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ORIGINAL RESEARCH

Impact of socioeconomic status on utilisation of a Virtual Emergency Department: An exploratory analysis

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Abstract

Objective: To explore whether utilisation of a Virtual Emergency Department (VVED) differs according to socioeconomic status (SES).

Methods: A retrospective analysis was undertaken of data from the VVED – a telehealth service that provides care for patients across Victoria, Australia with non-life-threatening emergencies. The study included all individuals who presented to the VVED between July 2022 and June 2023 through the two most common referral pathways (self-referral and ambulance referral). Area-level SES was ascertained by matching residential postcodes to the corresponding Australian Bureau of Statistics (ABS) Index of Relative Socioeconomic Advantage and Disadvantage (IRSAD) decile. IRSAD scores were divided into quintiles (1 = lowest SES, 5 = highest SES) and multivariable logistic regression modelling was used to analyse associations between the SES quintile and referral pathway, presented as odds ratios (ORs) with 95% confidence intervals (CIs).

Results: There were 68 598 participants included in the analyses (mean age: 36.6 years; 58.4% female). Compared to SES quintile 3, higher odds of self-referral to the VVED were observed in the two most advantaged SES groups (Quintile 4; adjusted OR [aOR] = 1.16; 95% CI: 1.06–1.26; $P = 0.001$) (Quintile 5; aOR = 1.38; 95% CI: 1.25–1.52; $P < 0.001$). Conversely, lower odds of self-referral were observed in the most disadvantaged SES group (Quintile 1; aOR = 0.82; 95% CI: 0.75–0.90; $P < 0.001$).

Conclusions: The present study demonstrated a relatively even utilisation of the VVED service across SES population groups. The use of healthcare provider pathways, such as ambulance paramedics, may increase equitable access to telehealth. Clinical attention should be directed toward specific social groups in the emergency care setting.

Key findings

- Individuals from higher SES areas were significantly more likely to self-refer to the VVED, while those from the most disadvantaged SES areas were more likely to access the VVED through the ambulance referral pathways.
- Younger individuals, those who identified as First Nations, those with a spouse/partner, and those who spoke English as their primary language at home were more likely to self-refer to the VVED.
- The VVED was accessed by individuals across all SES levels, with healthcare provider pathways such as ambulance referrals potentially playing a critical role in improving access to virtual emergency care in disadvantaged populations.

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Key words: *emergency care, social disadvantage, socioeconomic status, telehealth, virtual care.*

Introduction

Virtual healthcare has seen consistent growth and adoption over

recent decades because of improvements in technology,[1] which accelerated exponentially following the COVID-19 pandemic. Several virtual and digital healthcare technologies are now widely applied (e.g. clinician decision support systems, online risk assessment tools, mobile health applications) and are promising approaches to improving access to healthcare, are convenient for patients, and have been shown to improve staff efficiency and patient satisfaction.[2,3] However, notable barriers to the implementation of virtual healthcare remain including privacy concerns, diagnosis and treatment constraints because of lack of a physical examination, and reduced uptake in vulnerable population groups.[2,4,5]

The prevalence of chronic diseases follows a social gradient, whereby higher incidence is observed in low socioeconomic status (SES) populations.[6,7] Individuals from lower SES populations have higher rates of ambulance callouts, ED presentations, hospitalisations, and primary care physician visits compared to their in higher SES counterparts.[8–10] Despite an increasing number of virtual care interventions available to consumers, the efficacy of virtual services in mitigating healthcare disparities remains unclear.[11] A recent scoping review evaluating inequity in access and delivery of virtual care interventions reported that low SES status was associated with lower use of virtual care services.[12] Other cross-sectional studies have also found that patients residing in socioeconomic disadvantaged sreas are less likely to participate in telemedicine visits.[13,14] Hesitancy and negative attitudes toward using digital health interventions within low SES populations may explain this.[15,16]

Despite healthcare systems being reliant on a patient's ability to navigate the digital world, it remains disputed as to why some communities are less able, or less likely, to successfully engage with emergency virtual care. The present study aimed to explore whether uptake of the Victorian Virtual Emergency Department (VVED) differs according to social disadvantage and to determine any differences in referral pathways by SES.

