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ORIGINAL RESEARCH

Management of mental health patients in Victorian emergency departments: A 10 year follow-up study

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Abstract

Objectives: Despite efforts to restructure mental health (MH) services across Victoria, the social and economic burden of MH illness continues to grow. This study compares MH presentations to EDs with a study undertaken 10 years earlier.

Methods: The article is a retrospective observational study of MH presentations to four Victorian EDs between May and October 2013. Subjects were included if the presentation was MH related as determined by an International Classification of Diseases (version 10) discharge diagnosis, they were referred to an emergency crisis assessment team or had a documented presenting psychiatric complaint. Variables were extracted from electronic medical records and compared with 2004 data from a previous published study.

Results: There were 5659 MH presentations over the 5 months compared with 2788 in 2004. The median ED length of stay decreased from 4:18 h in 2004 to 3:20 h in 2013 ($P < 0.001$), with a significant reduction in length of stay >4 h from 52.5% to 35.4% ($P < 0.001$). There was a 22-fold increase in short stay units as discharge destination from 0.9% to 20.2% ($P < 0.001$). Patients presenting with concurrent methamphetamine exposure doubled from 2.2% of presentations to 4.3% ($P < 0.001$).

Conclusion: Despite increasing MH-related presentations, changes in ED practice have allowed improvements in delivery of care through a shortened ED length of stay and the virtual elimination of very long stays over 24 h. However, there continues to be significant variability in management and performance across hospital sites. Identifying which interventions lead to standout site performance, and subsequent application more broadly, may improve future ED delivery of care.

Key words: *emergency department length of stay, emergency department performance, emergency medicine, emergency psychiatric services, mental health.*

Key findings

- Over the last decade, the time spent in emergency being treated and waiting for a bed has fallen substantially.
- New models of care, including the use of short stay units, are at least partially responsible for the improved care although considerable variation across sites exists.
- The increasing use of amphetamines in this population may warrant new approaches to acute mental health management.

Introduction

Despite efforts in recent decades to restructure mental health (MH) services across Victoria by shifting resources away from institutionalised care and towards community-based programmes, MH illness remains a great social and economic burden.[1] The high prevalence of MH illness, coupled with limited resources, ensures services to operate at full capacity, which are unable to meet demand.[2,3] The resulting overflow of acute MH crisis situations is thereby shifted to hospitals and, more specifically, the ED.

Over recent years, EDs have been struggling to deal with increasing total presentations and are unable to meet state-established performance goals.[4,5] In the past 10 years, Victorian population growth has led to ED presentations increasing by 7% yearly, reaching 1 530 000 presentations statewide in 2012; the number of MH presentations is expected to have increased proportionally.[6] Care of MH patients in the ED is particularly challenging, often requiring more resources and specialised care than non-MH patients.[7] Evaluation of the 4 h target implemented in the UK's National Health Service showed that MH patients were disproportionately represented in presentations where disposition was delayed for over 4 h.[8] This may also be true in Victoria.

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Evaluation of MH presentations to Victorian EDs should provide valuable data on obstacles to delivery of care, an essential requirement if Victoria is to improve patient care while meeting performance goals.

Knott *et al.* (2007) evaluated the demographics, presentation, management and disposition of MH patients in Victorian EDs and provided a comprehensive picture of the MH burden to EDs over the 2004 study period.[9] This analysis found that EDs were being increasingly used as initial points of care for acute MH presentations. The study observed significant variability in MH patient management among hospitals despite a similar burden of patients presenting to each site. These findings may indicate localised deficiencies in systems or resource availability across sites.

This 10 year follow-up study gathered similar data to Knott *et al.*, and aims to provide a current snapshot of MH presentations to Victorian EDs. It also aims to identify major changes in MH presentations and management in the last 10 years through comparison with the original 2004 study data.

