


ORIGINAL ARTICLE

Factors associated with paediatric and adolescent Emergency Department presentations involving acute behavioural disturbance events

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Aim: Studies reporting factors associated with paediatric/adolescent acute behavioural disturbance (ABD) in the Emergency Department (ED) are lacking. The aim of this study is to describe paediatric/adolescent ED presentations involving ABD events.

Methods: A retrospective chart review of presentations involving ABD events, identified via hospital security log, to a tertiary referral paediatric ED during the 2017 calendar year. Data reported included: cause of presentation, use of sedation/physical restraint, ED/inpatient length of stay (LOS) and time requiring security staff presence.

Results: From 280 reported ABD episodes 26 were excluded leaving 254 events involving 150 patients across 233 presentations of whom 38 (25.3%) presented on multiple occasions. Median age was 14 years (interquartile range (IQR): 13–16), 132/233 (56.7%) were female, 167/233 (71.7%) primary mental health complaints, 30/233 (12.9%) deliberate self-harm, 18/233 (7.7%) deliberate self-poisoning, 11/233 (4.7%) acute intoxication and 7/233 (3.0%) other.

Transport to hospital involved police and ambulance in 124/233 (53.2%), ambulance only 71/233 (30.5%), police only 16/233 (6.9%), relative or carer 20/233 (8.6%), with self-presentation in 2/233 (0.9%).

Sedation or physical restraint was used in 81/233 (34.8%), both 38/233 (16.3%), restraint only 26/233 (11.2%) and sedation only 17/233 (7.3%). Intramuscular droperidol accounted for 57/96 (59.4%) sedations, IM/IV benzodiazepines 15/96 (15.6%), IM/IV ketamine 5/96 (5.2%) and 19/96 (19.8%) other.

Discharge from ED occurred in 171/233 (73.1%) with median ED LOS 5.1 h (IQR: 3.5–7.7) and median hospital LOS 92.4 h (IQR: 47.5–273.4) for those admitted. The Mental Health Act was utilised in 183/233 (78.5%) presentations.

Median security staff time requirement per presentation was 2.4 h (IQR: 1.0–3.9).

Conclusions: Paediatric/adolescent ED presentations involving ABD are primarily due to mental health complaints. Less than half require the use of sedation/physical restraint. Time requiring security staff involvement is a significant resource consumption.

Key words: adolescent; emergency medicine; psychiatry/mental health.

What is already known on this topic

- 1 There is a paucity of information in the medical literature documenting the incidence and underlying causes of acute behavioural disturbance in paediatric/adolescent Emergency Department populations.
- 2 Available data suggest mental health complaints are the predominant underlying cause.

What this paper adds

- 1 Acute behavioural disturbance events are a relatively common occurrence in paediatric/adolescent Emergency Department presentations.
- 2 Mental health complaints are the most common aetiology.
- 3 Acute behavioural disturbance events place a significant burden on resources, with particular regard to the time period for which a hospital security presence is required.

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Conflict of interest: None.

Accepted for publication 13 July 2021.

Acute behavioural disturbance (ABD) is a common and often resource-consuming event in the Emergency Department (ED) setting.¹ Within the 18–65 year age group, such presentations have been commonly associated with acute drug intoxication.² In those aged over 65 years, dementia in combination with acute medical illness is most commonly the underlying cause.³ There is however a paucity of data describing ABD in those

under 18 years and the clinical factors associated with its occurrence.

The use of physical restraint is commonly used as a proxy for ABD in a paediatric population.⁴ However this is likely an underestimate as ABD events may resolve following the use of verbal de-escalation techniques, the initial recommended approach where possible.⁵

Of the sparse literature available, a study by Carison described ABD events, 'code grey', in patients with acute mental health presentations in a tertiary referral children's hospital ED in Victoria. This study concluded ABD events to be associated with a disproportionate use of physical restraint and pharmacological sedation when compared with other mental health presentations not requiring code grey activation.⁶ Whilst this study only included those with a mental health diagnosis code, this comprised almost 70% of all code greys suggesting mental health complaints to be a significant precipitating factor.⁶

A wider exploration of related literature in this age group indicates an increasing frequency of presentations to ED with mental health and other related complaints such as deliberate self-harm and deliberate self-poisoning.^{7–10} Whilst one might postulate this to be part of a generalised increase in ED presentations, data from Victoria suggest that the increase in mental health-related presentations is disproportionately higher than that associated with solely physical health complaints.¹¹ It would seem a reasonable extrapolation from this body of literature to assert that ABD events might have a significant incidence within an ED population under 18 years.

