ORIGINAL RESEARCH

Emergency department presentations and associated hospital admissions for low back pain in Australia

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Abstract

Objective: To determine factors associated with hospital admissions from ED presentations for low back pain (LBP).
Methods: This was a retrospective analysis of 147 ED centres in New South Wales (NSW), Australia, between 2005 and 2014. Data were accessed from the NSW Emergency Department Data Collection to determine patients who attended ED and whether or not they were admitted to hospital.
Results: There were 1 388 078 ED visits for LBP across 147 different ED centres between 2005 and 2014. Between 2005 and 2013, hospital admission rates from ED visits for LBP increased annually by 5.1% (95% confidence interval [CI] 3.9–6.4) from 477 per 100 000 in 2005 to 730 per 100 000 in 2013. Patients who were under injured workers' insurance (i.e. workers compensation insurance) had significantly lower odds (odds ratio [OR] 0.42, 95% CI 0.40–0.43) of being admitted to hospital for LBP compared with those not on injured workers' insurance. Patients living in the highest socioeconomic areas were also more likely to be admitted to hospital from an ED visit, compared with those from the lowest socioeconomic areas (OR 1.26, 95% CI 1.24–1.29).
Conclusion: Rates of hospitalisation following attendance to ED for LBP increased annually by 5% between 2005 and 2013. Hospital admission rates were lower among patients from the lowest socioeconomic areas or under injured workers' compensation insurance.

Key words: emergency medicine, low back pain, lumbar spinal stenosis, lumbar vertebrae, pain.

Key findings

- Between 2005 and 2013, hospital admission rates from ED visits for LBP increased annually by 5.1% (95% CI 3.9–6.4) from 477 per 100 000 in 2005 to 730 per 100 000 in 2013.
- Patients who were under injured workers' insurance (i.e. workers compensation insurance) had significantly lower odds (OR 0.42, 95% CI 0.40–0.43) of being admitted to the hospital when presenting with LBP.
- Patients living in the highest socioeconomic areas were also more likely to be admitted to hospital from an ED visit for LBP, compared with those from the lowest socioeconomic areas (OR 1.26, 95% CI 1.24–1.29).

Introduction

Low back pain (LBP) remains the leading cause of disease burden measured as years lived with disability, impacting around half a billion people globally.[1] The incidents of LBP are increasing and are contributing to the rising rates of hospitalisations.[2] LBP is one of the top 10 reasons why patients will attend an ED in Australia.[3] Australian citizens can attend a public ED or hospital at no personal cost, under the government Medicare scheme. Patients can choose to attend private hospitals, but these do incur costs that vary depending upon the type of private health insurance the patient has purchased.

Admissions to hospitals occur via two main pathways: (i) scheduled and (ii) unscheduled admissions. Scheduled admissions commonly include booked operations, such as surgery and other procedures. Unscheduled admissions include ED walk-ins or those brought in by ambulance and these make up around half of all hospitalisations.[2]

It is standard practice that people presenting to an ED are triaged by an ED nurse and/or physician. The person conducting the triage must

TABLE 1. Baseline characteristics for each year of ED presentations in NSW

Year	Total patients (n)	Total patients per '000	ED visits (n)	ED visits per '000	Hospital admissions (n)	Hospital admission per '000	Mean age (years)	Male %	IRSAD, mean
2005	51 801	762	109 048	1604	32 421	477	47.6	48.5	5.17
2006	56 302	822	121 510	1774	37 240	544	48.5	48.5	5.13
2007	58 049	838	129 826	1873	36 865	532	49.4	47.9	5.15
2008	57 516	817	128 902	1831	37 338	530	50.3	47.8	5.15
2009	60 777	845	135 853	1889	40 717	566	50.7	47.6	5.16
2010	65 164	896	147 275	2026	44 324	610	51.7	47.6	5.13
2011	67 143	926	154 063	2125	47 795	659	52.3	47.6	5.06
2012	69 745	949	166 270	2262	51 022	694	52.7	47.5	5.06
2013	70 664	946	171 552	2297	54 530	730	53.2	47.3	5.09
Annual percentage change (95% CI)	3.9 (3.2–4.6)	2.7 (1.9–3.4)	5.5 (4.7–6.3)	4.3 (3.4–5.2)	6.4 (5.2–7.5)	5.1 (3.9–6.4)	1.4 (1.2–1.6)	−0.3 (−0.4 to −0.2)	−0.2 (−0.4 to −0.1)

CI, confidence interval; IRSAD, Index of Relative Socio-economic Advantage and Disadvantage; NSW, New South Wales.

help determine who should be admitted and who should be sent home. A person with LBP may be admitted if they are considered to require inpatient treatment, further assessment (i.e. imaging) or monitoring.[4] The decision to admit a patient is at the discretion of the ED, and the treating physician. Previous studies of ED presentations found significant levels of servicing for LBP,[5–7] with lumbar imaging requested in around one-quarter of all presentations and opioid prescription in around two-thirds.[5] These findings suggest that the utilisation of some interventions (i.e. imaging) in ED settings may not be consistent with what is recommended in ED guidelines.[8,9] High rates of servicing for nonserious LBP contribute to hospital costs of AUD$392.9 million annually in Australia.[10]

