



Increasing multimorbidity in an Australian street health service

A 10-year retrospective cohort study



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Background and objectives

Street-based clinics provide general practice services to marginalised and homeless persons. The objective of this study was to examine prevalence, patterns and severity of multimorbidity in patients attending one such service.

Method

A retrospective cohort study (2006–15), comprising medical record review of patients ($n = 4285$), was undertaken. A Cumulative Illness Rating Scale (CIRS) was used to assess multimorbidity.

Results

Average age of patients was 38.2 ± 17.9 years. Of 31.5% Aboriginal patients, 50.8% were female (37.6% in non-Aboriginal patients). Of all patients, 53% had multimorbidity. Aboriginal patients had higher rates of multimorbidity than non-Aboriginal patients (58.0% vs 50.6%, $P < 0.001$). Psychiatric, musculoskeletal (especially skin) and respiratory conditions were most common. Disease severity was mild to moderate, with 26.8% having at least one severe or extremely severe condition. Multimorbidity and disease severity increased between 2006–11 and 2012–15. Aboriginality was the strongest predictor of multimorbidity (odds ratio [OR] = 2.1; 95% confidence interval [CI]: 1.8–2.4; $P < 0.001$).

Discussion

Street-based general practice services are critical to facilitate easy access to primary and secondary management of chronic multimorbid conditions in marginalised (especially Aboriginal) patients.

PATIENTS EXPERIENCING homelessness, deprivation and marginalisation are often affected by physical and mental illness, as well as by misuse of alcohol and drugs.¹ The combination of early onset multiple chronic diseases² and poor access to primary healthcare leads to higher prevalence of multimorbidity and associated disease severity, compared with mainstream populations,³ and is accompanied by higher direct and indirect health costs.⁴ A recent US paper was critical of attempts at cost savings for services to this population, arguing instead that it is preferable to focus on meeting the real-life needs of the marginalised and homeless rather than reducing ‘a complex social situation to a financial calculation’.⁵

Being labelled ‘homeless’ creates stigma and discrimination.⁶ Such patients avoid contact with regular doctors, engaging reactively instead with healthcare services.⁷ A Swedish study found homeless men and women had twice the risk of being hospitalised for physical diseases, compared with housed counterparts, with those aged 18–35 years at highest risk.⁸ National data show annual inpatient costs for homeless individuals in England are eight times that of the housed population, with attendances at emergency departments (EDs) five times higher.⁹

The Freo Street Doctor (FSD) service is a free, primary care-based, mobile clinic that has been operating in Fremantle, Western Australia since 2005. It operates from locations within the city and surrounding suburbs, offering homeless and disadvantaged patients access to an accredited general practice service.¹⁰ The FSD is serviced by a number of general practitioners (GPs) but also works collaboratively with several ancillary services to improve the health and circumstances of patients in this population group. Service access is unrestricted, and electronic records are maintained for all attendees.

This study used the Cumulative Illness Rating Scale (CIRS)^{11–13} to determine multimorbidity, focusing on cumulative and synergistic effects of conditions categorised by anatomical domains rather than simply counting numbers of conditions, thereby ensuring more rigorous assessment of multimorbidity.

We previously published on multimorbidity in the FSD patient cohort of 2006–11.³ This study extends data coverage over the decade 2006–15 and complements our qualitative study exploring patient reasons for attending the service.¹⁴

Methods

Study design

A retrospective cohort study was undertaken incorporating electronic medical record review. The entire patient cohort attending the FSD service in 2006–15 was examined. Data extraction and coding of patient records were undertaken in two stages: 1 January 2006 – 31 December 2011 ($n = 2587$), completed in July 2012; and January 2012 – 31 December 2015 ($n = 1698$), completed in December 2016. The GP software used was consistent over both cohorts. For the 2012–15 sample, we excluded persons with prior visit(s) in 2006–11. Thus, each cohort comprised discrete persons with first visits to the service in each respective time period.

Data extraction and scoring

Electronic medical records of patients were reviewed and rated using the validated CIRS method.^{11–13} Each rater was assigned a subset of patients to score. All raters had health-related backgrounds and trained in the application of the CIRS. Inter-rater reliability was empirically assessed (outlined below).

