0.08 (-0.19, 0.02)	-0.01 (-0.12, 0.11)	-0.07 (-0.18, 0.04)	0.06 (-0.05, 0.17)	-0.12 (-0.26, 0.01)	**-0.19 (-0.31, -0.06)****	-0.12 (-0.24, 0.00)	-0.08 (-0.20, 0.04)
Lives alone	Yes	**3.12 (0.48)**	**2.96 (0.44)**	2.95 (0.45)	**2.87 (0.55)**	2.79 (0.44)	3.95 (0.59)	3.74 (0.57)	3.86 (0.52)	**3.96 (0.54)**
	No	**3.34 (0.55)****	**3.10 (0.50)***	3.04 (0.56)	**3.15 (0.49)*****	2.90 (0.54)	4.04 (0.65)	3.86 (0.62)	3.96 (0.59)	**4.14 (0.57)***
Effect size		**-0.41 (-0.68, -0.14)**	**-0.29 (-0.56, -0.02)**	-0.17 (-0.44, 0.09)	**-0.57 (-0.84, -0.30)**	-0.22 (-0.49, 0.04)	-0.14 (-0.41, 0.12)	-0.20 (-0.47, 0.06)	-0.18 (-0.44, 0.09)	-0.31 (-0.58, -0.05)
Adjusted co-efficient (95% CI)		**0.24 (0.10, 0.39)****	**0.15 (0.02, 0.29)***	0.13 (-0.01, 0.28)	**0.29 (0.16, 0.43)*****	**0.16 (0.03, 0.30)***	0.11 (-0.06, 0.28)	0.14 (-0.02, 0.30)	0.12 (-0.03, 0.28)	**0.21 (0.06, 0.36)****

Bolded results indicate a p-value of <0.05 for difference in means, tested by two sample t-tests and linear regression, or effect sizes, tested by cohen's d. Effect sizes are interpreted as <0.20-0.50 = "small", 0.50-0.80 = "medium" and >0.8 = "large". SD = standard deviation 95% CI = 95% confidence intervals * p-value <0.05 ** p value <0.01 *** p value <0.001

Table 4: Comparison of HLQ[(c)] scores between clinical sub-samples.

	Scale 1: Feeling understood and supported by healthcare providers	Scale 2: Having sufficient information to manage my health	Scale 3: Actively managing my health	Scale 4: Social support for health	Scale 5: Appraisal of health information	Scale 6: Ability to actively engage with healthcare providers	Scale 7: Navigating the healthcare system	Scale 8: Ability to find good health information	Scale 9: Understand health information enough to know what to do
	Score Range 1-4					Score Range 1-5			
	Mean Score (±SD)								
Clinic KH	3.40	3.09	2.99	3.08	2.85	4.12	3.92	4.02	4.19
CMC	3.41	3.16	2.94	3.21	2.88	4.16	3.96	3.97	3.98
Effect size	-0.01 (-0.45, 0.42)	-0.14 (-0.58, 0.29)	0.09 (-0.34, 0.53)	-0.23 (-0.66, 0.21)	-0.06 (-0.49, 0.38)	-0.06 (-0.49, 0.38)	-0.05 (-0.49, 0.39)	0.08 (-0.36, 0.52)	0.37 (-0.07, 0.81)

Bolded results indicate a p-value of <0.05 for difference in means, tested by two sample t-tests and linear regression, or effect sizes, tested by cohen's d. Effect sizes are interpreted as <0.20-0.50 = "small", 0.50-0.80 = "medium" and >0.8 = "large".SD = standard deviation

alone and single parents with dependent children, suggesting co-habitation may support health literacy to varying degrees, based on the extent to which household relationships influence health literacy.[6] More detailed research may elucidate the relationship between living alone and several dimensions of health literacy. In a local context, working with people who live alone and key stakeholders in their health may address access and engagement needs of this group.

