Causes of discharge delays from the acute medical unit (AMU) in a tertiary level teaching hospital, Brunei Darussalam

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Abstract
Background: Many patients admitted to the acute medical unit experience a prolonged length of stay in hospital due to discharge delays. Consequently, this may impact the patients, healthcare institution and national economy in terms of patient safety, decreased hospital capacity, lost patient workdays and financial performance.

Objectives: The main aim of this observational study was to identify the causes of discharge delays among acute medical unit patients admitted in the Raja Isteri Pengiran Anak Saleha Hospital, Brunei.

Methods: A retrospective observational study, with data of patients admitted to the acute medical unit collected from Brunei Health Information Systems between September and December 2018. Statistical analyses were performed to obtain relevant results and any statistically significant associations.

Results: A total of 357 patients were admitted to the acute medical unit over the 4-month period; 218 patients (61.1%) experienced discharge delays. Of these 218 patients, 158 patients (72.5%) encountered discharge delays mainly due to intrinsic patient factors, while the discharge delays in 88 patients (40.4%) were attributed to hospital factors. The main reason for discharge delays for patient factors was slow recovery among 67 patients (30.7%), whereas for hospital factors it was the weekend limitation of services available in 23 patients (10.6%).

Conclusions: There were various causes of discharge delays identified among the 218 acute medical unit patients who experienced discharge delays. Older patients with frailty, polypharmacy and complex medical issues were more likely to have a prolonged hospital stay in the acute medical unit. Stringent inclusion criteria, increasing discharge planning as well as an effective multidisciplinary approach will aid in reducing discharge delays from the acute medical unit.

Keywords
Discharge delay, causes, Acute Medical Unit, AMU, Quality improvement, observational study, prolonged length of stay

Introduction
The acute medical unit (AMU) in the Raja Isteri Pengiran Anak Saleha (RIPAS) Hospital, Brunei Darussalam was established in December 2011 following the British model concept of AMUs, which have been widely implemented in many tertiary hospitals around the world. This AMU model of care was found to be cost-effective and efficient, encompassing early assessment by senior clinicians, a multidisciplinary team and formulation of management and discharge plans within the typical admission timeframe of 24–72 hours.1,2

Patients can be admitted to the AMU from the accident and emergency department (AED), other peripheral hospitals or from community healthcare settings. The current inclusion criteria includes: (a) all patients diagnosed with sepsis not requiring intensive care support; and (b) patients with...
any medical conditions with a predicted length of hospital stay of 72 hours. During the study period, there was one full time AMU consultant, one part time AMU consultant, one senior medical officer (registrar) and four medical officers, as well as various allied health staff available on request allocated to the 357 patients admitted to the AMU. Non-office hours’ admissions (16:30–07:30) and weekends were covered by a team of rotating on-call medical doctors. Of note, the AMU is an open bed AMU which shares admissions under various medical specialties dictated by bed management. The staffing and patient ratio contrasts with other more developed and established medical specialties, which have a greater number of consultants and junior doctors allocated to manage their inpatient, consultative and outpatient workload as well as administrative tasks.

The AMU multidisciplinary team manages a variety of patients and decides on their predisposition, which may be a discharge to home or transfer to general wards or other hospital settings. Currently, the AMU at RIPAS Hospital has the capacity of 60 beds with two high dependency areas, and was recently refurbished in the middle of 2018. Virtually all the patients admitted to the AMU are reviewed during morning rounds by the junior doctors at the start of a working day then subsequently by the consultant. These patients are then seen by the multidisciplinary team and have relevant investigations performed as directed by the AMU team. Subsequently, the patients are discharged by the end of normal working hours at 16:30 to 17:00 if deemed suitable after afternoon AMU rounds.

Discharge delays are one of the crucial issues in hospitals affecting patient flow, access to medical services and consultations as well as the length of stay in hospitals. It is known that many patients admitted to hospital AMUs experience a prolonged length of stay due to discharge delays, which can also be defined as the unnecessary occupancy of hospital beds. The downstream effects for the health institution due to delays in patient discharge would be an increase in hospital expenditures, decreased hospital capacity and financial performance by means of cancelled elective surgeries or admissions and inability to accept inter-hospital patient transfers for specialised tertiary level care. Furthermore, patients who are affected by discharge delays may also experience dissatisfaction, an increased burden of preventable complications including sleep deprivation, hospital-acquired infections, deconditioning and mortality. Daily activities of the patient may also be disrupted and potential work income, contribution to society and economy are reduced, and communication with family and friends are decreased.

