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Body Mass Index and persistent pain in Australia: Patient characteristics and treatment outcomes

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Abstract

Body mass index (BMI) is calculated using a person's weight by the square of their height (kg/m2), and is used to broadly categorise a person as underweight, normal weight, overweight or obese. This paper will explore the association of patient characteristics and outcomes by BMI category using data collected by the electronic Persistent Pain Outcomes Collaboration (ePPOC).

Publication Details

Body Mass Index and persistent pain in Australia: Patient characteristics and treatment outcomes

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Summary:

This study aimed to explore sociodemographic profile, clinical characteristics and treatment outcomes by body mass index (BMI) for individuals who completed an episode of care at an Australian specialist pain service. 43846 adult patients who completed treatment and provided BMI information at referral were included in the analysis. Patients provided data at referral during the period 2014-2021. The analysis shows:

- Nearly 3 in 4 patients were either in the overweight or obese category. This is higher than the national estimate which reports two thirds of Australian adults are either overweight or obese.
- Obesity was more frequent in people who were born in Australia, did not require an interpreter and/or identified as Aboriginal or Torres Strait Islander.
- There was an increase in obesity from the least to the more disadvantaged socioeconomic areas
- Pain severity, interference, depression, anxiety, stress, catastrophising and pain self-efficacy were similar at referral, regardless of BMI.
- While there were some differences in patient reported outcomes by BMI, effect sizes were less than small despite statistical significance. This suggests that outcomes following treatment were similar, regardless of BMI at referral.

Publication details

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ePPOC
electronic persistent pain
outcomes collaboration

Background

Body mass index (BMI) is calculated using a person's weight by the square of their height (kg/m^2), and is used to broadly categorise a person as underweight, normal weight, overweight or obese. This paper will explore the association of patient characteristics and outcomes by BMI category using data collected by the electronic Persistent Pain Outcomes Collaboration (ePPOC).

ePPOC is an Australasian initiative that aims to improve the quality of care and outcomes for people who experience chronic pain. ePPOC works with Australian and New Zealand pain services to improve the quality of care and outcomes for people with chronic pain through the collection of non-identifiable data related to patients and their care. The data are then analysed and benchmarked to highlight areas for quality improvement to services. Furthermore, ePPOC promotes research into areas of importance in pain management. Further details regarding the establishment of ePPOC and the data collected can be found in Tardif et al [1] and at https://www.uow.edu.au/ahsri/eppoc/.

Aims

This study aimed to explore the sociodemographic profile, clinical characteristics and treatment outcomes for patients as a function of BMI. It focusses on patients seeking care in Australian pain services, with a separate paper addressing results in New Zealand pain services (Information Series No.2 2022).

Methods

The data included in the analysis were provided by Australian persistent pain management services participating in ePPOC. The inclusion criteria were:

- Adult patients aged 18 years and above at referral
- Completion of patient-rated information at referral during the period January 2014 - December 2021
- Completion of an episode of pain management at an Australian specialist pain service or Primary Health Network
- Completion of the Weight and Height variables to allow calculation of BMI

Frequencies and percentages were used to explore patients' sociodemographic profile, clinical characteristics and treatment outcome by BMI. We used Chi-squared tests to observe the association of BMI categories with patient characteristics for categorical variables and Kruskal-Wallis tests to test the relationship of age and pain assessment scores at referral by BMI category. Effect sizes were measured using Cramer's V to assess the degree or magnitude of associations between categorical variables and BMI. Cramer's V values range from 0 to 1, and are categorised as small (0.06 – 0.17), moderate (0.17 – 0.29 and high (> 0.29)[2]. The effect size for Kruskal-Wallis tests was computed using eta squared[3], with the value interpreted as a small (0.01 – 0.06), moderate (0.06 – 0.14) and large (> 0.14) effect.