Despite known associations, relative advantage or disadvantage of clinical site was not observed to be associated with health literacy; rather, recruitment from any clinical site independently predicted higher health literacy in practitioner support, practitioner engagement and healthcare system navigation. Though this result may be expected due to the inherent social support offered by co-habiting, the extent to which these differences were observed underscores the importance of targeting health literacy interventions at those disengaged, and/or underserved by primary health care systems. The Royal Australian College of General Practitioners' 2021 survey of 1,386 Australians found that 17% of their sample had not visited a general practitioner in the previous 12 months, and 23.7% did not have a regular general practitioner.[32] Engaging these populations in regular primary care should be the focus of future research and policy, thereby building health literacy capacity in these currently underserved groups. These results may also provide an opportunity to optimise access to primary care services in the Geelong region.

Overall, these findings support social and practitioner engagement as facilitators to an individual's wider health literacy, beyond expected HLQ[©] scales (i.e. social support for health, feeling understood and supported by healthcare providers). Current health literacy research overwhelmingly recommends practices to be adopted by practitioners when interacting with patients, such as use of teach-back.[33–35] However, the findings presented here suggest a focus on reducing isolation, from both social and clinical participation, may be just as pertinent for improving health literacy. Future research should more closely investigate the relationship between isolation and health literacy, particularly in the current COVID-19 environment which has increased social isolation and impacted on engagement with healthcare services.

Strengths & limitations

These findings should be considered alongside study limitations. The cross-sectional design limits findings to associations, rather than causality. Also, the convenience sample studied may introduce selection bias, particularly risking over-representation of individuals who take greater interest in their own health than other community members, potentially over-estimating HLQ [©] scores. While this study took care to recruit from both clinical and non-clinical sites, this introduced a need for adapted recruitment strategies at each site, potentially affecting results beyond expected demographic differences. For example, CMC sub-sample had a significantly higher number of respondents who required help completing the survey, likely due to a greater emphasis on non-digital methods of survey completion in the recruitment phase. However, this did enable a wider range of participants, who may have otherwise faced digital or time barriers to participation. Football club membership as a non-clinical setting provided a more diverse cross-section of participants than clinical settings alone, but did not fully reflect the demographic diversity of the study's catchment as a whole,[24] or have an optimal

response rate due to brevity of email campaign. Though great care was taken to communicate the unrelatedness of participation on patient care, social desirability bias may have compelled some clinic-based participants to provide favourable HLQ© answers, particularly in Scale 1 'Feel understood and supported by healthcare providers' and Scale 6 'Actively engage with healthcare providers'. Future studies should seek more representative recruitment methods, such as random population sampling. These methods may also yield greater response than the low rate observed in GFC sub-group.

While the HLQ© is a robust measurement tool, it should be noted that it relies on participant self-report, introducing social desirability bias. However, the HLQ©'s multi-dimensional, validated and reliable measurement of health literacy render it a more appropriate tool than singular-dimension, objective tools such as the TOFHLA or REALM.[36,37] A minimally clinically important difference for the HLQ© has not been established, though HLQ© differences of 0.5 or greater have been deemed meaningful in previous literature,[14] which the sample reported here did not reach. While HLQ© Scale 6: "Ability to actively engage with healthcare providers" reflects an individual's clinical engagement, future research may supplement this with objective measurements, such as patient visits reported in clinical records.

The use of the HLQ© in this study provided multidimensional insight into health literacy, where other tools often examine only one. Despite limitations, this study provided novel insights into the health literacy of general populations not recruited in clinical settings and provided three sub-samples of varying socio-economic status and clinical engagement.[6] In addition, these results were the first to stratify by recruitment setting and found a marked increase in healthcare engagement in clinically recruited participants.

Conclusions

This study provided a cross-sectional understanding of health literacy in a population from both clinical and non-clinical settings, and highlighted the importance of engaging populations who may be underserved by current health care systems. Findings from this study showed potential health literacy disparities by levels of connectedness with social and healthcare supports.

Results from this study can now be used to inform the development of an OpHeLiA intervention, to address identified health literacy barriers in the sample and similar regional populations. Future studies should further investigate relationships between social isolation, health literacy and healthcare participation by random sampling of demographically representative and larger populations.

Ethics

This project was deemed low-risk and approved by Deakin University's Faculty of Health Human Ethics Advisory Group (#HEAG-H 33_2017) and Kardinia Health's Research Committee in 2017. All recruitment settings provided organisational consent for participation, and each participant was provided a plain language statement prior to obtaining informed consent.