Methods

Study design

This was a multicentre retrospective study conducted between 14 May and 13 October 2013, across four metropolitan and regional EDs in Victoria. The Alfred Hospital is a tertiary referral adult hospital and a major trauma centre located close to Melbourne's central business district (CBD) and has 60 000 annual ED presentations and a 50% admission rate. Royal Melbourne Hospital is also a tertiary referral adult hospital and a major trauma centre adjacent to the CBD with 63 000 presentations and a 43% admission rate. Dandenong Hospital, a major urban hospital located 35 km southeast of the CBD, has 47 000 presentations and a 45% admission rate. Geelong Hospital is a major regional hospital 75 km southwest of the CBD and has 64 000 presentations and a 38% admission rate.[4] Dates were chosen to match the corresponding period in the original 2004 study.[9] In 2004, data were also obtained from Maroondah Hospital, but this site was unable to be included in the current study, and the 2004 data from Maroondah were excluded.

Participants

Patients were included if they presented during the study period and had a presentation defined by an International Classification of Diseases (version 10) (ICD-10) diagnosis of a MH disorder or illness, substance abuse or crisis situation; any patient referred for review by the Emergency Crisis Assessment Team (ECAT) or psychiatric unit; or any patient with a documented presenting complaint of deliberate self-harm, suicidal ideation or other psychiatric problem (e.g. violent behaviour and general psychiatric examination). Patients were excluded if the presentation was simple intoxication (e.g. ICD-10 diagnosis F-100, with no referral to ECAT), they had an ICD-10 discharge code for delirium or dementia (ICD-10 codes F050, F051, F059 and F03) or they were under 18 years of age. Participants were identified using each site's electronic medical record system.

Data collection

Unlike the previous study of Knott *et al.*, where data were extracted manually from scanned medical records, this study used reports generated from the electronic medical record at each site to extract variables of interest. Variables extracted and analysed directly from reports included age, gender, method of presentation, discharge diagnosis, triage time and category, discharge time and destination. For patients with multiple ICD-10 discharge codes, only the primary ICD-10 code was used for analysis. ED length of stay (LOS) was calculated as the duration between documented triage time and the time patient left the ED. Time 'seen by clinician' was calculated as the duration between triage time and when ED medical staff first assessed the patient. Determination of ethanol or drug exposure was carried out using a word search for key terms specific to each drug class (e.g. 'ETOH', 'alcohol' and 'drunk' for ethanol intoxication) within the triage comments provided.[10,11] Patients with automated hits for key terms were subsequently checked manually to ensure the algorithm was accurate in determining ethanol or drug exposure. All documented clinical imaging and pathology investigative requests (e.g. chest X-ray, head computed tomography and full blood exam) were considered when determining whether or not patients had any investigations while in the ED. Restrictive interventions including physical and chemical restraint were obtained from security logs. Chemical restraint was defined as the need for parenteral medication to manage acute agitation.

Statistical analysis and sample size

Comparisons between sites were completed to determine local variability in ED management of MH patients. Comparisons were also conducted between 2013 data and original 2004 data to determine temporal changes in MH presentations and management across Victorian EDs.

Data were entered into Microsoft Excel (v. 2013) and subsequently analysed using STATA version 10.0 (StataCorp, College Station, TX, USA). Proportions were compared using χ^2 tests; parametric variables were examined with *t*-test or analysis of variance and non-parametric variables using the Mann–Whitney or Kruskal–Wallis test as appropriate. For the analysis, all presentations at each site and across the 10 years were considered as independent events. A *P*-value of <0.01 was considered to be statistically significant.

In 2004, the median time to see a ED clinician was 25 min. Assuming this to be normally distributed with a standard deviation of 15 min and setting the power at 80% and the significance at 0.01, 1315 patients would be required in each sample to detect a 2 min change. Similarly, in 2004, the median ED LOS was 258 min. If this was normally distributed with a standard deviation of 120 min and setting the power at 80% and the significance at 0.01, 1497 patients would be required in each sample to detect a 15 min change. In 2013, the four EDs saw approximately 244 000 total presentations.[4] The proportion of patients with an ICD-10 diagnosis code

for an MH disorder is approximated at 6.8%, with 25% of these attributed to simple ethanol intoxication alone.[9,12,13] Therefore, it was expected that the four EDs would see approximately 12 500 MH presentations per annum excluding simple intoxication and anticipate including 5260 MH presentations from the 5 month study period.

This study was approved in accordance with the ethics committees of Alfred Health, Barwon Health, Melbourne Health and Monash Health.