[1] Tardif, H., et al., *Establishment of the Australasian electronic persistent pain outcomes collaboration.* Pain Medicine, 2017. **18**(6): p. 1007-1018

[2] Kim, H.-Y., *Statistical notes for clinical researchers: Chi-squared test and Fisher's exact test.* Restorative dentistry & endodontics, 2017. **42**(2): p. 152-155.

[3] Tomczak M, Tomczak E. *The need to report effect size estimates revisited. An overview of some recommended measures of effect size. Trends in sport sciences*. 2014 Jul;**1**(21):19-25.

Results

Data relating to 43846 patients were included. Of these patients, 948 (2.2%), 11368 (25.9%), 13328 (30.4%) and 18202 (41.5%) were classified as underweight, healthy weight, overweight and obese, respectively. The proportion of patients in the overweight or obese category (71.9%) is higher than the Australia national estimate, which reported that two thirds (67.0%) of Australian adults were overweight or obese[4]. The characteristics of the group by BMI category are shown in Figures 1 and 2, and detailed in Tables A1 and A2 in the Appendix. As the underweight category is relatively small, comparisons focus on the differences between the healthy weight and overweight/obese groups.

Obese and overweight patients were older than healthy weight patients, at 52 vs. 49 years of age (see Table A1). Males were less likely to be in the healthy weight range, although a higher proportion of females were obese (44% vs. 39% of males). People who were born in Australia, did not require an interpreter and/or those identifying as Aboriginal or Torres Strait Islander were less likely to be of healthy weight and more likely to be obese. There was a decrease in the proportion of people in the healthy weight range and an increase in obesity from the least to the more disadvantaged socioeconomic areas [5].

Figure 1: Distribution of BMI categories by sociodemographic characteristics

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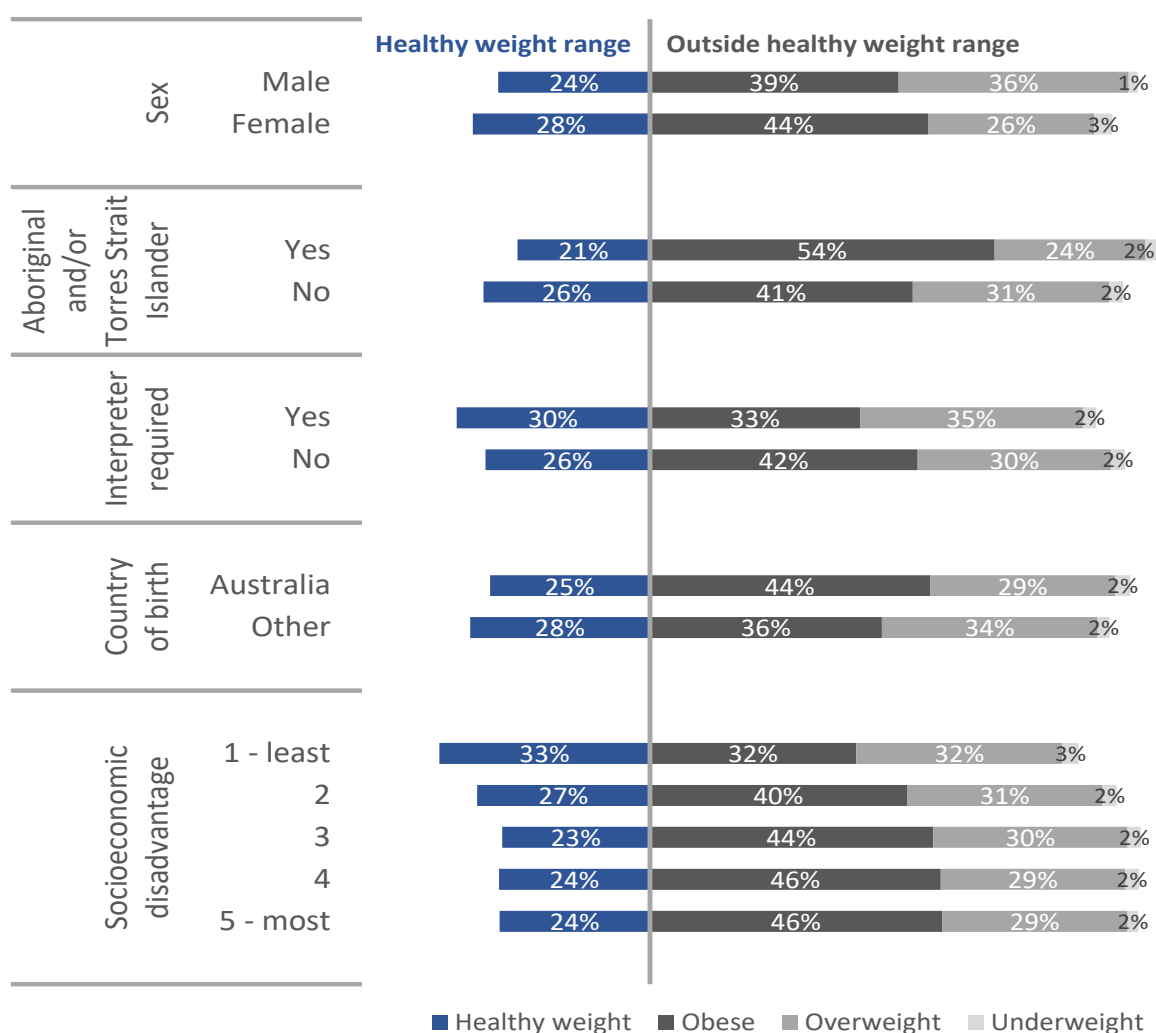
Figure 2: Distribution of BMI category by referral source and other clinical characteristics