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Conflict of interest

None.

References

1. Berkman ND, Sheridan SL, Donahue KE, Halpern DJ, Crotty K. Low health literacy and health outcomes: An updated systematic review. *Ann Intern Med* 2011; **155**(2):97–107.
2. Fan ZY, Yang Y, Zhang F. Association between health literacy and mortality: A systematic review and meta-analysis. *Arch Public Health* 2021;**79**(1):119.
3. Beauchamp A, Dodson S, Batterham R, Asproloupos D, Osborne R. *Ophelia Manual – How to Apply the Ophelia Health Literacy Process for Improving Health Outcomes. 2017. Melbourne (AUST)*. Swinburne University of Technology; 2019.
4. Nutbeam D, Lloyd JE. Understanding and responding to health literacy as a social determinant of health. *Annu Rev Public Health* 2021;**42**:159–73.
5. Osborne RH, Batterham RW, Elsworth GR, Hawkins M, Buchbinder R. The grounded psychometric development and initial validation of the Health Literacy Questionnaire (HLQ). *BMC Public Health* 2013;**13**:658.
6. Australian Bureau of Statistics. *National Health Survey: Health Literacy*. Canberra: (AUST): ABS; 2019.
7. Choudhry FR, Ming LC, Munawar K, Zaidi STR, Patel RP, Khan TM, et al. Health literacy studies conducted in australia: A scoping review. *Int J Environ Res Public Health* 2019;**16**(7):1112.
8. Adams RJ, Appleton SL, Hill CL, Dodd M, Findlay C, Wilson DH. Risks associated with low functional health literacy in an Australian population. *Med J Aust* 2009; **191**(10):530–4.
9. Lim S, Beauchamp A, Dodson S, O'Hara J, McPhee C, Fulton A, et al. Health literacy and fruit and vegetable intake in rural Australia. *Public Health Nutr* 2017; **20**(15):2680–4.
10. Aaby A, Friis K, Christensen B, Rowlands G, Maindal HT. Health literacy is associated with health behaviour and self-reported health: A large population-based study in individuals with cardiovascular disease. *Eur J Prev Cardiol* 2017; **24**(17):1880–8.
11. Heine M, Lategan F, Erasmus M, Lombaard CM, Mc Carthy N, Olivier J, et al. Health education interventions to promote health literacy in adults with selected non-communicable diseases living in low-to-middle income countries: A systematic review and meta-analysis. *J Eval Clin Pract* 2021; **27**(6):1417–28.
12. Kang M, Robards F, Luscombe G, Sanci L, Usherwood T. The relationship between having a regular general practitioner (GP) and the experience of healthcare barriers: A cross-sectional study among young people in NSW, Australia, with oversampling from marginalised groups. *BMC Fam Pract* 2020; **21**(1):220.
13. Senn N, Cohidon C, Breton M, Levesque JF, Zuchuat JC. Patterns of patient experience with primary care access in Australia, Canada, New Zealand and Switzerland: A comparative study. *Int J Qual Heal Care* 2019;**31**(9):G126–32.
14. Beauchamp A, Buchbinder R, Dodson S, Batterham RW, Elsworth GR, McPhee C, et al. Distribution of health literacy strengths and weaknesses across socio-demographic groups: A cross-sectional survey using the Health Literacy Questionnaire (HLQ). *BMC Public Health* 2015;**15**:678.
15. Hosking SM, Brennan-Olsen SL, Beauchamp A, Buchbinder R, Williams LJ, Pasco JA. Health literacy in a population-based sample of Australian women: A cross-sectional profile of the Geelong Osteoporosis Study. *BMC Public Health* 2018;**18**(1):876.
16. Beauchamp A, Sheppard R, Wise F, Jackson A. Health literacy of patients attending cardiac rehabilitation. *J Cardiopulm Rehabil Prev* 2020;**40**(4):249–54.
17. Swerissen H, Duckett S. *Mapping Primary Care in Australia [report]. Melbourne (AUST)*. Grattan Institute; 2018.
18. Corscadden L, Levesque JF, Lewis V, Strumpf E, Breton M, Russell G. Factors associated with multiple barriers to access to primary care: An international analysis. *Int J Equity Health* 2018;**17**(1):28.
19. Bourne A, Peerbux S, Jessup R, Staples M, Beauchamp A, Buchbinder R. Health literacy profile of recently hospitalised patients in the private hospital setting: A cross sectional survey using the Health Literacy Questionnaire (HLQ). *BMC Health Serv Res* 2018;**18**(1):877.
20. Australian Institute of Health and Welfare. *Coordination of Health Care: Experiences of Barriers to Accessing Health Services among Patients Aged 45 and Over*. Canberra: (AUST): AIHW; 2016.
21. Kinsman L, Radford J, Elmer S, Ogden K, Randles S, Jacob A, et al. Engaging 'hard-to-reach' men in health promotion using the OPHELIA principles: Participants' perspectives. *Health Promot J Austr* 2021;**32**(Suppl 1):33–40.
22. Banbury A, Nancarrow S, Dart J, Gray L, Dodson S, Osborne R, et al. Adding value to remote monitoring: Co-design of a health literacy intervention for older people with chronic disease delivered by telehealth - The telehealth literacy project. *Patient Educ Couns* 2020;**103**(3):597–606.
23. Dias S, Gama A, Maia AC, Marques MJ, Campos Fernandes A, Goes AR, et al. Migrant communities at the center in co-design of health literacy-based innovative solutions for non-communicable diseases prevention and risk reduction:

Application of the OPtimising HEalth LIteracy and Access (Ophelia) Process. *Front Public Health* 2021;**9**:639405.

24. Australian Bureau of Statistics. *Greater Geelong (C) 2016 Census All Persons QuickStats*. Canberra: (AUST): ABS; 2016.

25. Australian Bureau of Statistics. *Census of Population and Housing: Socio-Economic Indexes for Areas (SEIFA), Australia*. Canberra: (AUST): ABS; 2016. 2018.

26. Geelong Football Club. Financial Statements *[Annual Report]*. Geelong (AUST): GFC; 2020. 2020.

27. Hudson F. Interactive footy fan map: AFL clubs' membership heartlands. *Herald Sun* 2015 Mar. 9;8:54pm.

28. Australian Bureau of Statistics. *Corio 2016 Census All Persons QuickStats*. Canberra: (AUST): ABS; 2017.

29. Australian Bureau of Statistics. *Belmont (C) 2016 Census All Persons QuickStats*. Canberra: (AUST): ABS; 2017.

30. Forward C, Khan HTA, Fox P. The health and well-being of older women living alone in the United Kingdom and beyond: A scoping review. *J Women Aging* 2022;**34**(1):79–92.

31. Haslbeck JW, McCorkle R, Schaeffer D. Chronic illness self-management while living alone in later life: A systematic integrative review. *Res Aging* 2012;**34**(5):507–47.

32. Royal Australian College of General Practitioners. *A Unique Insight into the State of Australian General Practice*. Melbourne (AUST): RACCP; 2020.

33. Morony S, Weir KR, Bell KJL, Biggs J, Duncan G, Nutbeam D, et al. A stepped wedge cluster randomised trial of nurse-delivered Teach-Back in a consumer telehealth service. *PLoS One* 2018;**13**(10):e0206473.

34. Ha TT DINH, Nguyen NT, Bonner A. Health literacy profiles of adults with multiple chronic diseases: A cross-sectional study using the Health Literacy Questionnaire. *Nurs Health Sci* 2020;**22**(4):1153–60.

35. Jessup RL, Osborne RH, Buchbinder R, Beauchamp A. Using co-design to develop interventions to address health literacy needs in a hospitalised population. *BMC Health Serv Res* 2018;**18**(1):989.

36. Baker DW, Williams MV, Parker RM, Gazmararian JA, Nurss J. Development of a brief test to measure functional health literacy. *Patient Educ Couns* 1999;**38**(1):33–42.

37. Davis TC, Crouch MA, Long SW, Jackson RH, Bates P, George RB, et al. Rapid assessment of literacy levels of adult primary care patients. *Fam Med* 1991;**23**(6):433–5.