Given the significant financial burden of LBP, including costs with hospital admissions, understanding the trends over time and potential drivers of hospital admissions following emergency presentations can provide valuable insights for the planning and provision of health services. Furthermore, hospitalisations for LBP are high, despite guideline recommendations to reduce unnecessary assessment and treatment interventions for LBP.[2,5] To help explore the reasons behind the discrepancy in recommendations and clinical practice, we analysed administrative data from 147 EDs in New South Wales (NSW), Australia between January 2005 and September 2014. This study aimed to determine factors (i.e. age, mode of arrival, socio-economic status [SES]) associated with hospital admissions from ED presentations for LBP. The secondary aim was to determine trends in ED attendance and hospital admission for LBP.

Methods

Data source

This retrospective study was performed using data from the NSW Emergency Department Data Collection (EDDC). The EDDC was established in July 1996 for data

TABLE 2. *Age and sex-stratified hospital admission rates (%)*

Year	Age 0–24	Age 25–44	Age 45–64	Age 65–84	Age 85+
Male	%	%	%	%	%
2005	14.2	20.5	29.0	47.5	60.3
2006	14.7	19.5	31.0	49.7	63.6
2007	12.3	17.5	27.4	46.1	58.3
2008	12.3	17.4	27.2	46.4	59.7
2009	11.9	18.3	27.7	48.2	61.2
2010	12.6	17.4	27.0	46.9	62.2
2011	12.8	17.9	27.0	48.0	62.6
2012	12.1	17.5	27.1	46.8	62.0
2013	12.3	18.2	27.7	46.9	62.8
Female					
2005	18.0	21.5	27.9	51.3	64.7
2006	17.4	22.2	28.7	50.1	64.5
2007	15.4	19.5	26.3	46.5	64.1
2008	16.0	19.3	26.0	48.1	63.9
2009	14.5	19.5	26.8	49.3	63.3
2010	15.1	19.5	25.8	48.2	64.7
2011	14.3	19.9	26.0	48.9	66.1
2012	15.1	19.0	25.8	48.0	63.6
2013	14.5	20.6	27.0	48.7	66.0

monitoring in ED of both public and private hospitals in the state of NSW, Australia. We accessed an extract of EDDC data from January 2005 to September 2014. For this study, we followed the REporting of studies Conducted using Observational Routinely-collected health Data (RECORD) Statement (Table S1).[11] Ethics approval was received from the New South Wales Human Research Ethics Committee.

Inclusion criteria

We included administrative data from all patients aged 18 years or older who presented to ED with LBP, identified by International Classification of Diseases (ICD), Ninth Revision, Clinical Modification; Tenth revision, Australian Modification and SNOMED CT (full list of included LBP conditions and codes are provided in Figure S1). As indicated by the data custodians, LBP could be the complaint at the beginning of attendance or the diagnosis at end of attendance.

Method of measurement
Prognostic factors

Based on available administrative data provided by EDs, the following key prognostic categories were selected and assessed: age, sex, mode of arrival, compensation status, visit type, Index of Relative Socioeconomic Advantage and Disadvantage (IRSAD) and hospitalisation. Age was defined as a continuous variable, while sex was defined as a binary variable. Mode of arrival, compensation status and ED visit type were all defined as categorical variables.

The IRSAD summarises information about the economic and social conditions of people and households within a postcode, including both relative advantage and disadvantage

measures.[12] The value of IRSAD ranged from 1 to 10, with a lower value representing lower advantage, and a higher value greater advantage. In Australia, IRSAD is collected every 5 years (e.g. 2006, 2011, 2016). We linked the year 2011 IRSAD data with the postcode reported in the EDDC for each patient. Due to the large sample size[13] and the potential nonlinear association of two continuous variables (IRSAD and age) with the outcome (hospitalisation), age and IRSAD were coded with restricted cubic spline, a validated approach to model nonlinear associations.[14]

Primary outcome

The primary outcome of this study was hospital admission from ED attendance for LBP. Data on the type of separation for each ED admission were used to define the primary outcome as described earlier.

Statistical analysis

The baseline data on presentation characteristics (Table 1) are presented as absolute numbers, percentages and means. For the time trends of ED presentations and subsequent hospital admission, results were tabulated, and descriptive statistics were presented (Tables 1,2; Figs 1,2). For all trends, the data from 2014 were excluded, as only the months of January to September were available; whereas for the association analyses, all data from January 2005 to September 2014 were included. The changes in trends (year as the unit of analysis) were calculated through the National Cancer Institute's Joinpoint software (version 4.8.0.1, Rockville, MD, USA)[15] and represented by annual percentage change. Results for patients' ED attendance and hospital admission are presented as rates per 100 000 population calculated in December of each represented year (Tables 1,2).