Methods

Study design and setting

This was a retrospective analysis of the VVED service. A detailed description of the VVED model of care has been described elsewhere[17]; therefore, a brief overview is provided below.

The VVED was established at the Northern Hospital in October 2020 with the main goal of diverting low-acuity patients from the hospital's ED to reduce overcrowding during the COVID-19 pandemic. In March 2022, the virtual triage service expanded to a statewide model of care and was made available to all individuals across Victoria, Australia, 24 h a day/7 days a week. The service utilises a telehealth model to provide real-time online audio-visual consultations to assess and manage patients and facilitate either complete or streamlined ongoing care. The service is accessed *via* the VVED website and patients can interact with telehealth services from any personal device with a camera (mobile phone, PC, tablet). Patients can access the VVED through various pathways: self-referral; Ambulance Victoria (*via* paramedics); residential aged care facilities; urgent care centres, or other healthcare professional practices such as general practitioners and community nurses.

Participants

The analysis included all individuals who presented to the VVED between 1 July 2022 and 30 June 2023 through the two largest referral pathways:

1. *Self-referral*: Individuals self-refer *via* the patient pathway on the VVED website, are placed in a virtual triage queue and a virtual triage consultation is undertaken by an emergency care nurse. They are then either provided with self-care advice, referred to outpatient/primary care services, recommended transfer to a physical ED, or placed in a waiting room to be assessed further by a clinician or specialist nurse practitioner.
2. *Ambulance Victoria referral*: Paramedics caring for individuals had the option to undertake a VVED consultation with their patients instead of transporting them to an ED. This pathway could be accessed from 'in-field' locations such as private homes or residential aged care facilities. This decision is made by the paramedics on scene; however, the patient has to consent to the consult. Ambulance referrals were not eligible for a VVED consultation for the following reasons: the main presenting problem was for suspected neck of femur fracture, acute injury causing severe pain, a new significant limitation on function, acute mental health condition, or alcohol or other drug intoxication; or if the patient was younger than 3 months.

Only data from the participants' first presentation were collected to ensure the independence of observations and avoid potential bias with recurrent visits skewing the results.[18]

Study outcomes

Information on participant demographics and VVED presentation details were extracted from VVED data including age, gender, marital status, postcode, Aboriginal and/or Torres Strait Islander origin, country of birth, primary language spoken at home, and triage category.

Area-level SES was ascertained by matching the residential postcode of each participant to the corresponding Australian Bureau of Statistics (ABS) Census Collection District for 2021, after which ABS software was used to determine the Socio-Economic Indexes for Areas (SEIFA) value. SEIFA is a collection of four separate indices, derived from Australian Census data and constructed from different variables, that provides a measure to rank the level of disadvantage or advantage at the area level.[19] For these analyses, we employed the Index of Relative Socioeconomic Advantage and Disadvantage (IRSAD), which encompasses both social advantage and disadvantage, providing a more comprehensive understanding of the socioeconomic characteristics. IRSAD considers indicators such as income, education, employment, and housing, offering a multidimensional view of population

SES. Participants were assigned to a category of social disadvantage according to cut points for SEIFA values (1–10). A low score as measured by the IRSAD represents a more disadvantaged area.[19]