The aim of this study is to describe paediatric and adolescent ED presentations involving ABD. In particular, we aimed to report the underlying causes and the use of specific interventions such as physical restraint and therapeutic sedation.

Methods

Design and setting

A retrospective review was undertaken of ED presentations aged under 18 years to a paediatric tertiary referral facility in New South Wales involving one or more episodes of ABD. The facility covers a population of 920 370. The ED has an annual census of approximately 85 000 presentations per annum of which around 30% are aged under 18 years. The study was approved by the area human research ethics committee (Authorisation number AU201801-02).

For the purpose of the study, an ABD event was defined as any scenario in which hospital security staff were notified to attend ED to assist with patient management. Security services are notified at the discretion of ED staff regarding a patient within or en-route to ED where there is a perceived safety risk to either patient or staff member. A minimum of two, and in some cases four, members of security staff attend the ED to assist depending on other competing priorities. Following each security attendance a report is filed in the security log, a spreadsheet detailing time of alert and time when security services were no longer required as a 'stand down'. The report lists the patient-specific medical record number (MRN), whether the event involved a child or adult and also gives a brief account of why security presence was required.

Selection of participants

The security log was reviewed for the period of 1st January to 31st December 2017 for all reports involving a patient younger than 18 years. We chose this approach to participant selection as it is an established precedent within the adult ABD literature.^{1,12} The MRN within the security log was then used to search the medical record to identify ED presentations associated with ABD events. Any security entry which did not contain the MRN was excluded.

Data collection

A small sample clinical audit done by one of the authors prior to the study period provided insight into what useful data might be extractable with a retrospective methodology. Following this, a consensus was reached by the authors over several meetings on what data variables should be collected. A database file was created with appropriate software (FileMaker Pro 17 Advanced 2017) allowing data entry via dropdown menus and direct text entry on either desktop or tablet devices performed by two of the authors. Following the completion of data collection, the database files were exported into Microsoft Excel spreadsheets for further analysis.

Data collected included the total number of ED presentations under 18 years during the study period from ED administrative records to calculate incidence of presentations involving ABD events. From the medical record we also noted the number of individual presentations, defined as single if occurring on one occasion and multiple if greater than one occasion. For each presentation, we recorded the number of ABD events, age in years, gender, triage category as per the Australasian triage scale (1–5), presenting complaint categorised as either primary mental health complaint if purely behavioural in nature, deliberate self-harm if an attempt to inflict physical damage was involved, deliberate self-poisoning if a toxin ingestion or exposure was involved as an attempted suicide, acute intoxication by alcohol or other substances or other if not fitting any of the above categories. Time of presentation categorised as either day if between 08–00 and 17–59 h, evening between 18–00 and 23–59 h and overnight if between midnight and 07–59 h. Presenting location, from which the patient presented to ED, was listed as residence if the patient came from their usual place of residence, community if transported from another location in the community, hospital or GP surgery, school or police custody, transport method recorded as ambulance and police, ambulance only, police only, accompanied by a relative or carer or self-presentation.

Initial ED location was recorded as resuscitation room, single room designed for primary mental health presentations or other, another location within ED. Time to first ABD episode was classified as within 30 min of ED arrival, greater than 30 min but less than 2 h, greater than 2 but less than 4 h and greater than 4 h.