Results

There were 5659 MH presentations across the four sites during the 2013 study period and 2788 MH presentations from the 2004 study included for analysis. This MH population

TABLE 1. *Summary of 2013 mental health presentations by site*

	RMH	Dandenong	Geelong	Alfred	*P*
Total ED presentations	25 747	25 342	26 592	24 578	NA
Total MH presentations (%)	1496 (5.8)	1640 (6.5)	1098 (4.1)	1425 (5.8)	<0.01
Male, %	55.0	53.3	55.5	54.5	0.68
Age (year)					
Median (IQR)	34 (25–45)	35 (25–46)	35 (25–45)	36 (27–47)	0.04
≥60, *n* (%)	120 (8.0)	124 (7.6)	89 (8.1)	85 (6.0)	0.11
≤25, *n* (%)	391 (26.1)	426 (26.0)	285 (26.0)	311 (21.9)	0.02
Presentation, *n* (%)					
Ambulance	718 (48.0)	731 (44.6)	448 (40.8)	656 (46.0)	<0.01
Police	179 (12.0)	209 (12.7)	132 (12.0)	206 (14.5)	0.18
Other	599 (40.0)	700 (42.7)	518 (47.2)	563 (39.5)	<0.01
Time to see clinician					
Median, h:mm (IQR)	1:13 (0:32–2:11)	0:55 (0:10–2:17)	0:40 (0:12–1:32)	0:19 (0:07–0:40)	<0.01
Max	7:58	11:14	9:51	5:19	NA
Investigations in ED, *n* (% yes)	445 (29.8)	662 (40.4)	†	684 (48.0)	<0.01
Referral made to ECATT/psych unit (%)	874 (58.4)	1286 (78.4)	883 (80.4)	839 (58.9)	<0.01
Code greys					
Codes called, *n* (%)	250 (16.7)	84 (7.3)	37 (3.4)	233 (16.4)	<0.01
Chemical restraint, *n* (%)	81 (32.4)	†	12 (32.4)	72 (30.9)	0.94
Physical restraint, *n* (%)	127 (50.8)	†	25 (67.6)	61 (26.2)	<0.01
ED length of stay					
Median h:mm (IQR)	4:05 (2:32–6:55)	3:17 (1:54–5:27)	2:43 (1:34–4:53)	3:05 (1:57–3:56)	<0.01
Max	23:44	47:54	30:34	23:55	NA
>4 h, *n* (%)	758 (50.7)	573 (35.0)	344 (31.3)	327 (22.9)	<0.01
>24 h, *n* (%)	0 (0)	8 (0.5)	1 (0.1)	0 (0)	<0.01
Disposition, *n* (%)					<0.01
Usual residence	864 (57.8)	684 (41.7)	636 (57.9)	552 (38.7)	
Medical ward	140 (9.4)	64 (3.9)	91 (8.3)	143 (10.0)	
Mental health ward	225 (15.0)	203 (12.4)	205 (18.7)	168 (11.8)	
DNW	36 (2.4)	56 (3.4)	72 (6.6)	13 (0.9)	
Absconded	104 (7.0)	93 (5.7)	37 (3.4)	29 (2.0)	
Police	11 (0.7)	14 (0.9)	14 (1.3)	2 (0.1)	
Short stay unit	81 (5.4)	513 (31.3)	34 (3.1)	515 (36.1)	
Other	35 (2.3)	13 (0.8)	9 (0.8)	3 (0.21)	

†Incomplete dataset. DNW, did not wait to be seen; ECATT, Emergency Crisis Assessment Treatment Team; IQR, interquartile range; MH, mental health; NA, not applicable; RMH, Royal Melbourne Hospital.

made up approximately 5.5% of all ED presentations in the 2013 study period, an increase from 4.2% in 2004.

Demographics and presentations

Table 1 provides a summary of variables across the four sites in 2013; Table 2 compares results from 2004 to 2013. There was no variation in presentations across days of the week or months of the year among sites or between the 2004 and 2013 periods. There was a similar gender distribution across sites with a slight male majority, and this was comparable with that found in 2004. Age distributions were also similar across sites and years; however, there was an increase in the proportion of MH patients under 25 years of age.