Statistical analyses

Participants were divided by VVED referral pathway (self-referral/ambulance referral). Descriptive and clinical characteristics were summarised as mean (SD) or frequency (percentage) and compared using independent *t*-tests for continuous data or chi-squared tests for categorical data. IRSAD scores were divided into quintiles (1 = most disadvantaged, 5 = least disadvantaged) and logistic regression modelling was used to analyse associations between the SES quintile and referral pathway, presented as odds ratios (ORs) with 95% confidence intervals (CIs). Quintile 3 was selected as the reference group for SES comparisons in order to enable a comprehensive exploration of relative differences in outcomes across varying socioeconomic strata, as applied in our previous work.[20] A *P*-value of <0.05 was considered statistically significant. Because of the potential for confounding, two multivariable models were built; one which included age and sex and the other further adjusted for covariates that were significantly associated with SES within univariable models. While univariate analyses did not reveal a significant association between sex and referral pathway, we chose to include this in the final multivariable regression model to account for any latent confounding effects that may exist. The Variance Inflation Factor was utilised to examine the presence of collinearity among variables included in each model.[21] Analyses were performed using STATA statistical software, version 18 (Stata Corporation, Inc., College Station, TX, USA).

Ethics and consent

This project has been approved by St Vincent's Hospital Human Research Ethics Committee (Project ID: 82094). A waiver of consent for the use of patient information was obtained from participants during the VVED registration process.

Results

Participants

A total of 103 015 patients presented to VVED during the study period. After the removal of individuals residing outside Victoria ($n = 873$), subsequent presentations of individuals ($n = 20\,794$) and individuals who presented *via* other referral pathways ($n = 12\,750$), there were 68 598 participants included in the analyses. Table 1 summarises participant characteristics for the whole study cohort. The study cohort had a mean age of 36.6 years and consisted of mostly women ($n = 40\,073$; 58.4%). Overall, 46 983 participants self-referred to the VVED and 21 615 participants were referred *via* ambulance (68.5% *vs* 31.5%, respectively). In terms of SES distribution, there were 33 479 participants from the lowest 5 SES deciles (48.8%) and 35 119 (51.2%) in the highest five SES deciles ($P < 0.001$), however, this distribution was not linear across SES quintiles or referral pathways (Fig. 1).

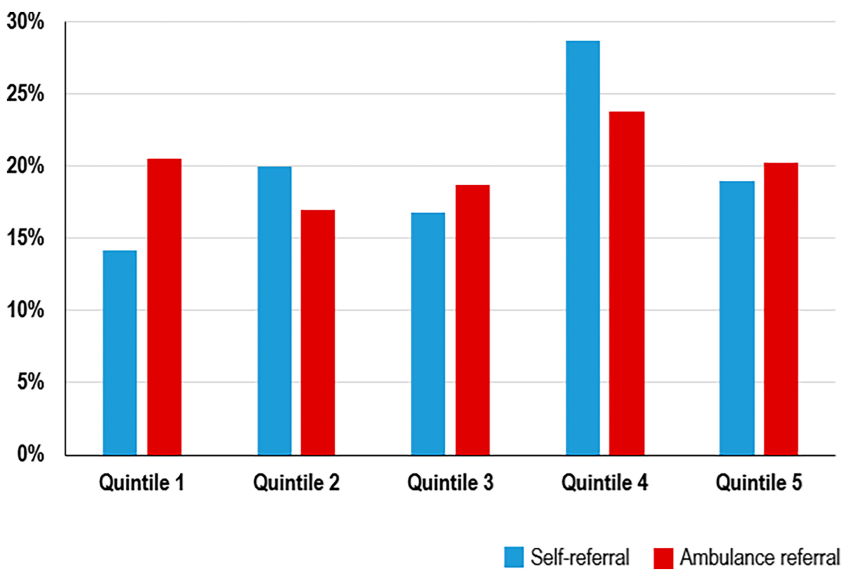

Figure 1. *Proportion (%) of patients presenting to the VVED though self-referral or ambulance referral, by socioeconomic status.*

SES outcomes

Univariate analyses identified the following variables as significant predictors for the VVED referral pathway in the study cohort: age group, Indigenous status, marital status, born in Australia, and English as the primary language spoken at home (Table 2). Individuals referred to the VVED *via* the self-referral pathway were more likely to be younger, identify as Indigenous, have a spouse/partner, and speak English as their primary language.