		Healthy weight range	Outside healthy weight range		
Hearing or sight impaired?	Yes	27%	41%	31%	2%
	No	22%	46%	30%	2%
Pain duration	Less than 3 months	36%	30%	32%	3%
	3 months to 12 months	30%	37%	31%	3%
	12 months to 2 years	27%	39%	33%	2%
	2-5 years	26%	41%	31%	2%
	More than 5 years	24%	45%	29%	2%
Referral source	Private hospital	34%	32%	31%	4%
	Specialist practitioner	27%	39%	32%	2%
	Public hospital	26%	42%	29%	3%
	GP/nurse practitioner	26%	42%	30%	2%
	Other	26%	42%	31%	2%
	Rehab provider/private insurer	25%	43%	30%	2%
	Other pain management service	22%	45%	32%	1%
Site of main pain	Abdomen	29%	40%	28%	4%
	Chest	28%	40%	29%	3%
	Head	28%	40%	30%	3%
	Neck	27%	41%	30%	2%
	Pelvic and/or genital	27%	42%	29%	3%
	Arm/shoulder	26%	42%	30%	2%
	Back	25%	43%	30%	2%
	Hands	25%	45%	29%	2%
	Hips	24%	44%	29%	2%
	Leg	23%	45%	30%	2%
	Feet	23%	46%	29%	2%
	Knee	23%	47%	29%	2%