Interventions within ED as well as pre hospital was recorded as use of either therapeutic sedation or physical restraint at any time, use of both together and use of restraint or sedation as a sole therapeutic intervention. Additional details on sedation use was recorded including agent administered and route of administration, the latter defined as intra-muscular (IM), intra-venous

(IV) or other if given by any other route and any complications occurring.

Disposition data were recorded as discharge from ED, mental health or other hospital admission. Length of stay (LOS) in hours is defined by the time period from presentation to discharge for those discharged from ED, and total hospital LOS for admitted patients.

Any presentation involving the Mental Health Act was recorded and subdivided into whether this occurred in ED or pre hospital.

From the security log, we recorded the total length of time in hours which security staff spent with an individual patient whilst in ED per presentation as well as reported injuries sustained by any staff member or patient.

Statistical analysis

Median and interquartile ranges (IQRs) were used for continuous variables with proportions expressed as percentages calculated for

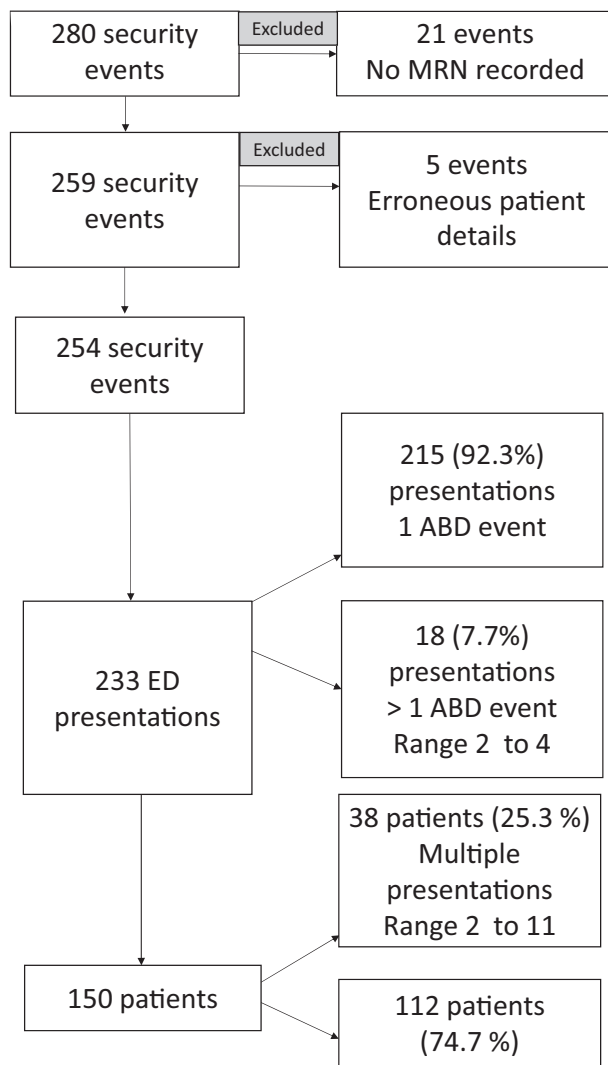


Fig 1 Flow diagram.

categorical variables using Microsoft Excel® (2013). The Wilson method without continuity correction was used to calculate 95% confidence intervals (95% CIs) for proportions using the Vassar Stats website calculator <http://vassarstats.net/index.html>.

Results

There were 25 109 ED presentations under 18 years during the study period. The security log documented 280 ABD episodes involving a patient aged under 18 years. Of these, 26 were excluded due to erroneous details in 5 and a missing MRN in 21 leaving 254 ABD episodes occurring over 233 (0.9%) of the 25 109 ED presentations. One ABD episode occurred in 215/233 (92.3%) and greater than 1 in 18 (7.7%) of presentations with 150 patients involved. Of these, 112/150 (74.6%) presented on one occasion and 28/150 (25.4%) on multiple occasions (Fig. 1).

Median age was 14 years (IQR: 13–16), 132 (56.7%) were female and median triage category was 3 (range: 2–5). There were 167 presentations (71.7%) with primary mental health complaints, 30 (12.9%) deliberate self-harm, 18 (7.7%) deliberate self-poisoning, 11 (4.7%) acute intoxication and 7 (3.0%) other. There were 112 (48.1%) daytime presentations, 99 (42.5%) in the evening and 22 (9.4%) overnight.