Results from the multivariable logistic regression analyses are presented in Table 3. Compared to the mid-SES group (Quintile 3), higher odds of self-referral to the VVED were observed in the two least disadvantaged SES groups (Quintile 4; OR = 1.43; 95% CI: 1.36–1.51; $P < 0.001$) (Quintile 5; OR = 1.17; 95% CI: 1.01–1.10; $P = 0.017$), and in Quintile 2 (OR = 1.61; 95% CI: 1.53–1.70; $P < 0.001$). These associations were slightly attenuated after adjusting for age and sex, although remained significant. After further adjustment for demographic characteristics found to be significant in univariate analyses, the likelihood of self-referral remained significantly higher for participants in these quintiles, except for Quintile 2 (OR = 0.98; 95% CI: 0.90–1.07; $P = 0.665$). Conversely, significantly lower odds of self-

TABLE 1. *Patient characteristics* (n = *68 598)*

	N (%)
Age (years), mean ± SD	36.6 ± 27.8
Age group (years)	
0–17	21 424 (31.2%)
18–64	33 105 (48.3%)
65+	14 069 (20.5%)
Sex	
Female	40 073 (58.4%)
Male	28 480 (41.5%)
Other	45 (0.1%)
Indigenous status	
Non-indigenous	61 125 (89.1%)
Aboriginal	1246 (1.8%)
Torres Strait Islander	58 (0.1%)
Aboriginal and Torres Strait Islander	134 (0.2%)
Not Stated/Unknown	6035 (8.8%)
Marital status	
Single	30 899 (60.6%)
Married/*De facto*	16 859 (33.0%)
Divorced	1929 (3.8%)
Separated	1310 (2.6%)
Born in Australia	59 525 (87.4%)
Primary language English	63 478 (97.1%)
Socioeconomic status	
Quintile 1†	11 110 (16.2%)
Quintile 2	14 515 (21.2%)
Quintile 3	11 440 (16.7%)
Quintile 4	18 642 (27.1%)
Quintile 5‡	12 891 (18.8%)
Triage category§	
1	446 (1.2%)
2	2162 (5.7%)
3	27 081 (71.7%)
4	8065 (21.4%)

†Most disadvantaged socioeconomic quintile. ‡Least disadvantaged socioeconomic quintile. §There were four virtual triage categories available: Category 1 (attend ED urgently); Category 2 (attend ED semi-urgently); Category 3 (await video consultation with an emergency physician); or Category 4 (GP or outpatient referral for follow up). Triage data is only available in self-referral patients and was missing for 9229 patients (19.6% of the self-referral cohort).

referral were observed in the most disadvantaged SES group (Quintile 1) in both unadjusted and fully adjusted analyses (OR = 0.82; 95% CI: 0.78–0.87; $P < 0.001$) (OR = 0.82; 95% CI: 0.75–0.90; $P < 0.001$), respectively.

Discussion

Virtual care now plays a pivotal role in the healthcare system to provide care options that ensure safe, effective, and equitable access for all individuals.[22] This is the first study to primarily explore whether uptake of a virtual emergency model of care differs across socioeconomic groups. We report a significant difference in VVED referral patterns across SES groups, with individuals from higher SES areas showing a greater likelihood of using the VVED self-referral pathway. The present paper forms part of a larger body of work to determine the effectiveness and successful implementation of the VVED model of care.

The consistant utilisation of the VVED across SES groups in the present study, when split into the lowest and highest five SES deciles (48.8% *vs* 51.2%), conflicts with trends observed in other countries internationally.[12–14,23] These results may be influenced by past government policies in Australia aimed at widespread access to technology and the internet across lower SES populations.[24] According to the Australian Communication and Media Authority, over 99% of Australian adults went 'online' in 2022, with approximately 93% of adults registering they have access to a home internet connection.[25] However, while our findings offer promise in addressing the health equity digital divide, it is premature to declare that the VVED functions as a universally accessible emergency care resource without comprehensive data reflecting healthcare utilisation rates across the entirety of the current healthcare system.