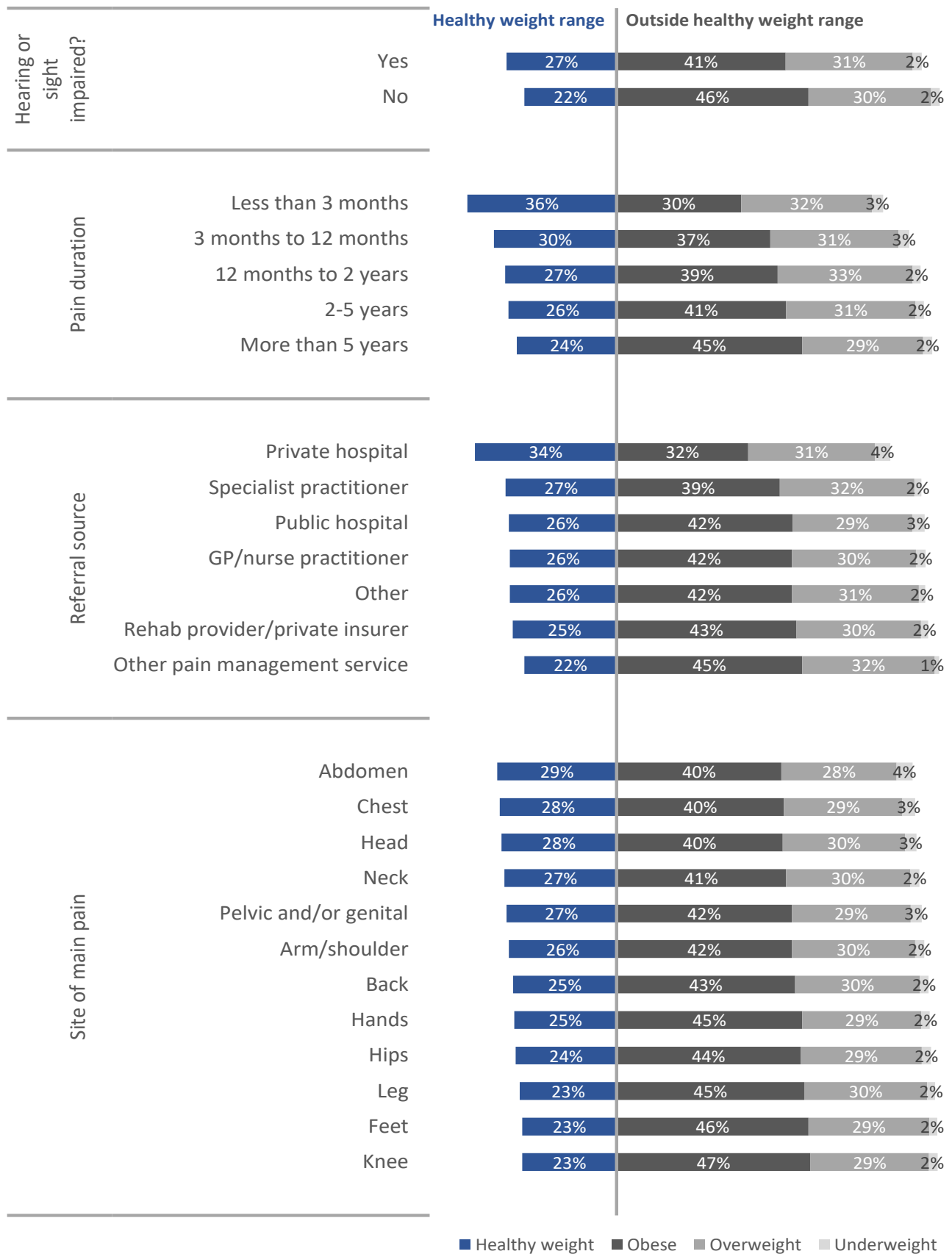■ Healthy weight   ■ Obese   ■ Overweight   ■ Underweight

Figure 2 depicts the relationship between BMI and the presence of a hearing or sight impairment, pain duration, referral source and main pain region. Most notably, longer pain duration was associated with a decrease in the proportion of healthy weight individuals and an increase in obesity. For example, obesity was reported in 45% of patients whose pain duration was more than 5 years, and 30% in those who had experienced their pain for less than 3 months.

Table 1 shows medication use and comorbidities at referral by BMI category. Patients who were obese and overweight were somewhat more likely to use medications containing opioids, paracetamol, antidepressants, NSAIDs and anticonvulsants compared to those in the healthy weight range. The prevalence of comorbidities was also greater, particularly in the obese group, with a higher proportion reporting mental health conditions, arthritis, heart and circulation problems, high blood pressure, diabetes, and digestive and respiratory problems. The prevalence of living with three or more comorbidities was 46% in patients who were obese compared to 27% in those of a healthy weight.