There were 159 (68.2%) presentations to ED from usual residence, 48 (21.0%) from the community, 14 (6.0%) from hospital/GP surgery, 6 (2.6%) from school and 5 (2.1%) from police

Table 1 Demographic and presentation details

Variable	Number	95% confidence intervals
Median age (IQR)	14 (13–16)	NA
Proportion female (%)	132 (56.7)	50.2–62.9
Median triage category (range)	3 (2–5)	NA
Presenting complaint		
Primary mental health (%)	167 (71.7)	65.6–77.1
Deliberate self-harm (%)	30 (12.9)	9.2–17.8
Deliberate self-poisoning (%)	18 (7.7)	5.0–11.9
Acute intoxication (%)	11 (4.7)	2.7–8.3
Other (%)	7 (3.0)	1.5–6.1
Time of presentation		
Day (%)	112 (48.1)	41.7–54.5
Evening (%)	99 (42.5)	36.3–48.9
Overnight (%)	22 (9.4)	6.3–13.9
Presenting location		
Usual residence (%)	159 (68.2)	62.0–73.9
Community (%)	48 (21.0)	15.9–26.3
Hospital/GP surgery (%)	14 (6.0)	3.6–9.8
School (%)	6 (2.6)	1.2–5.5
Police custody (%)	5 (2.1)	0.9–4.9
Transport method		
Ambulance and police (%)	124 (53.2)	46.8–59.5
Ambulance only (%)	71 (30.5)	24.9–36.7
Police only (%)	16 (6.9)	4.3–10.9
Accompanied by relative or carer (%)	20 (8.6)	5.6–12.9
Self-presented	2 (0.9)	0.2–3.1

Table 2 Clinical details

Variable	Number	95% confidence intervals
Initial ED location		
Single room (%)	153 (65.7)	59.4–71.5
Other (%)	70 (29.9)	24.5–36.2
Resuscitation room (%)	10 (4.3)	2.4–7.7
Time to first ABD event		
Less than 30 min	136 (58.4)	52.0–64.5
30 min < 2 Hours	60 (25.8)	20.6–31.7
2 h < 4 h	26 (11.2)	8.1–16.3
4 h or greater	11 (4.8)	2.7–8.3
Intervention		
Sedation or restraint (%)	81 (34.8)	28.9–41.1
Restraint and sedation (%)	38 (16.3)	12.1–21.6
Restraint only (%)	26 (11.2)	7.7–15.9
Sedation only (%)	17 (7.3)	4.6–11.4
Use of Mental Health Act		
Prehospital providers (%)	171 (73.4)	67.4–78.7
ED (%)	12 (5.2)	3.0–8.8
Not used (%)	50 (21.5)	16.7–27.2
Disposition		
Discharged from ED (%)	171 (73.1)	67.4–78.7
Admitted to mental health service (%)	50 (21.4)	16.7–27.2
Admitted other (%)	12 (5.5)	3.0–8.9
Median length of stay (h)		
Discharged ED LOS (IQR)	5.1 (3.5–7.7)	NA
Admitted to hospital (IQR)	92.4 (47.5–273.4)	NA

custody. Transport was undertaken by police and ambulance services in 124 (53.2%) presentations, ambulance only in 71 (30.5%), police only in 16 (6.9%), a relative or carer in 20 (8.6%) of presentations with 2 (0.9%) self-presenting (Table 1).