The association between age, mode of arrival or compensable status and risk of hospitalisation post-ED visits was analysed using logistic regression. Results were reported as odds ratios (ORs) and 95% confidence intervals (CIs). As the hospitalisation risk may be different
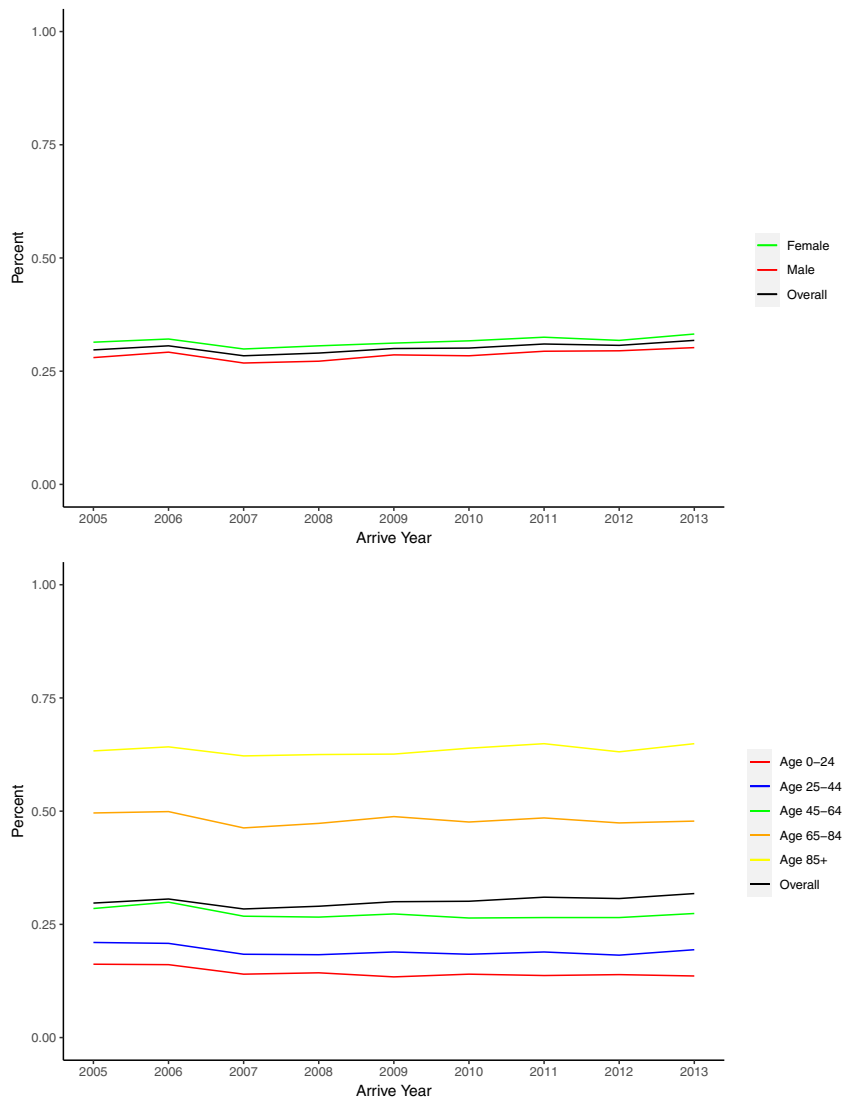
Figure 1. *Percent of hospitalisations per year for low back pain from the ED by sex and age. Note: 1.0 on the y-axis is equal to 100%.*

between patients who attend once and those who attend on multiple occasions, we performed an additional analysis that only included patients' first visit to ED for LBP, to determine if differences in associations were present (Table S2).

A redundancy analysis was performed through a flexible parametric additive regression model.[16] The redundancy analysis found no prognostic factor could be predicted by other prognostic factors and therefore should not be excluded from the analysis.[14] A complete-case analysis was used to handle missing data, as less than 1% of missing data were identified in our dataset (age, 0.0016%, 21/1339209; IRSAD, 0.8%, 10 663/1339209).