Method of presentation to the ED was similar across sites in 2013. However, from 2004 to 2013, there was a significant increase in presentations by ambulance service, and a significant drop in those brought in by police. There was also an increase in acuity of MH patients at triage, with high-acuity patients (ATS categories 1 and 2) increasing from 10.5% of presentations in 2004 to 18.5% in 2013 ($P < 0.001$). There were differences in the triage acuity of presentations between sites in 2013, but with no specific trend.

TABLE 2. *Temporal comparison of results between 2004 and 2013*

	2004	2013	*P*
Total ED presentations, *n*	66 786	102 259	NA
Total MH presentations, *n* (%)	2788 (4.2)	5659 (5.5)	<0.01
Male, %	54.1	54.5	0.76
Age (year)			
Median (IQR)	34 (26–44)	35 (26–46)	0.05
>60, *n* (%)	214 (7.7)	418 (7.4)	0.67
<25, *n* (%)	627 (22.5)	1413 (25.0)	0.01
Presentation, *n* (%)			
Ambulance	991 (35.6)	2553 (45.1)	<0.01
Police	475 (17.1)	726 (12.8)	<0.01
Other	1322 (47.4)	2380 (42.1)	<0.01
Triage category, *n* (%)			<0.01
1 (to be seen immediately)	34 (1.22)	139 (2.49)	
2 (to be seen within 10 min)	260 (9.39)	919 (16.24)	
3 (to be seen within 30 min)	1071 (38.55)	2629 (46.46)	
4 (to be seen within 60 min)	1177 (42.37)	1667 (29.46)	
5 (to be seen within 120 min)	236 (8.50)	305 (5.39)	
Time to see clinician			
Median, h:mm (IQR)	0:25 (0:10–0:58)	0:40 (0:13–1:39)	<0.01
Max	9:50	11:14	NA
Investigations in ED, (% yes)	1118 (40.10)	1791 (39.27)	0.48
Referral to ECATT/psych, *n* (%)	2243 (80.45)	3882 (68.60)	<0.01
Code greys			
Codes called, *n* (%)	241 (8.69)	604 (11.66)	<0.01
Chemical restraint, *n* (%)	141 (58.51)	165 (31.73)	<0.01
Physical restraint, *n* (%)	114 (47.3)	213 (40.96)	0.10
ED length of stay			
Median, h:mm (IQR)	4:18 (2:09–10:17)	3:20 (1:58–5:26)	<0.01
Max	119:12	47:54	NA
>4 h, *n* (%)	1464 (52.5)	2002 (35.4)	<0.01
>24 h, *n* (%)	166 (6.0)	9 (0.16)	<0.01
Disposition from ED, *n* (%)			<0.01
Usual residence	1612 (58.38)	2736 (48.35)	
Medical ward	186 (6.74)	438 (7.74)	
Mental health ward	656 (23.76)	801 (14.15)	
DNW/absconded	179 (6.49)	440 (7.78)	
Short stay unit	25 (0.91)	1143 (20.20)	
Other	103 (3.73)	101 (1.78)	

DNW, did not wait to be seen; ECATT, Enhanced Crisis Assessment Treatment Team; IQR, interquartile range; MH, mental health; NA, not applicable.

Reason for presentation

Table 3 shows that final diagnoses including schizophrenia, anxiety and alcohol intoxication have remained stable since 2004. However, there is a shift from depression-related presentations towards suicidal ideation/self-harm, with presentations secondary to depression falling while those with suicidal ideation increased.

Management

Figure 1 shows the variability in ED LOS among the sites in 2013. Royal Melbourne Hospital had the highest median LOS of 4:05 h, and Geelong had the shortest time of 2:43 h ($P < 0.001$). There was improvement from 2004 to 2013 in the EDs' ability to discharge patients quickly, with a reduction in median LOS from 4:18 h to 3:20 h ($P < 0.001$). Figure 2 illustrates the proportion of patients staying in ED longer than 4 h across the four sites and compares eras. There was variability among sites, but overall a decrease in proportion of prolonged stays from 2004 to 2013. Furthermore, Tables 1 and 2 show that ED presentations with stays