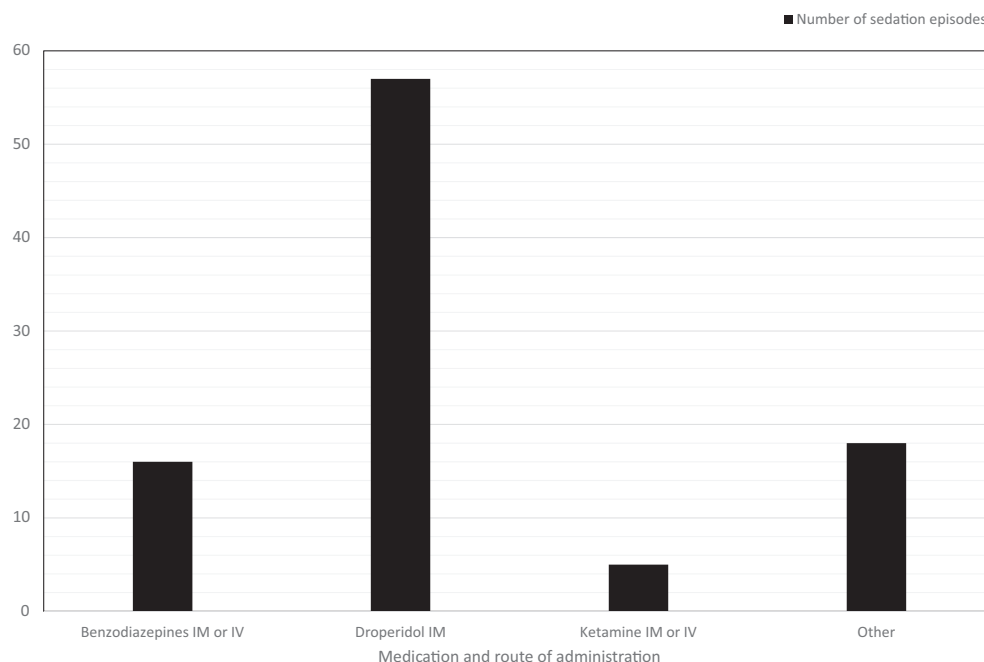
There were 153 (65.7%) presentations offloaded to a single room within ED, 10 (4.3%) the resuscitation room and 70 (29.9%) another ED location. ABD episodes occurred within 30 min of arrival in 136/233 (58.4%), 60/233 (25.8%) between 30 min and 2 h, 26/233 (11.2%) between 2 and 4 h and 11/233 (4.8%) at greater than 4 h.

Therapeutic sedation or physical restraint was used in 81 (34.8%) of which 38 (16.3%) involved both, restraint only in 26 (11.2%) and sedation only in 17 (7.3%). The Mental Health Act was enacted by prehospital providers in 171 (73.4%) presentations, ED clinicians in 12 (5.2%) and not used in 51 (21.5%) of presentations.

Discharge from ED occurred in 171 (73.1%) presentations, with 50 (21.4%) admitted to mental health services and 12 (5.5%) admitted to other inpatient wards. Median ED LOS was 5.1 h (IQR: 3.5–7.7) for those discharged and median hospital LOS 92.4 h (IQR: 47.5–273.3) for those admitted (Table 2).

Therapeutic sedation was administered on 96 occasions across 55 presentations, with IM droperidol on 57/96 (59.4%) occasions, IM/IV benzodiazepines 15/96 (15.6%), IM/IV ketamine 5/96 (5.2%) and 19/96 (19.8%) were other administrations via sublingual, intra-nasal and oral routes (Fig. 2). One adverse reaction was documented; a dystonic reaction to droperidol treated with IM bntropine and midazolam.

The five ketamine administrations occurred over four presentations. Two presentations involved patients with autism who

**Fig 2** Sedative medications administered.

required removal of an aural foreign body in one and extended work up for possible organic illness in the other. A third presentation involved an agitated patient who had self-poisoned with tricyclic antidepressants and was intubated shortly after. The only primary mental health presentation administered ketamine had five other sedations administered prior to this.

Eleven presentations accounted for 15 pre-hospital administrations, all by the IM route, with 48 presentations accounting for 81 administrations within ED.

Median time spent by security staff with an individual patient during each presentation was 2.4 h (IQR: 1.0–3.9). Two staff injuries were recorded, a bite to the hand and a blunt strike with a hand. On one other occasion, a patient accessed a plastic knife during the ABD episode and made superficial cuts to the forearm area as an act of self-harm.