From the logistic regression analyses, the relationships between age or SES and post ED visit hospitalisation rate were presented visually (Fig. 3) using partial effect plots. Partial effect plots present the effect varying age or IRSAD had upon hospitalisation, when other predictors remain unchanged (i.e. their medians or modes).[17] All statistical analyses were performed with R (version 3.6.2, Vienna, Austria).
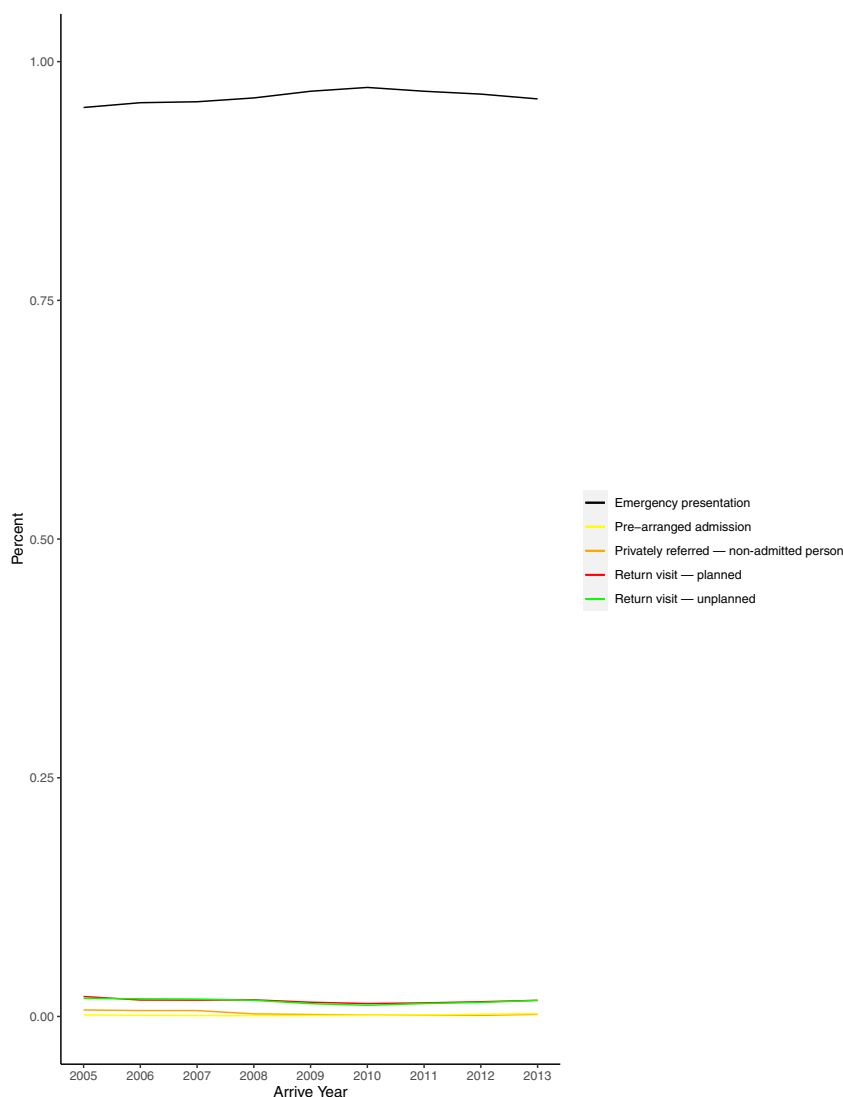
Results

This study included 1 388 078 ED visits for LBP across 147 different

centres between January 2005 and September 2014. Of those, 13.4% (*n* = 22 209) only attended ED on one occasion during the study period, with 41.2% (*n* = 68 308) attending between two and five occasions, 33.4% (*n* = 33 805) between six and 10 visits and 22.0% (*n* = 36 662) attending 10 or more occasions (Table S3). By excluding patients who had unmatched information in the coding system, 1 339 209 ED visits were included in the association analysis. The baseline characteristics for each year of patient visits between 2005 and 2013 are summarised in Table 1. A visual representation of the number of visits by postcode in NSW is shown in Figures S2 and S3.

The total number of patients attending ED for LBP increased annually by 5.5% (95% CI 4.7–6.3) from 1604 per 100 000 in 2005 (*n* = 109 048) to 2297 per 100 000 in 2013 (*n* = 171 552), with the total number of hospital admission also increasing from 477 per 100 000 (*n* = 32 421) in 2005 to 730 per 100 000 (*n* = 54 530) in 2013, an annual increase of 5.1% (95% CI 3.9–6.4). The mean age of those attending ED increased from 47.6 years in 2005 to 52.7 years in 2013.

Using the results from the logistic regression analysis, the probability that a patient, based on either age or IRSAD would be admitted to hospital following attendance to ED with LBP was calculated and presented (Fig. 3). The results show that with increasing age, the probability of being admitted to hospital increased, with patients aged 85 years or older having odds of 5.45 (95% CI 5.34–5.57) times those aged 24 years or younger (Table S4). Increased SES was also associated with greater odds of being admitted to hospital, although the relationship was nonlinear (Fig. 3; Table S5).

A total of 26 separate variables (i.e. prognostic factors) from ED presentation for LBP were analysed for their association with hospital admission (Table 3). Of the 26 prognostic factors, a planned return visit to the ED had the lowest odds of

Legend:
- Emergency presentation
- Pre–arranged admission
- Privately referred — non-admitted person
- Return visit — planned
- Return visit — unplanned

Figure 2. *Percent of hospitalisations per year for low back pain from the ED by triage category. Note: 1.0 on the y-axis is equal to 100%.*

admissions directly from these visits in NSW, Australia. We found that ED attendance and hospital admission rates from ED attendance had increased between 2005 and 2013, likely leading to increased costs and burden on hospital resources.