For the 2006–11 cohort, 42 conditions, and for the 2012–2015 cohort, 43 conditions (skin conditions identified separately) were scored using CIRS criteria (0 = no problems, 1 = mild problems, 2 = moderate morbidity, 3 = severe morbidity, 4 = extremely severe functional impairment). Conditions were categorised into 14 body system domains affected (Appendix 1, available online only) and maximum scores summed for each domain to generate a total score (0–56) for each patient. The total score was divided by number of domains with identified morbidities to generate a CIRS Severity Index (SI) score for each patient (0 = none/low, 1 = mild, 2 = moderate, 3 or 4 = severe). The frequency of at least one severe or extremely severe condition (ie level 3 or 4 score) within CIRS domains was also included as an additional indicator of disease severity.¹²

We defined multimorbidity as chronic (>6 months) and deteriorating conditions affecting ≥ 2 domains.¹⁵

Inter-rater reliability

To assess inter-rater reliability, raters scored a common set of 30 (2006–11 cohort) and 50 (2012–15 cohort) randomly selected patients. Inter-rater reliability was assessed using the intra-class correlation coefficient (ICC) on CIRS scores and number of domains with morbidities. To assess inter-rater reliability between cohorts, we calculated the ICC on CIRS scores between two raters common to both cohorts based on 60 randomly selected patients (30 from each cohort).

Previously reported ICC for the 2006–11 cohort was 0.94 (95% CI: 0.89–0.97) for number of domains with morbidities, and 0.96 (95% CI: 0.93–0.98) for CIRS scores.³ For the 2012–15 cohort, the ICC was 0.92 (95% CI: 0.86–0.96) for number of domains with morbidities, and 0.62 (95% CI: 0.37–0.79) for CIRS scores. The ICC between cohorts was 0.94 (95% CI: 0.90–0.96) for CIRS scores.

Statistical analysis

Data analysis was conducted using Stata 14.0. All analyses were tested against an alpha level of 0.05 (two-tailed). Demographic data are expressed as means \pm standard deviation for continuous variables and frequencies (percentages) for categorical variables. Crude differences between FSD patients in the 2006–11 and 2012–15 cohorts were examined using independent sample t-tests and chi-square tests for continuous and categorical variables, respectively.

Severity was examined using the CIRS SI score and as distribution between age categories. General linear modelling (GLM) was used to examine differences in severity between Aboriginal and non-Aboriginal patients, controlling for age and sex. The relationship between demographic characteristics (age, sex, Aboriginal status) and the presence (Y/N) of multimorbidity across two, three and five domains was examined using a series of multivariate logistic regression analyses.

Ethics

Ethical approval was granted by the University of Notre Dame Human Research Ethics Committee (Project ID 015154F).

Results

A total of 4285 patients attended the FSD service over the study period (2006–15). Data for the 2006–11 cohort reported previously³ is included for reference and temporal comparison.

Patient characteristics

Table 1 shows patient characteristics. The majority of FSD patients were male. The proportion of Aboriginal patients attending (mainly female) increased between the two cohorts. Though less than the proportion of males, that of non-Aboriginal females increased over time.

Multimorbidity prevalence

Multimorbidity was present in 53.0% (2269/4285) of patients overall. This is an increase from 46.4% (1199/2587) in 2006–11 to 63.0% (1070/1698) in 2012–15, ($P < 0.001$). Overall, significantly more Aboriginal patients (58.0%, 774/1332) had multimorbidity, compared with non-Aboriginal patients (50.6%, 1466/2897; $P < 0.001$).

Figure 1 shows the age distribution of multimorbidity. The difference between the two cohorts in the prevalence of multimorbidity is greatest in Aboriginal and non-Aboriginal patients aged <25 years.