Discussion

Our findings suggest some key differences when paediatric and adult ABD literature are compared, with previous adult studies reporting those involved more likely to be male¹³ and the predominant causes being alcohol or other recreational substance intoxication rather than primary mental health problems.¹

In their description of code grey incidents in a 7–17 year-old ED cohort, Carison *et al.* report female presentations are more likely to result in an ABD event as well as a significantly high rate of ambulance and police involvement in transfer to ED at 76.6%. This study also reports the incidence of multiple presentations by individual patients with greater than 50% of presentations due to 31% of patients. Multiple presentations are also reported to be a feature of those under 18 presenting to ED with an episode of self-harm with the occurrence of a code grey in an index presentation predictive of subsequent representations.¹⁴

Use of physical restraint or therapeutic sedation was required in 34.6% presentations in our study with 27.3% having restraint only and 23.5% receiving sedation only. Carison *et al.* report a greater use of both physical restraint and sedation at 51% and 37.6%, respectively,⁶ with a significantly higher proportion of sedation administered via the oral route. Our inclusion of pre-hospital sedation data, exclusively by the IM route, was a notable difference between the two studies.

Our use of sedation is lower than the 60% incidence of use reported in adult ABD¹; however, our rate of physical restraint is similar to the rate of 24.3% reported by Knott in an adult ED code grey population. The retrospective nature of our study does raise the possibility that restraint incidence may be an underestimate.¹⁵

Droperidol was the most commonly used agent for sedation in our study reflecting current guidelines.⁵ Whilst we were unable to accurately measure efficacy, the low rate of reported adverse events would appear to support the safety profile of droperidol as reported previously in both the adult² and paediatric literature.¹⁶

Ketamine was used sparingly in our population but has been shown previously to be a useful rescue sedative in scenarios where droperidol has not provided adequate sedation.¹⁷ Most ketamine administrations in our study had a non-mental-health aetiology and the one case that did not had failed to sedate with multiple sedative administrations prior to the ketamine.

Pre-hospital use of the Mental Health Act was common in our study population accounting for 73% compared with 38% reported by Carison.⁶ This may be related to differences in Mental Health Act legislation between states which allowed application in our population of the more liberally interpreted mental disorder category as opposed to a requirement of being presumed mentally ill.¹⁸

The proportion of patient's discharged from ED in our study was similar to that of Carison being 73.9% compared to 70.1%.⁶ Our median LOS was 5.1 h for those discharged but increased to just under 4 days in those admitted. Whilst not directly comparable due to differing methodology, the Carison data report an ABD event as being associated with a longer LOS.⁶

We report a median of 2.4 h of security time occupied per presentation which raises concerns about the resource consumption of ABD events. A minimum of two security staff are involved, thus the actual number of security hours is at least double this figure. Security staff play an often underrecognised role in patient care during ABD events and frequently have to manage their involvement alongside wider hospital duties.¹⁹

A previous study by Grover explored an innovative model of care involving a combined paediatric ED/mental health behavioural unit leading to a significant reduction in security time required.²⁰ Such innovations would require an early intervention approach as our data, like that of Carison, suggest that greater than 70% of ABD episodes occur within 2 h of arrival in ED.⁶

Strengths and Limitations

Our study is limited by its retrospective nature relying on recording and subsequent interpretation of information in the medical record which may have a subjective component. Likewise, the single-centre setting may limit extrapolation to other centres.

Within the context of a retrospective study, we believe our decision to use the security log for case inclusion is a strength as this has previously been reported to be the most reliable record of security events, outperforming other clinical records and minimising the likelihood of missed cases.²¹ The relatively large size of our case series as well as the extensive population covered by the facility is in our opinion also a strength.

Conclusions

We found paediatric ED presentations involving ABD episodes to be common, have a female preponderance with repeat occurrence of similar presentations likely. The underlying cause was a primary mental health issue in most cases with therapeutic sedation and physical restraint required in less than half of all presentations.

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