Between 2005 and 2013 there was a 4.3% (95% CI 3.4–5.2) annual increase in patient attendance to ED for LBP, and an annual rate increase from 1604 per 100 000 in 2005 to 2297 per 100 000 in 2013. Hospital admission also increased annually by 5.1% (95% CI 3.9–6.4) between 2005 and 2013, with the rate increasing from 477 per 100 000 to 730 per 100 000. The increasing rates of hospital admission and mean age of patients found in this study was consistent with previous studies from both Australia and England.[18,19] In our study, the mean age increased from 47.6 years in 2005 to 53.2 years in 2013, while the age in the UK study increased from 52.5 in 1999 to 56.5 in 2013.[19] The reasons for the increasing hospital admission rates are not clear but may reflect the increasing presence of comorbidities, heightened concerns of serious pathology, new options to include patients in short-stay units, and an ageing population.[4]

Our study found older adults had a higher probability of being admitted when compared with younger adults (Fig. 3). Adults aged 85 years or older had the highest odds of hospital admission (OR 5.45, 95% CI 5.34–5.57), with those aged 65–84 years of age the second highest (OR 3.81, 95% CI 3.74–3.88), when compared with patients aged 24 years or younger. Given the Australian population is ageing,[20] and older adults had higher odds of hospital admission, the rate of hospital admission is likely to continue increasing in the absence of any changes to the current management of LBP in the ED setting. Although older adults being admitted at higher rates is unsurprising, consideration of how best to manage this population when they attend an ED with LBP may become an increasing priority.

being admitted to hospital (OR 0.37, 95% CI 0.36–0.39). The second lowest odds of hospital admission were recorded for patients under the injured workers' insurance scheme. Patients under the injured workers insurance had less than half the odds of being admitted (OR 0.42, 95% CI 0.40–0.43) compared with non-workers compensation patients (i.e. standard attendees). There was no difference between the odds of men being admitted compared with women (OR 1, 95% CI 0.99–1.01).

The breakdown for the time of arrival to ED with LBP for each day of the week is outlined in Table 4. Of the days of the week, Monday had the highest attendance rate overall, with between 08:00 and 11:59 the most common timeslot. The lowest rate of attendance was seen on Friday, between the times of 00:00 and 03:59.
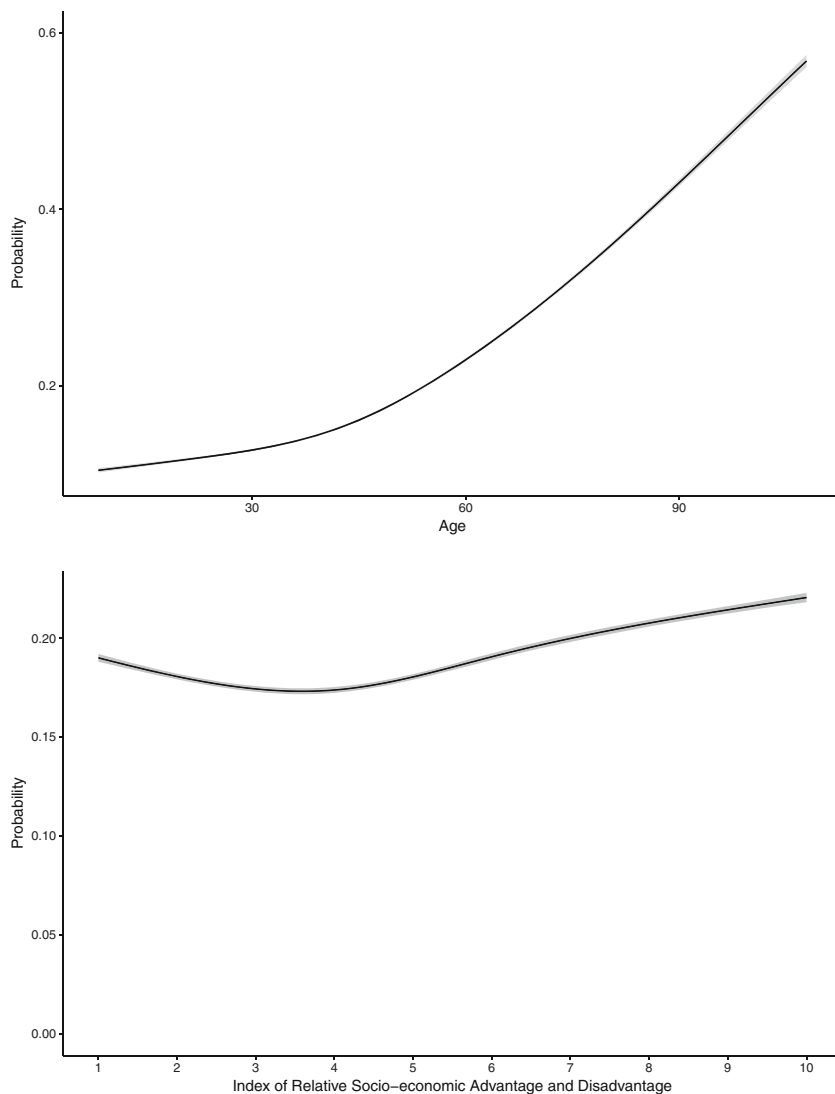
Discussion