TABLE 3. *Mental health issues and intoxication at presentation*

	2004	2013	*P*
Mental health issue†, *n* (%)			
Poisoning with drug, T391–T509	283 (10.2)	663 (11.7)	0.04
Anxiety, F419	268 (9.6)	549 (9.7)	0.93
Suicidal ideation/physical, Z915 and R4581	101 (3.6)	424 (7.5)	<0.01
Depression, F3290	441 (15.8)	408 (7.2)	<0.01
Schizophrenia, F209	202 (7.2)	402 (7.1)	0.85
Psychotic episode, F2390	297 (10.7)	320 (5.7)	<0.01
Alcohol intoxication, F100–F109	151 (5.4)	262 (4.6)	0.13
Unknown‡	97 (3.5)	521 (9.2)	<0.01
Other	948 (34.0)	2110 (37.3)	<0.01
Intoxication§, *n* (%)			
None	1899 (68.11)	4109 (72.61)	<0.01
Alcohol	462 (16.57)	897 (15.85)	0.40
Methamphetamines	62 (2.22)	245 (4.33)	<0.01
Ecstasy	16 (0.57)	20 (0.35)	0.14
Benzodiazepines	159 (5.70)	278 (4.91)	0.12
Marijuana	57 (2.04)	78 (1.38)	0.02
Narcotics	60 (2.15)	108 (1.91)	0.45
Cocaine	4 (0.14)	14 (0.25)	0.33
Chroming	6 (0.22)	7 (0.12)	0.31
GHB	4 (0.14)	128 (2.26)	<0.01
Other	164 (5.88)	97 (1.71)	<0.01

†Primary International Classification of Diseases (version 10) discharge codes used to classify each mental health issue are listed in the table. ‡International Classification of Diseases (version 10) code not available/recorded. §Multiple drugs per patient possible. GHB, gamma-hydroxybutyric acid.

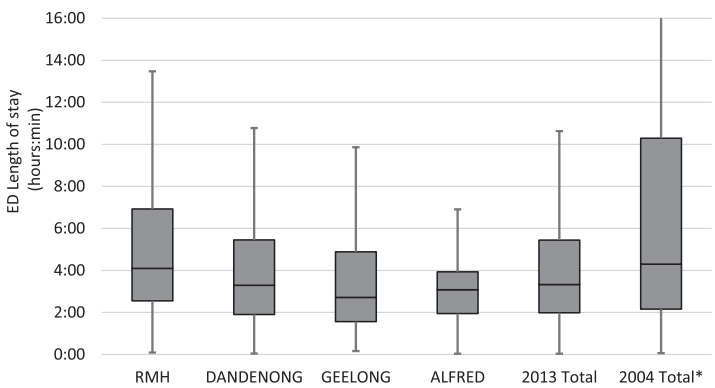

Figure 1. *ED length of stay for patients with mental health issues. Whiskers represent the lowest and highest datum still within 1.5 times the interquartile range from the lower and upper quartiles. All data are from the 2013 period except the comparative 2004 total.* [*] *Positive whisker for 2004 total ends at 22:29. RMH, Royal Melbourne Hospital.*

over 24 h were significantly reduced with two of the four sites having zero such presentations in 2013.

Figure 3 shows that the median time to see a clinician varied among sites, ranging from 19 to 73 min ($P < 0.001$), with an increased time between 2004 and 2013 (25 to 40 min, respectively, $P < 0.001$). The proportion of MH patients who underwent any investigation while in the ED showed no change from 2004 to 2013 (Table 2).

There was a total of 604 security codes for an unarmed threat (code grey) called across the four sites in 2013, representing 11.7% of all MH presentations. Significant variation in the code grey rate between sites was observed. Overall, there was an increase in code grey numbers and rates between 2004 and 2013. Despite this, comparing 2004 with 2013, lower proportions of MH patients required physical or chemical restraint.

Disposition

There was significant variability in discharge disposition between sites. The most important difference was seen in the use of short stay units (SSUs). Significant variability was again noted between sites. Between 2004 and 2013, the use of SSU as a discharge destination for this patient population increased from <1% to 20%.