We also identified significant differences in referral pathways between SES quintiles, whereby patients living with the most disadvantage were more likely to be referred to the VVED *via* the established Ambulance Victoria pathway. The presence of a healthcare provider may reduce barriers to virtual healthcare being utilised by patients with low SES. Previous studies suggest incidence of ambulance callouts is higher in low SES populated areas,[26,27] which are also generally lower triage category patients.[28] Our ambulance referral pathway reflects a similar cohort of patients in another Australian study of an Ambulance Victoria secondary telephone triage service,[29] which reported a higher rate of calls to

TABLE 2. *Univariate logistic regression analyses modelling the associations between demographic variables and VVED referral pathway*

	Referral pathway, *n* (%)			
	Self-referral (*n* = 46 983)	Ambulance (*n* = 21 615)†	OR (95% CI)	*P*-value
Age group (years)				
0–17	17 945 (38.2%)	3479 (16.1%)	**2.04 (1.95–2.13)**	**<0.001**
18–64 (*reference*)	23 719 (50.5%)	9386 (43.4%)	-	-
65+	5319 (11.3%)	8750 (40.5%)	**0.24 (0.23–0.25)**	**<0.001**
Sex§				
Male (*reference*)	19 482 (41.5%)	8998 (41.6%)	-	-
Female	27 475 (58.5%)	12 598 (58.4%)	1.01 (0.97–1.04)	0.664
Indigenous status‡				
No (*reference*)	44 196 (97.6%)	16 929 (97.9%)	-	-
Yes	1079 (2.4%)	359 (2.1%)	**1.15 (1.02–1.30)**	**0.022**
Marital status‡				
Unpartnered (*reference*)	28 299 (64.0%)	4529 (66.7%)	-	-
Partnered	15 911 (36.0%)	2258 (33.3%)	**1.13 (1.07–1.19)**	**<0.001**
Born in Australia				
No (*reference*)	7054 (15.1%)	1560 (7.3%)	-	-
Yes	39 721 (84.9%)	19 804 (92.7%)	**0.44 (0.42–0.47)**	**<0.001**
Primary language English				
No (*reference*)	1155 (2.5%)	718 (3.7%)	-	-
Yes	44 834 (97.5%)	18 644 (96.3%)	**1.49 (1.36–1.64)**	**<0.001**

†Referent group. ‡Variable is condensed to include fewer response options for the logistic regression model. §'Other' category was excluded from the analysis because of low numbers (<0.1%). Bold text indicates statistical significance at *P*-value <0.05.

TABLE 3. *Adjusted multivariable logistic regression models showing effects of socioeconomic status on the utilisation of the VVED by referral pathway*

	Unadjusted		Model 1		Model 2	
	OR (95% CI)†	*P*-value	OR (95% CI)†	*P*-value	OR (95% CI)†	*P*-value
Level of socioeconomic status						
Quintile 1‡	**0.82 (0.78–0.87)**	**<0.001**	**0.94 (0.88–0.99)**	**0.029**	**0.82 (0.75–0.90)**	**<0.001**
Quintile 2	**1.61 (1.53–1.70)**	**<0.001**	**1.59 (1.50–1.69)**	**<0.001**	0.98 (0.90–1.07)	0.665
Quintile 3 (*reference*)	-	-	-	-	-	-
Quintile 4	**1.43 (1.36–1.51)**	**<0.001**	**1.38 (1.31–1.45)**	**<0.001**	**1.16 (1.06–1.26)**	**0.001**
Quintile 5§	**1.17 (1.01–1.10)**	**0.017**	**1.19 (1.12–1.26)**	**<0.001**	**1.38 (1.25–1.52)**	**<0.001**

†Represents the likelihood of self-referral to the VVED *versus* referral through ambulance. ‡Most disadvantaged quintile of socioeconomic status. §Least disadvantaged quintile of socioeconomic status. Model 1: Adjusted for age and sex. Model 2: Adjusted for age, sex, marital status, Aboriginal and/or Torres Strait Islander status (yes/no) and Born in Australia (yes/no). Bold text indicates statistical significance at *P*-value <0.05.

the service made from low SES areas, attributing to over 60% of total calls during the retrospective study period. Though both pathways reflect different levels of perceived urgency and severity of medical symptoms, they also underscore the influence that health literacy has on healthcare-seeking behaviours. Low health literacy is more common in low SES populations and serves as a mechanism of decreased healthcare access.[30,31] It is possible that individuals in the present study with higher health literacy were more inclined to self-refer to the VVED, while those with lower health literacy depended on emergency responders for guidance as to how to best navigate the system.