In this retrospective study, 1 388 078 patient visits to 147 NSW hospital EDs for LBP between 2005 and 2014 (129 months) were recorded. The data included both patient visits to ED, and the number of hospital

Figure 3. *Probability of hospital admission based upon age and Index of Relative Socio-economic Advantage and Disadvantage.*

During the analysis of associations between prognostic factors of hospital admission from ED presentation, we found no difference between the odds of men being admitted compared with women (OR 1, 95% CI 0.99–1.01). This finding was in contrast to previous studies of hospitalisation rates by sex for LBP, which found females were hospitalised at higher rates than males.[7,21] The studies of LBP provided no explanation for the difference, but previous studies of other conditions hypothesised that higher rates of hospital admission may be related to a higher prevalence of comorbidities among women.[22] Future studies of ED attendance and hospital admission could consider exploring the presence of comorbidities, to determine if any specific comorbidities are associated with admission rates from ED.

In Australia, any person who is injured as part of their employment can apply for workers compensation insurance, which covers some or all of their medical costs related to their injury.[23] Workers compensation patients have been found to have poorer long-term outcomes for LBP, compared with nonworkers compensation patients.[24] The reason for the poorer outcomes among workers compensation patients has been attributed to several factors, including poorer psychological function and the presence of litigation.[24] It is possible that the low hospital admission rates observed for injured workers may also be due to bias of hospital staff towards these patients. Another reason for the lower admission rates among workers' compensation patients could be related to these patients having a lower threshold for attending ED for their LBP, compared with non-injured workers. A previous study of injured workers found patients under workers compensation insurance have significantly higher levels of healthcare utilisation when accounting for injury type, age, income and sex.[25] Given the significance of this finding, future studies should consider exploring the reasons behind low hospital admission rates for injured workers, including analysis of ED criteria for hospital admissions of LBP attendees.

Another significant finding of this study was the lower rates of hospital admissions from ED for patients from more socioeconomically disadvantaged backgrounds. Previous smaller sample studies[26–28] reported that lower SES was associated with higher rates of hospital admission (up to 21% higher) compared with the most advantaged socioeconomic group.[27] In our study, people more socioeconomically advantaged had significantly higher odds of being admitted to hospital compared with those less advantaged (OR 1.26, 95% CI 1.24–1.29). As with findings of lower hospital admission rates for injured workers, it is unclear if differences in hospital admission rates for lower SES are suggestive of bias during the triage of patients in ED centres or other factors.

Limitations

The main limitation of this study was the dataset did not include detailed comorbidities for each patient and the small number of putative prognostic factors available. Including data on comorbidities, symptom severity, and duration of

TABLE 3. *Association among prognostic factors to hospital admission from ED for LBP*

Prognostic factor	Number of ED patient visits	Odds ratio with 95% confidence interval
Sex		
Female	696 631	Reference
Male	642 578	1 (0.99–1.01)
Model of arrival		
No transport (walked in)	28 203	Reference
State ambulance vehicle	452 923	**4.12 (3.98–4.26)**
Community/public transport	16 738	0.99 (0.94–1.04)
Private vehicle	823 246	**1.28 (1.24–1.32)**
Helicopter rescue service	730	**11.57 (9.84–13.60)**
Air ambulance service	629	**18.58 (15.09–22.88)**
Internal ambulance/transport	3784	**15.76 (14.45–17.20)**
Police/correctional services vehicle	9306	**3.72 (3.52–3.93)**
Other, e.g. undertakers/contractors	2561	**1.99 (1.81–2.19)**
Retrieval	293	**7.60 (5.95–9.72)**
Internal bed/wheelchair	796	**5.13 (4.41–5.96)**
Compensable status		
Noncompensable	1 249 995	Reference
Injured worker insurance (workcover)	37 648	**0.42 (0.40–0.43)**
Motor vehicle injury insurance	11 036	**0.90 (0.86–0.94)**
Other compensable	2184	**1.42 (1.29–1.56)**
Overseas visitor	5317	**0.74 (0.68–0.81)**
Department of Veteran's Affairs	31 588	**1.06 (1.03–1.08)**
Defence Force personnel	485	**1.29 (1.04–1.59)**
Eligible overseas visitor	861	0.91 (0.72–1.15)
Visit type		
Emergency presentation	1 290 997	Reference
Return visit: planned	21 055	**0.37 (0.36–0.39)**
Return visit: unplanned	21 173	1.03 (1.00–1.07)
Privately referred: nonadmitted person	3860	**2.18 (2.06–2.30)**
Prearranged admission	2124	**8.85 (7.86–9.97)**

Bold for statistically significant findings ($P < 0.05$). LBP, low back pain.

symptoms would be of benefit in future studies to determine their impact on hospital admission, although obtaining reliable records on these outcomes from an ED setting may be difficult.