Intoxication

There was little variation in the proportion of MH patients presenting intoxication among the sites, but this changed from 2004 and is summarised in Table 3. While fewer patients presented with ethanol or drug intoxication in 2013 compared with 2004, exposure to methamphetamines has nearly doubled in prevalence. Exposure to gamma-hydroxybutyric acid also significantly increased. Exposure to substances such as marijuana, opioids, benzodiazepines and alcohol all showed a relative decline between 2004 and 2013.

Discussion

This study describes the current clinical picture of MH presentations across four hospital EDs in Victoria, as well as the major changes in management of these presentations in the past 10 years. Despite the increasing presentations and acuity, changes in ED practice have allowed for improvements in the delivery of care through shortened

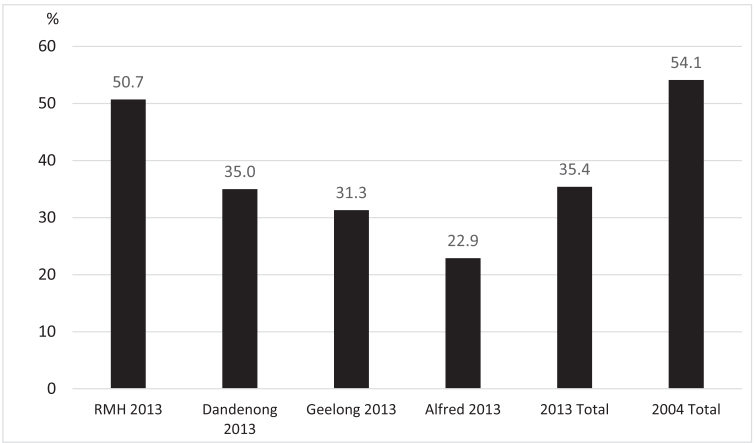

Figure 2. *Proportion of presentations due to mental health issues with ED length of stay >4 h. RMH, Royal Melbourne Hospital.*

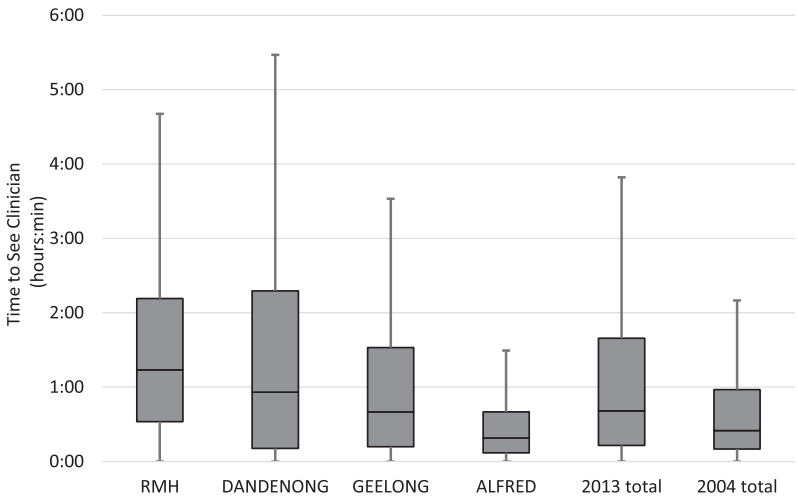

Figure 3. *Wait times to see clinician by patients with mental health issues. Whiskers represent the lowest and highest datum still within 1.5 times the interquartile range from the lower and upper quartiles. All data are from the 2013 period except the comparative 2004 total. RMH, Royal Melbourne Hospital.*

ED LOS and a decrease in the use of restrictive interventions.

The study found a 53% increase in total ED presentations from 2004. This is attributed mostly to population growth and is in line with previous estimates.[14] However, the proportion represented by MH patients has risen since 2004. This may support concerns that community MH services are not meeting the demands of a growing population. Patients arriving in the ED have higher acuity based on triage scores, and there is an increase in the proportion under 25 years old and those exposed to amphetamines. Dedicated services focusing on early intervention for MH disorders in young adults, such as Headspace, may be required. Headspace is a federally funded community service programme offering MH counselling and intervention to the youth demographic.[15,16] Not only does the vast majority of mental illness emerge before the age of 25 years but the 20 to 24 year age bracket also has the highest rate of suicide.[17]

Reasons for presentation remain largely unchanged in the past 10 years with anxiety, drug intoxication, depression and suicidality as the main contributors. The 2013 national report on MH suggests that rates of depression and suicidality have remained constant in recent years.[18] Interestingly, this study found a significant change in the rates of depression and suicidality as causes for ED presentations. This finding may be a reflection of the limitation of using primary ICD-10 codes for analysis rather than actual trends.