The hospital discharge of a patient is complex, requiring sound clinical judgement as well as effective communication to multiple staff to ensure the logistics of preparing the formal paperwork with follow-up clinical appointments, dispensing of appropriate medications and ensuring the availability of transport to a safe as well as a supported place of residence. In addition, home services, follow-up appointments and discharge summaries as well as medical reports have to be prepared to ensure continuity of care and good communication between health providers.

Discharge delays may be caused by many reasons. Recognition of different causes of discharge delays will allow health professionals, hospital administrators and stakeholders to propose potential strategies for minimising delays. The delays of when the patient has been identified for discharge home (usually by morning medical physician rounds) and the actual time of leaving the AMU would also have to be addressed.

Currently, there is a paucity of evidence about the extent of discharge delays from the AMU, RIPAS Hospital as well the significance and impact on the patients and the health services. This quality improvement study is important to ensure the patient flow in the AMU, RIPAS Hospital, will be optimal and is hoped to provide insight for other institutions into the value of reviewing their workflows and processes in order to improve clinical services and provide the most cost-effective and high quality medical services.

**Objectives**

The general objective of this study was:

1. To identify causes of prolonged delays in discharge among AMU patients admitted to the AMU at RIPAS Hospital.

Specific objectives:

2. To estimate the proportion of patient characteristics, comorbidities, complications and diagnosis/es among patients discharged with and without delay.
3. To correlate length of stay with the age of patients.
4. To propose strategies for eliminating avoidable delays and improving healthcare delivery as well as patient flow processes.

**Methods**

**Study design**

This research was a retrospective cross-sectional (observational) study.

**Target population**

Patients admitted to the AMU at RIPAS Hospital from September until December 2018.

**Inclusion criteria**

All patients admitted to the AMU during the specified timeframe were obtained from computer generated lists and handover meetings and were included in this study.

**Sampling method**

All suitable reviewed charts of patients were included in the study without sample as all data were extracted from Brunei Health Information Systems (BruHIMS).

**Sample size**

The hospital stay was calculated from the time the patient had arrived physically in the AMU ward and/or was seen by
the AMU team. Based on the pattern of average patient admissions of three persons per day, using the formula below, a sample of at least 286 participants was required to achieve precision of 5% ($d=0.05$) with an expected proportion of 50% at 95% confidence interval.\(^5\) Accounting for attrition and missing data, a 20% inflation was taken into consideration, therefore a total minimum sample of at least 343 was expected.

$$n' = \frac{NZ^2P(1-P)}{d^2(N-I) + Z^2P(1-P)}$$

where
- $n'$ = sample size with finite population correction
- $N$ = population size
- $Z$ = $Z$ statistic for a level of confidence
- $P$ = expected proportion, and
- $d$ = precision.

### Data collection

Commencement of data collection was on obtaining approval from the Institute of Health Science Research and Ethics Committee (RiHSREC) by the primary investigator NH. Data collection was extracted from BruHiMS. Data collection was performed by the primary and secondary investigators. Information that was taken from the BruHiMS includes patients admitted to the AMU during the timeframe specified above. De-identified data from patients consisting of age, gender, comorbidity, number of usual medications, total length of stay, diagnoses, indications for admission complications, discharge destination and reasons for delayed discharge were collected from BruHiMS. A data collection form was used by the student. Literature reviews and staff feedback were conducted to identify potential strategies to reduce delays in discharge.

### Research instruments

Data were extracted from BruHiMS and was compiled in Microsoft Excel.

### Statistical analysis

All collected data were analysed using RStudio (for Mac). Frequency and percentage were presented to identify the causes of prolonged delays in discharge among patients admitted to the AMU at RIPAS Hospital. Inferential statistics including the chi-square test for independence, Fisher's exact test and independent t-test were used to explore the association of patients' characteristics, comorbidities, complications and diagnosis/es among patients discharged with and without delay. Pearson correlation was used to examine the association between length of hospital stay and age of patients. A $P$ value of less than 0.05 ($P<0.05$) was considered statistically significant.