As per the inclusion criteria, LBP from multiple causes was included in this study. This approach allowed for a pragmatic assessment of the attendance and hospital admission rates for LBP from ED in Australia, but may not provide results that are representative of subgroups of LBP. LBP from some causes (e.g. traumatic incident), for example, may have higher hospital admission rates compared with LBP from non-traumatic events (e.g. chronic LBP from "spinal stenosis" [M48.0]).

The SES (i.e. IRSAD) of a patient in the study was calculated by using the known economic and social status of their postcode and then

TABLE 4. *Time of arrival to ED for LBP for each day of the week*

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Total
	n = (%)	n = (%)	n = (%)	n = (%)	n = (%)	n = (%)	n = (%)	n = (%)
00:00–3:59	14 234 (6.5)	13 714 (6.9)	13 770 (7.1)	13 850 (7.2)	14 351 (7.5)	16 238 (8.5)	16 867 (8.2)	103 024 (7.4)
4:00–7:59	17 018 (7.8)	15 326 (7.7)	14 702 (7.6)	14 669 (7.7)	14 781 (7.7)	14 937 (7.8)	15 930 (7.7)	107 363 (7.7)
8:00–11:59	59 942 (27.6)	51 087 (25.8)	49 030 (25.4)	47 988 (25.0)	48 196 (25.3)	46 040 (24.0)	52 042 (25.2)	354 325 (25.5)
12:00–15:59	50 951 (23.5)	45 803 (23.1)	44 853 (23.3)	44 611 (23.3)	45 370 (23.8)	44 825 (23.4)	47 838 (23.2)	324 251 (23.4)
16:00–19:59	44 197 (20.3)	41 982 (21.2)	40 441 (21.0)	40 261 (21.0)	38 697 (20.3)	39 806 (20.8)	42 583 (20.6)	287 967 (20.7)
20:00–23:59	30 887 (14.2)	30 006 (15.2)	30 028 (15.6)	29 934 (15.6)	29 345 (15.4)	29 782 (15.5)	31 166 (15.1)	211 148 (15.2)
Total	217 229	197 918	192 824	191 313	190 740	191 628	206 426	1 388 078

LBP, low back pain.

inferring their SES on this basis. This approach has been used by other prognostic studies of SES on hospitalisation[29,30] but requires the results of IRSAD to be interpreted with some caution. Another limitation is that General Practice (GP) services are primary care providers for patients with LBP. Because of the variability in GP service availability across the state, the limited consultation hours, and a variation on no-cost access (i.e. bulk billing), ED presentations may be sensitive to the availability of the GP.

Based on previous literature, the size of ED/designation might be an important prognostic factor, but this information was not available from the EDDC. If available, future studies should consider exploring this. A final limitation, many EDs may have opened or increased observation and/or short-stay units over the time of the study to manage ED admissions. These units may have contributed to the increase in admissions observed in this study.

Conclusions

Our study found that the rates of attendance to ED for LBP increased between 2005 and 2014, as did the hospital admission rate and the mean age of patients. Patients from lower socioeconomic backgrounds or those under workers compensation insurance had lower hospital admission rates. Future studies should consider including more clinical information on LBP patients to determine how this affects the hospital admission rate.

Acknowledgment

Competing interests

None declared.

Data availability statement

The data that support the findings of this study are available from https://www.cherel.org.au. Restrictions apply to the availability of these data, which were used under license for this study. Data are available from https://www.cherel.org.au with their permission.

References

1. Hurwitz EL, Randhawa K, Yu H, Cote P, Haldeman S. The global spine care initiative: a summary of the global burden of low back and neck pain studies. *Eur. Spine J.* 2018; **27**: 796–801.

2. Australian Institute of Health and Welfare. Emergency department care 2017–18: Australian Hospital Statistics. Canberra: Australian Institute of Health and Welfare, 2018.

3. Australian Institute of Health and Welfare. Emergency department care 2015–16: Australian Hospital Statistics. Canberra: Australian Institute of Health and Welfare, 2016.

4. Needs C, Laurent R. Hospital admissions for acute low back pain. *Intern. Med. J.* 2019; **49**: 294–6.

5. Ferreira GE, Machado GC, Abdel Shaheed C *et al*. Management of low back pain in Australian emergency departments. *BMJ Qual. Saf.* 2019; **28**: 826–34.

6. Lovegrove MT, Jelinek GA, Gibson NP, Jacobs IG. Analysis of 22,655 presentations with back pain to Perth emergency departments over five years. *Int. J. Emerg. Med.* 2011; **4**: 59.

7. McCaughey EJ, Li L, Georgiou A, Golding MH, Westbrook JI. Imaging for patients presenting to an emergency department with back pain: impact on patient pathway. *Emerg. Med. Australas.* 2016; **28**: 412–8.

8. Emergency Care Institute. Acute low back pain. 2021. [Cited 9 Aug 2021.] Available from URL: https://aci.health.nsw.gov.au/networks/eci/clinical/clinical-tools/orthopaedic-and-musculoskeletal/acute-low-back-pain

9. Lin I, Wiles L, Waller R *et al*. What does best practice care for musculoskeletal pain look like? Eleven consistent recommendations from high-quality clinical practice guidelines: systematic review. *Br. J. Sports Med.* 2020; **54**: 79–86.