Multimorbidity patterns

Domain combinations for the 2006–11 cohort have been reported previously.³ For the 2012–15 cohort, the most commonly affected domains individually or across combinations were psychiatric, musculoskeletal (including integumental) and respiratory (Appendix 2, available online only). For this cohort, Aboriginal patients had a significantly higher frequency of chronic skin conditions (46.1%, 261/566), compared with non-Aboriginal patients (29.7%, 320/1076; $P < 0.001$).

Severity index

The majority of patients' conditions were of mild or moderate severity (Table 2). Only 19% of patients had no or low-severity chronic conditions. The proportion of patients with at least one severe or extremely severe condition (scored at

Table 1. Age and gender distribution

	Overall			2006–11 cohort ³			2012–15 cohort		
	Total	Aboriginal	Non-Aboriginal	Total	Aboriginal	Non-Aboriginal	Total	Aboriginal	Non-Aboriginal
Number of patients	4,285	1,332 (31.5)	2,897 (68.5)	2,587	766 (29.6)	1,821 (70.4)	1,698	566 (34.5) [^]	1,076 (65.5)
Sex, n (%)									
Male	2,496 (58.3)	656 (49.2) [*]	1,809 (62.4)	1,482 (57.3)	385 (50.3)	1,097 (60.2)	1,014 (59.7)	271 (47.9)	712 (66.2)
Female	1,789 (41.2)	676 (50.8) [*]	1,088 (37.6)	1,105 (42.7)	381 (49.7)	724 (39.8)	684 (40.3)	295 (52.1) [†]	364 (33.8) [†]
Age, mean ± SD [range] years									
Overall	38.2 ± 17.9 [<1–103.0]	32.1 ± 18.1 [*] [<1–82.7]	41.1 ± 17.2 [<1–103.0]	37.8 ± 18.7 [<1–103.0]	32.1 ± 17.9 [<1–81.0]	40.2 ± 18.4 [<1–103.0]	38.8 ± 16.8 [1.4–89.0]	32.2 ± 18.2 [1.4–82.9]	42.5 ± 14.8 [†] [2.7–89.0]
Male	39.6 ± 17.7 [<1–103.0]	31.5 ± 18.4 [*] [1–81.0]	42.5 ± 16.6 [<1–103.0]	39.1 ± 16.5 [<1–103.0]	31.8 ± 18.1 [1–81.0]	41.6 ± 17.9 [<1–103.0]	40.3 ± 16.5 [1.4–88.5]	31.1 ± 18.8 [1.4–77.9]	43.9 ± 14.1 [†] [3.9–88.5]
Female	36.2 ± 18.1 [<1–90.0]	32.7 ± 17.7 [*] [<1–82.9]	38.6 ± 17.9 [<1–90.0]	36.1 ± 18.7 [<1–90.0]	32.3 ± 17.7 [<1–75.0]	38.0 ± 18.9 [<1–90.0]	36.6 ± 16.9 [1.9–89.0]	33.2 ± 17.6 [1.9–82.7]	39.7 ± 15.8 [2.7–89.0]
Age category, years, n (%)									
<25	970 (22.6)	491 (36.9) [*]	465 (16.1)	626 (24.2)	282 (36.8)	344 (18.9)	344 (20.3)	209 (36.9)	121 (11.3) [†]
25– 44	1,739 (40.6)	482 (36.2) [*]	1,229 (42.4)	1,023 (39.5)	274 (35.8)	749 (41.1)	716 (42.2)	208 (36.8)	480 (44.7)
45–64	1,288 (30.1)	321 (24.1) [*]	956 (33.0)	732 (28.3)	187 (24.4)	545 (29.9)	556 (32.8)	134 (23.7)	411 (38.2)
65–74	194 (4.5)	29 (2.2) [*]	162 (5.6)	136 (5.3)	18 (2.4)	118 (6.5)	58 (3.4)	11 (1.9)	44 (4.1)
≥75	93 (2.2)	9 (0.7) [*]	84 (2.9)	70 (2.7)	5 (0.7)	65 (3.6)	23 (1.4)	4 (0.7)	19 (1.8)

Aboriginal status was not recorded for 56 patients of the 2012–15 cohort (1.3% of the total cohort)
^{*}*P* <0.05, compared with non-Aboriginal; [†]*P* <0.05, compared with 2006–11 cohort³
 SD, standard deviation

level 3 or 4) across all domains increased with multimorbidity and was higher for Aboriginal patients. This disparity was present across all age groups ≥25 years and greatest for those aged ≥65 years. The SI (Figure 2) increased in patients attending in 2012–15 compared with 2006–11.