Despite an overall increase in ED presentations, the median LOS fell over the 10 year period, which may suggest successful introduction of new models of care. Innovative changes in ED practice including the implementation of SSUs and Psychiatric Assessment and Planning Units may be contributory; there was a 22-fold increase in the proportion of MH patients discharged to SSUs. Importantly, hospitals that had greater proportions of SSU discharges in 2013 had fewer presentations with ED LOS over 4 h. As a key indicator of improved patient care, ED stays over 24 h have essentially been eliminated. This is an encouraging result for Victorian EDs as prolonged stays were usually attributed to system failures (e.g. unavailability of MH beds).[9] A strong driving force for the reduced ED LOS may have been the recent National Emergency Access Target recommendations to decrease ED discharge times to below 4 h.[5] Promisingly, Psychiatric Assessment and Planning Units have led to improved performance with reduced ED LOS and reduced code greys.[7] While the number of MH presentations increased over the 10 year period, the proportion referred to ECAT fell significantly. Based on triage scores, the acuity of patients was higher in 2013, which might have increased referral rate. The reason for the fall is unclear and might be due to saturation of ECAT workload or improved competency or confidence of the ED staff. It may also be a consequence of the need to move patients through the ED within 4 h, leading to an avoidance of secondary referrals. Further research is required to understand both the reason for the decrease in referrals and its consequences.

Over 60% of presentations in 2013 did not have any pathology or radiology investigations while in ED. It is likely that a significant proportion of patients in ED requiring psychiatric assessment do not need a medical workup. If these patients could be assessed in a community setting and only referred to ED if further medical

services were required, the strain and resource burden on EDs might be alleviated. Further evaluation is required to determine whether patients not undergoing investigative services had any benefit from their ED attendance. The observed rise in code greys, together with a reduction in the use of restraints, may reflect a lowering in the threshold (or improved anticipation of aggression) for these alerts. In addition, it may reflect improved management of events by the clinical and security staff.

Of public interest is the doubling in methamphetamine use among patients with MH presentations since 2004. This is in line with Victoria-wide reports suggesting an overall increase in methamphetamine use.[19–21]

Limitations

Limitations of this study are acknowledged and largely attributed to the use of electronic reporting and the complexities of the study population. Each study site had differing electronic systems and reports available, and certain variables were not readily available, resulting in incomplete datasets. The use of target-word searches within triage text to identify intoxications may have underreported the true rate, although this methodology has been previously validated.[10,11] Finally, patient selection was complicated as each presentation is attributed a single ICD-10 code and MH patients have high rates of comorbidities. Some patients may have been missed if assigned a non-MH code (for example, laceration of arm) for a MH disorder (self-harm). This was countered by manually looking at a documented presenting complaint and referral to MH clinicians, including ECAT.

It is important to note that the original 2004 study utilised manual extraction of data from medical records, which was a thorough but resource-demanding method. Extraction from electronic records provides high-quality data far more readily. This approach should allow temporal comparisons to be readily conducted in the future, allowing close monitoring of changes in ED performance and MH presentations, and provide nimble feedback about success of changing practices. Further development of the electronic systems and optimising these for data extraction would seamlessly facilitate research across all levels and disciplines.[22]

Conclusion

Despite increasing MH-related presentations, changes in ED practice have allowed for improvements in the delivery of care through a shortened ED LOS and the virtual elimination of very long stays over 24 h. However, there continues to be significant variability in management and performance across hospital sites. There has been a disproportionate increase in patients presenting with concurrent exposure to amphetamines and unarmed threat to patients and/or staff in the context of such presentations. Identifying which interventions lead to standout site performance, and their subsequent application more broadly, may improve future ED delivery of care.

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Author contributions

PAM and JK originally conceived the study. All authors were subsequently involved in the design, data collection and manuscript preparation. The analysis was undertaken by JK.

Competing interests

None declared.

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