Table 1: **Medication use and comorbidities by BMI category**

	Body Mass Index (BMI) classification				
	Underweight	Healthy weight	Overweight	Obese	Total
Medication use at referral, n(%)					
Opioid	257 (61.2)	3066 (56.5)	3999 (59.5)	6033 (62.8)	13355 (60.2)
Paracetamol	170 (40.5)	2692 (49.6)	3398 (50.5)	5136 (53.5)	11396 (51.4)
Antidepressant	167 (39.8)	2147 (39.5)	2836 (42.2)	4590 (47.8)	9740 (43.9)
NSAID	113 (26.9)	1780 (32.8)	2228 (33.1)	3303 (34.4)	7424 (33.5)
Anticonvulsant	122 (29.0)	1625 (29.9)	2180 (32.4)	3317 (34.5)	7244 (32.7)
Sedatives	96 (22.9)	927 (17.1)	1017 (15.1)	1438 (15.0)	3478 (15.7)
Medicinal cannabinoids	1 (0.2)	55 (1.0)	54 (0.8)	53 (0.6)	163 (0.7)
Comorbidities, n(%)					
Mental Health condition	457 (48.2)	5050 (44.4)	5878 (44.1)	9277 (51.0)	20662 (47.1)
Arthritis	274 (28.9)	3205 (28.2)	4248 (31.9)	7441 (40.9)	15168 (34.6)
Heart and circulation	173 (18.2)	2006 (17.6)	3269 (24.5)	6221 (34.2)	11669 (26.6)
Digestive problems	213 (22.5)	1948 (17.1)	2352 (17.6)	4132 (22.7)	8645 (19.7)
Muscle, bone and joint problems	220 (25.4)	2231 (21.1)	2684 (21.6)	4217 (24.7)	9352 (22.9)
Respiratory problems	178 (18.8)	1444 (12.7)	1768 (13.3)	3881 (21.3)	7271 (16.6)
High blood pressure	70 (7.4)	1152 (10.1)	2258 (16.9)	4710 (25.9)	8190 (18.7)
Diabetes	32 (3.4)	449 (4.0)	855 (6.4)	2404 (13.2)	3740 (8.5)
Neurological problems	72 (7.6)	750 (6.6)	888 (6.7)	1285 (7.1)	2995 (6.8)
Liver, kidney and pancreas	61 (6.4)	508 (4.5)	678 (5.1)	1231 (6.8)	2478 (5.7)
Cancer	56 (5.9)	496 (4.4)	560 (4.2)	766 (4.2)	1878 (4.3)
Thyroid	32 (3.7)	465 (4.4)	574 (4.6)	1166 (6.8)	2237 (5.5)
Other medical problems	184 (19.4)	1710 (15.0)	1947 (14.6)	3040 (16.7)	6881 (15.7)
Number of co-morbidities, n(%)					
0	209 (22.1)	2943 (25.9)	3140 (23.6)	2777 (15.3)	9069 (20.7)
1	241 (25.4)	3279 (28.8)	3336 (25.0)	3736 (20.5)	10592 (24.2)
2	199 (21.0)	2130 (18.7)	2507 (18.8)	3412 (18.8)	8248 (18.8)
3 or more	299 (31.5)	3016 (26.5)	4345 (32.6)	8277 (45.5)	15937 (36.4)

NSAID: Non-steroidal anti-inflammatory medication

Scores at referral on each of the assessment tools are shown in Table 2. These scores reflect increasing symptom severity from the healthy weight range to the overweight and obese categories. Whilst this information suggests that people in the healthy weight range tend to have less severe symptoms at referral, it should be noted that the differences between groups (the effect size) are classified as being less than small and, as such, are unlikely to be clinically significant.