Risk factors for multimorbidity

For the total cohort, multimorbidity was significantly associated with male sex (OR 1.4; 95% CI: 1.2–1.6; *P* <0.001), increasing age (OR 1.1; 95% CI: 1.04–10.5; *P* <0.001) and Aboriginality (OR 2.1; 95% CI: 1.8–2.4; *P* <0.001).

Discussion

Much of the research to date on chronic disease in homeless and marginalised populations has focused on patients

inappropriately attending EDs.¹⁶ We examined medical records from a GP-accredited, street-based clinic involving a large cohort of homeless and marginalised patients (n = 4285) over a 10-year period.

Findings from this study are in line with our previous research³ and other studies^{17,18} showing high prevalence of multimorbidity in marginalised patients, ranging from 46.3% to 69.9% across various studies. The overall trend shows prevalence increasing between the two data periods. The reasons for this are unclear but this trend has been observed internationally,⁸ suggesting the observation is not an aberration resulting from differences in inter-cohort ratings or selection bias between samples in our study.

Psychiatric, musculoskeletal and respiratory conditions were the most

frequent presentations. We have accounted for the limitation noted in our previous analysis³ and separated chronic skin problems from other musculoskeletal or integumental conditions. In doing so, we have highlighted chronic skin conditions as prominent and in agreement with other studies.¹

Within the 2012–15 cohort, 26.8% of all FSD patients and 44.5% of those with multimorbidity had at least one severe or extremely severe condition. Our data also show multimorbidity increasing with age, peaking at age 45–64 years and then decreasing for non-Aboriginal patients aged ≥65 years. The reasons for this are unclear. The fact that multimorbidity is less severe in this latter age category for non-Aboriginal patients suggests patients who are healthier are more likely to survive and remain users of the service.

Table 2. Severity scores for total cohort

	Overall, n = 4,285*	Aboriginal, n = 1,332	Non-Aboriginal, n = 2,897
Severity index score, mean ± SD [range]	1.37 ± 0.84 [0–4.0]	1.40 ± 0.80† [0–4.0]	1.36 ± 0.89 [0–4.0]
Severity index category, n (%)			
None/low	815 (19.0)	214 (16.1) [†]	595 (20.5)
Mild	1,759 (41.1)	568 (42.7) [†]	1,157 (39.9)
Moderate	1,511 (35.3)	501 (37.6) [†]	996 (34.4)
Severe	199 (4.7)	48 (3.6)	149 (5.1)
All patients with severe or extremely severe condition within domains			
Number of patients, n (%)	1,148 (26.8)	406 (30.5) [†]	732 (25.3)
Age category (years) breakdown, n (%)			
<25	58 (5.9)	29 (5.9)	29 (6.2)
25–44	518 (29.8)	180 (37.3) [†]	331 (26.9)
45–64	504 (39.1)	176 (54.8) [†]	325 (34.0)
65–74	48 (24.7)	15 (51.7) [†]	33 (20.4)
≥75	20 (21.5)	6 (66.7) [†]	14 (16.7)
Patients with multimorbidity (2+ domains) and severe or extremely severe condition within domains			
Number of patients, n (%) [‡]	1,001 (44.1)	372 (48.1) [†]	621 (42.4)
Age category (years) breakdown, n (%)			
<25	40 (15.8)	25 (15.5)	15 (16.9)
25–44	439 (45.9)	158 (50.0) [†]	276 (44.2)
45–64	459 (52.8)	168 (64.4) [†]	288 (48.1)
65–74	45 (36.0)	15 (57.7) [†]	30 (30.9)
≥75	18 (27.7)	6 (66.7) [†]	12 (21.4)

*Aboriginal status not recorded for 56 patients

[†]P<0.05, compared with non-Aboriginal patients

[‡]Percentage of 2,269 patients with 2+ domain

The flattening of the S-shaped prevalence curve¹⁹ could suggest diminished survival beyond age 45 years, reflecting the UK experience where the average age at death among homeless persons is 40–44 years.⁹ It could also reflect that the less able are more likely to be in more stable accommodation (sheltered housing/nursing home), off the streets and therefore less likely to use the service.