10. Coombs DM, Machado GC, Richards B *et al*. Healthcare costs due to low back pain in the emergency department and inpatient setting in Sydney, Australia. *Lancet Reg. Health West. Pac.* 2021; **7**: 100089.

11. Benchimol EI, Smeeth L, Guttmann A *et al*. The REporting of studies conducted using observational routinely-collected health data (RECORD) statement. *PLoS Med.* 2015; **12**: e1001885.

12. Australian Bureau of Statistics. Socio-Economic Indexes for Areas. Canberra: Australian Bureau of Statistics, 2011.

13. Steyerberg EW. *Clinical Prediction Models*. Cham: Springer International Publishing, 2019.

14. Harrell FE Jr. *Regression Modeling Strategies: With Applications to Linear Models, Logistic and Ordinal Regression, and Survival Analysis*. Cham: Springer, 2015.

15. Kim HJFM, Feuer EJ, Midthune DN. Permutation tests for joinpoint regression with applications to cancer rates. *Stat. Med.* 2000; **19**: 335–51.

16. Harrell FE Jr, and Dupont C. Harrell miscellaneous. V4.4–0. Nashville, TN: Vanderbilt University, 2020.

17. Harrell Jr FE. Rms: Regression Modeling Strategies. R Package Version 5.1–4. Nashville, TN: Vanderbilt University, 2019.

18. Australian Institute of Health and Welfare. Trends in Hospitalised Injury, Australia 1999–00 to 2014–15. Canberra: Australian Institute of Health and Welfare, 2018.

19. Sivasubramaniam V, Patel HC, Ozdemir BA, Papadopoulos MC. Trends in hospital admissions and surgical procedures for degenerative lumbar spine disease in England: a 15-year time-series study. *BMJ Open* 2015; **5**: e009011.

20. Australian Institute of Health and Welfare. Older Australians at a glance. Canberra: Australian Institute of Health and Welfare, 2018.

21. Owens PL, Woeltje M, Mutter R. Emergency Department Visits and Inpatient Stays Related to Back Problems, 2008: Statistical Brief #105. Healthcare Cost and Utilization Project (HCUP) Statistical Briefs. Rockville (MD)2008.

22. Lee JM, Davis MM, Gebremariam A, Kim C. Age and sex differences in hospitalizations associated with diabetes. *J. Womens Health (Larchmt)* 2010; **19**: 2033–42.

23. Collie A, Sheehan L, Lane TJ, Gray S, Grant G. Injured worker experiences of insurance claim processes and return to work: a national, cross-sectional study. *BMC Public Health* 2019; **19**: 927.

24. Murgatroyd DF, Casey PP, Cameron ID, Harris IA. The effect of financial compensation on health outcomes following musculoskeletal injury: systematic review. *PLoS One* 2015; **10**: e0117597.

25. Harris IA, Murgatroyd DF, Cameron ID, Young JM, Solomon MJ. The effect of compensation on health care utilisation in a trauma cohort. *Med. J. Aust.* 2009; **190**: 619–22.

26. Turrell G, Mathers CD. Socioeconomic status and health in Australia. *Med. J. Aust.* 2000; **172**: 434–8.

27. Walker A TL, Pearse J, Harding A. Hospitalisation rates and costs by socioeconomic status, New South Wales, 1996–97 and 2000–01. Health Services and Policy Research Conference. 2003.

28. Moorin RE, Holman CD. The effects of socioeconomic status, accessibility to services and patient type on hospital use in Western Australia: a retrospective cohort study of patients with homogenous health status. *BMC Health Serv. Res.* 2006; **6**: 74.

29. Moorin RE, Youens D, Preen DB, Harris M, Wright CM. Association between continuity of provider-adjusted regularity of general practitioner contact and unplanned diabetes-related hospitalisation: a data linkage study in New South Wales, Australia, using the 45 and up study cohort. *BMJ Open* 2019; **9**: e027158.

30. Taylor R, Quine S, Lyle D, Bilton A. Socioeconomic correlates of mortality and hospital morbidity differentials by local government area in Sydney 1985-1988. *Aust. J. Public Health* 1992; **16**: 305–14.

Supporting information

Additional supporting information may be found in the online version of this article at the publisher's web site:

Figure S1. Full list of included LBP conditions by code.
Figure S2. Number of visits by postcode to an ED for low back pain in New South Wales, Australia between 2005 and 2014.
Figure S3. Number of visits by postcode to an ED for low back pain in Greater Sydney area, New South Wales, Australia between 2005 and 2014.
Table S1. The RECORD statement – checklist of items, extended from the STROBE statement, that should be reported in observational studies using routinely collected health data.
Table S2. Association among prognostic factors to hospital admission from ED (patient's first visit) for LBP.
Table S3. Number of total visits for each patient during 2005 and 2014.
Table S4. Odds of hospital admission from ED visits per age group.
Table S5. Odds of hospital admission from ED visits by socioeconomic status.