Increasing age conferred an additional likelihood of ambulance referral to the VVED, as per previous studies observing trends of physical ED presentations.[32,33] Individuals whose first language was English were more likely to access the VVED through self-referral, while on the contrary, those born in Australia were more likely to access the VVED through ambulance referral. Individuals whose first language is not the primary language of the country they reside in may contribute to their preference for accessing care through emergency services, as they may perceive ambulance services as a difficult means of communication during emergency situations.[34,35] However, nativity and primary language are often correlated as immigrants are more likely to speak a language other than English as their primary language. One potential explanation for this paradoxical finding may lie in the influence of cultural and social factors on healthcare seeking behaviours among immigrant populations. Previous research has highlighted that immigrants are more inclined to call emergency healthcare services and are more likely to seek an ambulance because of factors such as unfamiliarity with the healthcare system and perceived severity of their condition.[5,36,37] Another explanation for this finding may be that the mean age of participants not born in Australia was significantly older than those born in Australia. The VVED has implemented various strategies to enhance cultural competence, including offering registration instructions in over 20 languages and providing interpreter services for patients with limited English proficiency. Identifying the needs of multicultural communities that may benefit from virtual emergency care warrants further exploration.

Limitations

First, there were large numbers of ambulance registered participants with missing data. However, the large patient cohort ensured the present study was not underpowered to detect significant differences between referral groups. Second, our analyses relied on population-based SES measures determined by postcode rather than individual-level SES indicators. While population-based SES measures provide a broad assessment of community-level socioeconomic characteristics, individual-level SES indicators offer more nuanced insights and may better account for variations in healthcare behaviours among individuals within the same geographic area. Future research incorporating individual-level SES measures could provide a more comprehensive understanding of the relationship between socioeconomic factors and access to virtual emergency care services. Third, the VVED database lacked information about detailed clinical conditions and comorbidities that could have been included in multivariable regression models. We were unable to comment on whether the variation in referral pathways may be explained by health-related variables (e.g. heart disease, diabetes), which have greater prevalence in low SES populations[6,38] and higher healthcare utilisation.[8–10] Finally, the study exclusively examines individuals who accessed the VVED and may not accurately reflect access patterns in emergency care utilisation among the entire Australian population. For example, 86% of participants in the present study were born in Australia, which is significantly higher than the Victorian state proportion of 65% reported in the most recent ABS Census data.[39]

Conclusion

Emergency care services, both physical and virtual, are an important gateway into the healthcare system for vulnerable communities. Healthcare systems are continuously seeking to provide equitable health access to all individuals. The present study showed that the VVED was being accessed by individuals across differing levels of SES, indicating rising efforts in supporting healthcare equity for patients. The use of healthcare provider pathways such as ambulance paramedics may improve equitable access to telehealth and warrants further investigation.

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Competing interests

None declared.

Data availability statement

The data for these analyses was accessed from the Victorian Virtual Emergency Department (VVED) database. Access to this database should be discussed with the data custodian (LS).

References

1. Dorsey ER, Topol EJ. State of telehealth. *N. Engl. J. Med.* 2016; **375**: 154–61.
2. Gajarawala SN, Pelkowski JN. Telehealth benefits and barriers. *J. Nurse Pract.* 2021; **17**: 218–21.
3. Talevski J, Guerrero-Cedeño V, Demontiero O *et al.* Implementation of an electronic care pathway for hip fracture patients: a pilot before and after study. *BMC Musculoskelet. Disord.* 2020; **21**: 1–7.