The flattening of the prevalence curve for Aboriginal patients aged ≥45 years (Figure 1C) was comparatively less pronounced. The reasons for this are again unclear but it is possible, given the lower numbers attending within this age

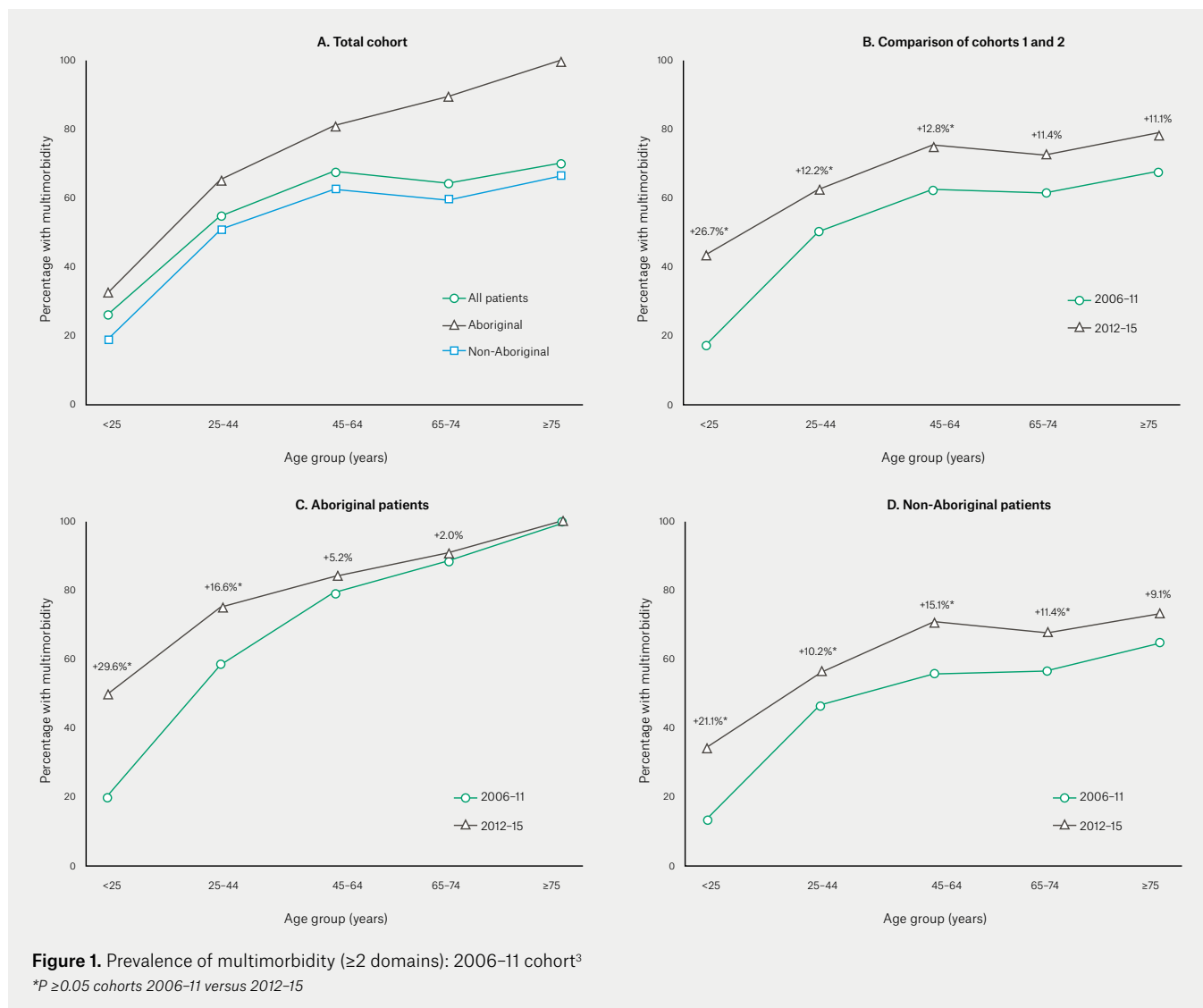
category for this group and the higher level of disease severity, that older, less healthy Aboriginal patients continue using the service. Further research involving longitudinal follow-up of patients through hospital and mortality databases will assist in clarification for both patient groups, although follow-up may prove challenging given the marginalised status of the population.