Table 2: Mean scores on the patient-reported assessment tools at referral, by BMI category

| Assessment tool | Body Mass Index (BMI) classification | | | | Total | Effect size | Effect size description |
	Under-weight	Healthy weight	Over-weight	Obese			
Pain severity	6.3	6.1	6.2	6.3	6.3	0.003	< small
Pain interference	7.1	6.8	6.9	7.2	7.0	0.010	< small
Depression	20.6	19.1	19.5	21.0	20.1	0.004	< small
Anxiety	15.0	13.1	13.1	14.5	13.9	0.005	< small
Stress	21.3	20.4	20.6	21.2	20.9	0.001	< small
Pain catastrophising	29.8	28.2	28.5	29.4	29.1	0.001	< small
Pain self-efficacy	20.2	22.0	21.4	19.6	20.8	0.006	< small

Note: '< small' indicates the effect size is less than small. Higher PSEQ indicates less impairment.

Patient outcomes at the end of the episode are shown in the following Tables. Table 3 shows the proportion of patients reporting clinically significant improvement on each domain measured by the standardised assessment tools (for patients reporting at least a moderate level of symptom at referral). Approximately one in four reported clinically significant improvement in their pain and a large proportion reported improvements across the other clinical domains.

Table 3: Patients reporting clinically significant improvement at episode end, by BMI category

| Assessment tool, n(%) | Body Mass Index (BMI) classification | | | | Total | Effect size | Effect size description |
	Under-weight	Healthy weight	Over-weight	Obese			
Pain severity	44 (27.3)	744 (26.0)	871 (24.6)	1084 (22.5)	2743 (24.1)	0.034	< small
Pain interference	115 (65.3)	1865 (61.2)	2296 (59.7)	3057 (58.2)	7333 (59.5)	0.029	< small
Depression	65 (57.0)	1206 (55.7)	1539 (54.5)	2060 (53.1)	4870 (54.2)	0.022	< small
Anxiety	52 (40.6)	815 (43.1)	1013 (41.5)	1384 (40.0)	3264 (41.2)	0.025	< small
Stress	65 (62.5)	1066 (58.1)	1315 (55.3)	1750 (54.8)	4196 (55.9)	0.031	< small
Pain catastrophising	89 (64.0)	1339 (56.2)	1601 (52.5)	2176 (53.3)	5205 (53.9)	0.038	< small
Pain self-efficacy	75 (51.0)	1326 (50.0)	1591 (46.2)	2218 (46.8)	5210 (47.4)	0.031	< small

< small indicates the effect size is less than small

Table 4 shows scores on the Global Rating of Change, which measures the patient's perception of change (both overall and in respect to physical functioning) compared to before receiving treatment at the pain service. At the end of the episode, around 70% of all patients reported making at least some overall improvement, and 67% reported some improvement in their physical abilities.

A comparison of outcomes across the BMI groups suggests that overweight and obese patients are less likely to report clinically significant improvement or provide positive ratings of change. However, the size of the differences between BMI categories is less than small, and hence, unlikely to be clinically important.

Table 4: Global rating of change scores, by BMI category

	Body Mass Index (BMI) classification						
	Under-weight	Healthy weight	Over-weight	Obese	Total	Effect size	Effect size description
GRC – overall, n (%)							
3 (very much better)	11 (8.7)	248 (11.0)	295 (10.3)	408 (10.6)	962 (10.6)	0.037	< small
2	37 (29.1)	601 (26.7)	802 (28.0)	1051 (27.2)	2491 (27.4)		
1	37 (29.1)	763 (33.9)	931 (32.5)	1204 (31.2)	2935 (32.3)		
0 (no change)	16 (12.6)	418 (18.5)	547 (19.1)	767 (19.9)	1748 (19.2)		
-1	8 (6.3)	103 (4.6)	124 (4.3)	176 (4.6)	411 (4.5)		
-2	7 (5.5)	79 (3.5)	97 (3.4)	150 (3.9)	333 (3.7)		
-3 (very much worse)	11 (8.7)	42 (1.9)	67 (2.3)	102 (2.6)	222 (2.4)		
GRC – physical, n (%)							
3 (very much better)	10 (7.9)	195 (8.7)	242 (8.5)	342 (8.9)	789 (8.7)	0.043	< small
2	33 (26.2)	592 (26.4)	701 (24.5)	947 (24.6)	2273 (25.1)		
1	30 (23.8)	742 (33.1)	980 (34.3)	1276 (33.2)	3028 (33.4)		
0 (no change)	29 (23.0)	539 (24.0)	676 (23.7)	865 (22.5)	2109 (23.2)		
-1	6 (4.8)	82 (3.7)	117 (4.1)	167 (4.3)	372 (4.1)		
-2	8 (6.3)	60 (2.7)	90 (3.2)	158 (4.1)	316 (3.5)		
-3 (very much worse)	10 (7.9)	34 (1.5)	50 (1.8)	94 (2.4)	188 (2.1)		