4. Lin C-CC, Dievler A, Robbins C, Sripipatana A, Quinn M, Nair S. Telehealth in health centers: key adoption factors, barriers, and opportunities. *Health Aff.* 2018; **37**: 1967–74.
5. Whitehead L, Talevski J, Fatehi F, Beauchamp A. Barriers to and facilitators of digital health among culturally and linguistically diverse populations: qualitative systematic review. *J. Med. Internet Res.* 2023; **25**: e42719.
6. Brennan-Olsen SL, Vogrin S, Balogun S *et al*. Education, occupation and operational measures of sarcopenia: six years of Australian data. *Australas. J. Ageing* 2020; **39**: e498–505.
7. Kivimäki M, Batty GD, Pentti J *et al*. Association between socioeconomic status and the development of mental and physical health conditions in adulthood: a multi-cohort study. *Lancet Public Health* 2020; **5**: e140–9.
8. Begley C, Basu R, Lairson D *et al*. Socioeconomic status, health care use, and outcomes: persistence of disparities over time. *Epilepsia* 2011; **52**: 957–64.
9. Filc D, Davidovich N, Novack L, Balicer RD. Is socioeconomic status associated with utilization of health care services in a single-payer universal health care system? *Int. J. Equity Health* 2014; **13**: 115.
10. Lemstra M, Mackenbach J, Neudorf C, Nannapaneni U. High health care utilization and costs associated with lower socio-economic status: results from a linked dataset. *Can. J. Public Health* 2009; **100**: 180–3.
11. Beauchamp A, Talevski J, Niebauer J *et al*. Health literacy interventions for secondary prevention of coronary artery disease: a scoping review. *Open Heart* 2022; **9**: e001895. https://doi.org/10.1136/openhrt-2021-001895
12. Mistry SK, Shaw M, Raffan F *et al*. Inequity in access and delivery of virtual care interventions: a scoping review. *Int. J. Environ. Res. Public Health* 2022; **19**: 9411–22.
13. Cherabuddi MR, Heidemann D, Gwinn M *et al*. Disparities in use of virtual primary care during the early COVID-19 pandemic. *Telemed. e-Health* 2023; **29**: 1127–33.
14. Kwarteng-Siaw M, Merz LE, Ren S *et al*. Association of race, ethnicity, age and socioeconomic status with access to virtual visits within the Brigham & Women's hospital division of hematology during the COVID-19 pandemic. *Blood* 2021; **138**: 342.
15. Choi NG, DiNitto DM. The digital divide among low-income homebound older adults: internet use patterns, eHealth literacy, and attitudes toward computer/Internet use. *JMIR* 2013; **15**: e93.
16. Schroder SL, Fink A, Richter M. Socioeconomic differences in experiences with treatment of coronary heart disease: a qualitative study from the perspective of elderly patients. *BMJ Open* 2018; **8**: e024151.
17. Talevski J, Semciw A, Boyd J *et al*. From concept to reality: a comprehensive exploration into the development and evolution of a virtual emergency department. *J. Am. Coll. Emerg. Physicians Open*. 2024; **5** (4): e13231.
18. Hansagi H, Olsson M, Sjöberg S, Tomson Y, Göransson S. Frequent use of the hospital emergency department is indicative of high use of other health care services. *Ann. Emerg. Med.* 2001; **37**: 561–7.
19. ABS. *Australian Statistical Geography Standard (ASGS): Volume 3—Non ABS Structures July 2021. Cat: 1270.0.55.003*. Canberra: ABS, 2011.
20. Brennan-Olsen SL, Vogrin S, Graves S *et al*. Revision joint replacement surgeries of the hip and knee across geographic region and socioeconomic status in the western region of Victoria: a cross-sectional multilevel analysis of registry data. *BMC Musculoskelet. Disord.* 2019; **20**: 300.
21. Freke MD, Crossley KM, Russell T, Sims KJ, Semciw A. Associations between type and severity of hip pathology with pre-operative patient reported outcome measures. *Braz. J. Phys. Ther.* 2019; **23**: 402–11.
22. Talevski J, Daly RM. Additional insights on the osteoporosis care gap. *J. Bone Miner. Res.* 2023; **38**: 615–6.
23. Williams C, Shang D. Telehealth usage among low-income racial and ethnic minority populations during the COVID-19 pandemic: retrospective observational study. *JMIR* 2023; **25**: e43604.
24. Harris C, Straker L, Pollock C. A socioeconomic related'digital divide'exists in how, not if, young people use computers. *PLoS One* 2017; **12**: e0175011.
25. Australian Communications and Media Authority (ACMA). *Communications and Media in Australia Series: How We Use the Internet Executive Summary and Key Findings [Internet]*. Canberra: Australian Communications and Media Authority (ACMA), 2023 [Cited 8 Feb 2024.] Available from URL: https://www.acma.gov.au/publications
26. Birmingham LE, Arens A, Longinaker N, Kummet C. Trends in ambulance transports and costs among Medicare beneficiaries, 2007–2018. *Am. J. Emerg. Med.* 2021; **47**: 205–12.
27. Dawson LP, Andrew E, Nehme Z *et al*. Incidence, diagnoses and outcomes of ambulance attendances for chest pain: a population-based cohort study. *Ann. Epidemiol.* 2022; **72**: 32–9.
28. Wachelder JJH, van Drunen I, Stassen PM *et al*. Association of socioeconomic status with outcomes in older adult community-dwelling patients after visiting the emergency department: a retrospective cohort study. *BMJ Open* 2017; **7**: e019318.
29. Eastwood K, Morgans A, Smith K, Hodgkinson A, Becker G, Stoelwinder J. A novel approach for managing the growing demand for ambulance services by low-acuity patients. *Aust. Health Rev.* 2016; **40**: 378–84.
30. Beauchamp A, Talevski J, Nicholls SJ *et al*. Health literacy and long-term health outcomes following myocardial infarction: protocol for a multicentre, prospective cohort study (ENHEARTEN study). *BMJ Open* 2022; **12**: e060480.
31. Lastrucci V, Lorini C, Caini S, Group FHLR, Bonaccorsi G. Health literacy as a mediator of the relationship between socioeconomic status and health: a cross-sectional study in a population-based sample in Florence. *PLoS One* 2019; **14**: e0227007.
32. Lowthian JA, Jolley DJ, Curtis AJ *et al*. The challenges of population ageing: accelerating demand for emergency ambulance services by older patients, 1995–2015. *Med. J. Aust.* 2011; **194**: 574–8.