An important aspect of our study is the high Aboriginal attendance, comprising 31.5% of the total cohort (with 50.8% female) compared to <2% Aboriginal patients attending mainstream GP clinics Australia-wide.²⁰ Equally noteworthy is

the progressive increase in the proportion of Aboriginal patients attending FSD between the two data periods.

Primary care management of young Aboriginal patients is critical in preventing exacerbations of chronic, multimorbid conditions. Being of Aboriginal descent is the strongest predictor of multimorbidity with these patients, who are 2.1 times more likely to have multimorbidity compared to non-Aboriginal patients. Although Aboriginal patients are younger, they have higher rates of multimorbidity across all age groups.

Studies show barriers to homeless individuals seeking primary healthcare



are multifactorial²¹ and have been explored for the FSD in our previous publication.¹⁴ This can lead to repeated use of hospital EDs,²² often for conditions that ideally should be managed in primary care.²³ While ED attendance has been identified as an opportunity in health intervention for homeless patients,²² ED social work services struggle to meet such needs.¹⁶ Hospital discharge planning is difficult for patients with no fixed abode and no regular doctor. Although discharge summaries from hospital EDs may be directed to the FSD, there is no guarantee of patients attending the service or of seeing the same GP at future visits. GP-led, in-reach

services are a possible solution for this impasse, although varying success has been reported.²⁴

Cost analysis of patient visits to FSD compared to GP or hospital ED visits has not been included in the study. An Australian national study report²⁵ on the cost of homelessness provides evidence of the diversity in health cost impact for this cohort. The report argues against the use of point estimates because of this diversity, suggesting instead that the focus should be on trends in magnitude and direction. We envisage that for the FSD the cost per consultation will be higher mainly because the street-based service is tailored to

meet the special needs of this population through additional ancillary onsite services (Aboriginal health workers, outreach workers and social workers). However, compared to hospital ED attendance costs, the FSD is likely to represent a substantial overall cost saving. In addition, the flow-on effect of increased hospital admissions may be mitigated if the physical and mental health issues of this population are addressed at an earlier stage.