Series List

2018

No.1 2018: *Normative data for patients referred for specialist pain management in Australia*

No.2 2018: *Normative data for children and adolescents referred for specialist pain management in Australia*

No.3 2018: *Carer-proxy and child self-reported ratings of pain and quality of life*

2019

No. 1 2019: *Socioeconomic disadvantage and referral to pain management services in Australasia*

No. 2 2019: *Proximity to specialist pain management services in Australia*

2021

No.1 2021: *Profile of adult patients referred for specialist pain management in New Zealand*

No.2 2021: *Characteristics and outcomes for individuals reporting low back pain*

2022

No.1 2022: *Body Mass Index and persistent pain in Australia: Patient characteristics and treatment outcomes*
No.2 2022: *Body Mass Index and persistent pain in New Zealand: Patient characteristics and treatment*

Appendix

Table A1: Sociodemographic characteristics by BMI category for patients who attended a pain management service in Australia (2014-2021)

Characteristics	Body Mass Index (BMI) classification				
	Underweight	Healthy weight	Overweight	Obese	Total
Age, mean (sd)	46.9 (17.1)	48.5 (15.9)	51.5 (15.2)	51.8 (14.1)	51.5 (15.3)
Sex, n(%)					
Male	258 (1.4)	4501 (23.7)	6856 (36.0)	7410 (38.9)	19025 (43.5)
Female	684 (2.8)	6849 (27.7)	6445 (26.0)	10764 (43.5)	24742 (56.5)
Aboriginal or Torres Strait Islander, n(%)					
Yes	26 (1.7)	308 (20.7)	351 (23.6)	801 (53.9)	1486 (3.6)
No	873 (2.2)	10438 (26.0)	12353 (30.7)	16545 (41.1)	40209 (96.4)
Interpreter required, n(%)					
No	893 (2.2)	10624 (25.7)	12497 (30.2)	17311 (41.9)	41325 (95.9)
Yes	37 (2.1)	540 (30.2)	624 (34.8)	590 (32.9)	1791 (4.1)
Country of birth, n(%)					
Australia	686 (2.3)	7565 (25.0)	8786 (29.0)	13263 (43.8)	30300 (70.5)
Other	242 (1.9)	3555 (28.1)	4269 (33.7)	4597 (36.3)	12663 (29.5)
Socioeconomic disadvantage quintile[6], n(%)					
1 – least	219 (2.6)	2797 (32.9)	2735 (32.2)	2740 (32.3)	8491 (20.5)
2	160 (2.2)	1962 (27.0)	2220 (30.6)	2914 (40.2)	7256 (17.6)
3	217 (2.1)	2362 (23.1)	3108 (30.4)	4525 (44.3)	10212 (24.7)
4	166 (2.2)	1775 (23.6)	2167 (28.8)	3426 (45.5)	7534 (18.2)
5 – most	137 (1.7)	1844 (23.5)	2279 (29.0)	3589 (45.7)	7849 (19)