33. Duong HV, Herrera LN, Moore JX *et al*. National characteristics of emergency medical services responses for older adults in the United States. *Prehosp. Emerg. Care* 2018; **22**: 7–14.
34. Karliner LS, Jacobs EA, Chen AH, Mutha S. Do professional interpreters improve clinical care for patients with limited English proficiency? A systematic review of the literature. *Health Serv. Res.* 2007; **42**: 727–54.
35. Ramirez D, Engel KG, Tang TS. Language interpreter utilization in the emergency department setting: a clinical review. *J. Health Care Poor Underserved* 2008; **19**: 352–62.
36. Alam K, Imran S. The digital divide and social inclusion among refugee migrants: a case in regional Australia. *Inf. Technol. People* 2015; **28**: 344–65.
37. Chiu M, Amartey A, Wang X, Kurdyak P. Ethnic differences in mental health status and service utilization: a population-based study in Ontario, Canada. *Can. J. Psychiatry* 2018; **63**: 481–91.
38. Mesinovic J, Fyfe JJ, Talevski J *et al*. Type 2 diabetes mellitus and sarcopenia as comorbid chronic diseases in older adults: established and emerging treatments and therapies. *Diabetes Metab. J.* 2023; **47**: 719.
39. Australian Bureau of Statistics. *Snapshot of Australia [Internet]*. Canberra: ABS, 2021 [Cited 25 Nov 2024.] Available from URL: https://www.abs.gov.au/statistics/people/people-and-communities/snapshot-australia/2021