Implications for general practice

Our data show that multimorbidity is increasing and presents as chronic

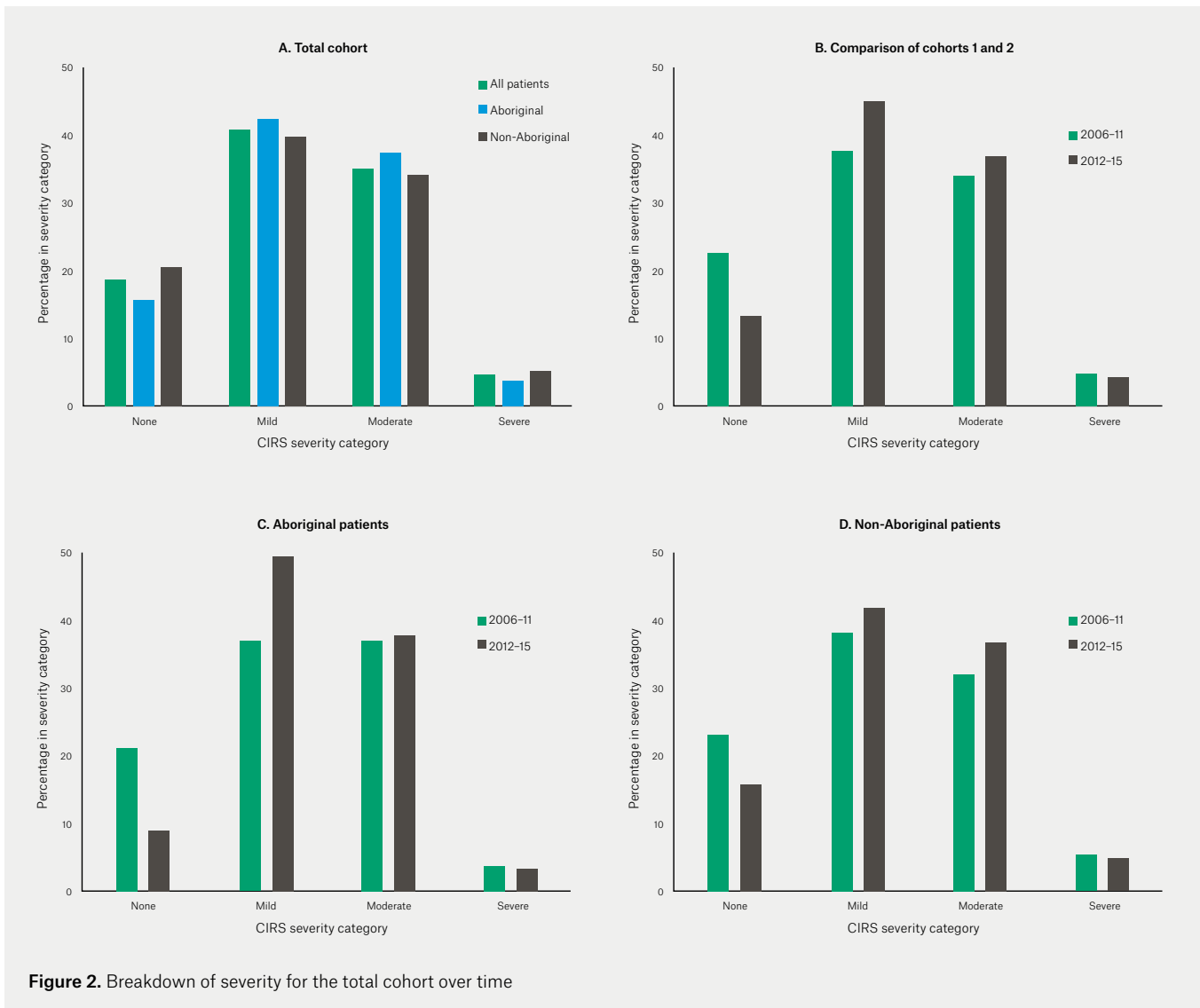


Figure 2. Breakdown of severity for the total cohort over time

physical and mental health problems in marginalised, street health patients. Such patients run the risk of ongoing neglect unless provided with a no-cost, multidisciplinary approach capable of delivering health and social services in a non-judgemental, comfortable and secure environment.

The progressive increase in attendance by young, especially Aboriginal, patients over the past decade, and the positive feedback from patients and allied services regarding service use,¹⁴ make a compelling argument that accredited, general practice-based services such as the FSD are addressing important health and

social needs in an environment where they are most needed.

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Appendix 1: Conditions rated within domains

Domain	Conditions
Musculoskeletal/Integumental	1. Osteoarthritis 2. Osteoporosis 3. Rheumatoid Arthritis 4. Chronic back pain 5. Skin disorders
Psychiatric	6. Anxiety 7. Depression 8. Psychosis 9. Drug Abuse 10. Alcohol Abuse 11. Other psychiatric
Respiratory	12. Asthma 13. Chronic Obstructive Pulmonary Disease 14. Smoking
Vascular	15. Peripheral Vascular Disease 16. Hyperlipidaemia 17. Abdominal Aortic Aneurysm 18. Coronary Artery Bypass Graft Surgery 19. Other vascular including hypertension
Endocrine	20. Diabetes 21. Metabolic Disorder 22. Breast 23. Obesity 24. Menopause 25. Other endocrine
Eye, ear, nose and throat	26. Eye problems 27. Ear, nose and throat problems 28. Dizziness
Genitourinary/Prostate	29. Genitourinary/Prostate
Lower gastrointestinal	30. Abdominal surgery 31. Other gastrointestinal problems
Haematological	32. Anaemia 33. Other Haematological
Upper gastrointestinal	34. Stomach 35. Oesophagus 36. Gastro Oesophageal Reflux Disease
Neurological	37. Cerebrovascular Accident 38. Other neurological
Cardiac	39. Ischemic Heart Disease 40. Chronic Heart Failure 41. Other cardiac
Hepatic/pancreatic	42. Hepatic/pancreatic
Renal	43. Renal