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[6] Census of Population and Housing: Socio-Economic Indexes for Areas (SEIFA), Australia, 2016 LATEST ISSUE Released at 11:30 AM (CANBERRA TIME) 27/03/2018.
https://www.abs.gov.au/Ausstats/abs@.nsf/0/4E5531D7B85288A9CA2577E4000E1F9E?OpenDocument

Table A2: Hearing or sight impairment, pain duration, referral source and main pain area by BMI category for patients who attended pain management service in Australia (2014-2021)

Characteristics	Body Mass Index (BMI) classification				
	Underweight	Healthy weight	Overweight	Obese	Total
Hearing or sight impaired?, n(%)					
No	797 (2.2)	9757 (26.5)	11268 (30.6)	14997 (40.7)	36819 (85.8)
Yes	130 (2.1)	1349 (22.2)	1798 (29.5)	2813 (46.2)	6090 (14.2)
Pain duration, n(%)					
less than 3 months	22 (2.7)	293 (35.9)	257 (31.5)	245 (30.0)	817 (1.9)
3 months to 12 months	152 (2.6)	1724 (29.5)	1802 (30.9)	2163 (37.0)	5841 (13.7)
12 months to 2 years	127 (1.9)	1788 (26.8)	2170 (32.5)	2592 (38.8)	6677 (15.6)
2-5 years	199 (2.0)	2623 (26.0)	3149 (31.2)	4107 (40.8)	10078 (23.8)
More than 5 years	417 (2.2)	4560 (24.0)	5531 (29.1)	8480 (44.7)	18988 (44.8)
Referral source, n(%)					
GP/nurse practitioner	657 (2.3)	7466 (25.7)	8681 (29.9)	12251 (42.2)	29055 (66.3)
Specialist practitioner	167 (1.7)	2702 (26.7)	3278 (32.4)	3972 (39.3)	10119 (23.1)
Other pain management service	4 (1.1)	80 (22.2)	115 (31.9)	161 (44.7)	360 (0.8)
Public hospital	106 (3.0)	907 (25.9)	1008 (28.8)	1485 (42.4)	3506 (8)
Private hospital	3 (3.7)	28 (34.1)	25 (30.5)	26 (31.7)	82 (0.2)
Rehabilitation provider/private insurer	2 (1.7)	30 (25.0)	36 (30.0)	52 (43.3)	120 (0.3)
Other	9 (1.5)	155 (25.7)	185 (30.6)	255 (42.2)	604 (1.4)
Main pain, n(%)					
Abdomen	215 (3.9)	1583 (28.7)	1525 (27.7)	2190 (39.7)	5513 (12.9)
Arm/shoulder	445 (2.2)	5257 (25.9)	6032 (29.7)	8557 (42.2)	20291 (47.1)
Back	563 (2.1)	6556 (24.9)	7920 (30.0)	11330 (43.0)	26369 (61.0)
Chest	141 (3.1)	1260 (28.1)	1276 (28.5)	1806 (40.3)	4483 (10.5)
Feet	282 (1.9)	3348 (22.7)	4293 (29.1)	6815 (46.2)	14738 (34.3)
Hands	216 (2.0)	2596 (24.6)	3026 (28.7)	4715 (44.7)	10553 (24.6)
Head	210 (2.7)	2141 (27.7)	2281 (29.5)	3091 (40.0)	7723 (18.0)
Hips	454 (2.2)	5065 (24.3)	6069 (29.2)	9230 (44.3)	20818 (48.2)
Knee	429 (2.1)	4593 (22.7)	5774 (28.5)	9475 (46.7)	20271 (46.8)
Leg	432 (1.9)	5359 (23.3)	6788 (29.6)	10380 (45.2)	22959 (53.2)
Neck	359 (2.2)	4345 (27.0)	4804 (29.9)	6563 (40.8)	16071 (37.4)
Pelvic and/or genital	124 (2.7)	1226 (26.5)	1322 (28.6)	1950 (42.2)	4622 (10.8)