Appendix 2. Five most common domain combinations for patients 2012–2015 cohort compared with 2006–2011 cohort

All patients, n (%)		Aboriginal, n (%)		Non-Aboriginal, n (%)	
2012–2015 Cohort					
Musculoskeletal	139 (34.6)	Musculoskeletal	55 (43.0)	Psychiatric	79 (31.1)
Psychiatric	108 (26.9)	Psychiatric	24 (18.8)	Musculoskeletal	77 (30.3)
Respiratory	46 (11.4)	Eye, ear, nose and throat	15 (11.7)	Respiratory	29 (11.4)
Eye, ear, nose and throat	22 (5.5)	Respiratory	15 (11.7)	Urogenital and prostate	16 (6.3)
Urogenital and prostate	22 (5.5)	Endocrine	4 (3.1)	Endocrine	16 (6.3)
Denominator population(one domain only), n	402		128		254
Respiratory + Psychiatric	606 (56.6)	Respiratory + Psychiatric	203 (52.3)	Respiratory + Psychiatric	389 (59.6)
Musculoskeletal + Psychiatric	437 (40.8)	Respiratory + Musculoskeletal	172 (44.3)	Musculoskeletal + Psychiatric	271 (41.5)
Vascular + Psychiatric	257 (24.0)	Musculoskeletal + Psychiatric	155 (40.0)	Psychiatric + Endocrine	123 (18.9)
Vascular + Respiratory	249 (23.3)	Psychiatric + Endocrine	105 (27.1)	Respiratory + Musculoskeletal	236 (36.1)
Hepatic and pancreas + Psychiatric	180 (16.8)	Respiratory + Endocrine	99 (25.5)	Psychiatric + Vascular	172 (26.3)
Denominator population (2 or more domains), n	1,070		388		653
2006–2011 Cohort					
Musculoskeletal	238 (29.8)	Musculoskeletal	74 (34.3)	Musculoskeletal	164 (28.2)
Psychiatric	162 (20.3)	Psychiatric	28 (13.0)	Psychiatric	134 (23.0)
Eye, ear, nose and throat	109 (13.7)	Eye, ear, nose and throat	41 (19.0)	Eye, ear, nose and throat	68 (11.7)
Respiratory	75 (9.4)	Respiratory	18 (8.3)	Respiratory	57 (9.8)
Urogenital and prostate	55 (6.9)	Lower GIT	13 (6.0)	Urogenital and prostate	43 (7.4)
Denominator population (one domain only), n	798		216		582
Respiratory + Psychiatric	445 (37.1)	Respiratory + Psychiatric	153 (39.6)	Respiratory + Psychiatric	292 (35.9)
Musculoskeletal + Psychiatric	388 (32.4)	Musculoskeletal + Psychiatric	136 (35.2)	Musculoskeletal + Psychiatric	252 (31.0)
Respiratory + Musculoskeletal	307 (25.6)	Respiratory + Musculoskeletal	121 (31.4)	Respiratory + Musculoskeletal	186 (22.9)
Vascular + Musculoskeletal	175 (14.6)	Respiratory + Endocrine	78 (20.2)	Vascular + Musculoskeletal	114 (14.0)
Psychiatric + Vascular	168 (14.0)	Psychiatric + Endocrine	74 (19.2)	Respiratory + Vascular	95 (11.7)
Denominator population (2 or more domains), n	1,199		386		813