### Results

A total of 357 patients were discharged from the AMU over the 4-month period; 139 (38.9%) patients were discharged within 72 hours (no discharge delays) while 218 patients (61.1%) experienced discharge delays. The mean (standard deviation; SD) age of the patients with discharge delays was 54.5 years (18.52) with a range of 14 to 91 years. Out of the 357 patients analysed, there were 82 male (50.6% of total male patients) and 136 female (70.0% of total female patients) patients with discharge delays.

Patient factors accounted for 72.5% compared to hospital factors seen in 40.4% of patients with discharge delays. There were also multiple reasons for discharge delays in a proportion of patients, and a patient could experience multiple reasons for discharge delays thus explaining the overlap of the proportion between patient and hospital factors. The main reason of discharge delays for patient factors was slow recovery (30.7%), whereas for hospital factors it was the weekend limitation of services available (10.6%). Patients who had been identified for discharge during the morning rounds had a time delay of 4–6 hours before physically exiting the AMU, mainly due to delays in dispensing medications rather than a lack of suitable transport or delays in administrative paperwork.

### Causes of discharge delays

A total of 24 patient factors were identified. The most common reason of discharge delays for patient factors was slow recovery (30.7%), followed by complicated case (19.3%); prolonged treatment requirement (13.3%), frailty (11.0%) and complications of hospital stay (5.5%). As for hospital factors, a total of 18 causes were recorded; 10.6% of which were due to weekend limitations. One patient (0.5%) was found to have discharge delays due to a bed issue. Table 1 summarises further the cause of discharge delays associated with patient factors and hospital factors.

The definitions for the terms ‘slow recovery’ and ‘complicated case’ can be found in Appendix 1.

### Patient characteristics of non-delayed and delayed AMU patient discharges

Factors associated with discharge delays of patients from the AMU were compared with patients with no discharge delays, Table 1. Top seven causes of discharge delays associated with patient factors ($n=158$) and hospital factors ($n=88$).

| Reasons                              | n (%) |
|--------------------------------------|-------|
| Patient factors                      |       |
| Slow recovery                        | 67 (30.7) |
| Complicated case                     | 42 (19.3) |
| Prolonged treatment requirement      | 29 (13.3) |
| Frail                                | 24 (11.0) |
| Complications                        | 12 (5.5) |
| Awaits normal blood test value       | 8 (3.7) |
| Mobility issues                      | 7 (3.2) |
| Hospital factors                     |       |
| Weekend                              | 23 (10.6) |
| No discharge instructions            | 12 (5.5) |
| Awaiting radiology                   | 11 (5.0) |
| Awaiting transfer to another department | 11 (5.0) |
| Waiting for lab results              | 9 (4.1) |
| Awaiting investigation results        | 7 (3.2) |
| Awaiting oesophago-gastro-duodenoscopy | 5 (2.2) |
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Factors showing a significant difference with discharge delays include medication reconciliation, polypharmacy, modified early warning score (MEWS) on arrival, seen by AMU staff or senior medical officer within 4 hours, seen by AMU consultant within 14 hours, Charlson comorbidity index, sequential organ failure assessment (SOFA) score and length of stay in AMU ward. The mean length of stay for patients with discharge delays was 7.3 (4.79) days ($P<0.001$).

### Table 2. Comparison of patient characteristics between patients with and without delay in discharge at the time of admission to the AMU ($n=357$).

| Variable                           | No discharge delay, mean (SD) $n=139$ | Discharge delay, mean (SD) $n=218$ | Mean difference (95% CI) | $t$ statistic ($df$) | $P$ value* |
|------------------------------------|--------------------------------------|-------------------------------------|--------------------------|----------------------|------------|
| Charlson comorbidity index         | 1.7 (2.40)                           | 3.1 (2.68)                          | 0.05 ($-1.19,-0.89$)     | $-5.14$ (355)        | $<0.001$   |
| Katz index                         | 5.8 (0.94)                           | 5.6 (1.16)                          | 0.05 ($-0.03,0.41$)      | $1.69$ (334)         | 0.093      |
| SOFA score on admission            | 0.3 (1.14)                           | 0.8 (1.30)                          | 0.05 ($-0.66,-0.15$)     | $-3.12$ (321)        | $0.002$    |
| Length of stay (days)              | 2.3 (0.73)                           | 7.3 (4.79)                          | 0.05 ($-5.64,-4.34$)     | $-15.12$ (233)       | $<0.001$   |

*Chi-square test for independence.

### Table 3. Comparison of patient characteristics between patients with and without delay in discharge at the time of admission to the AMU ($n=357$).

| Variable                          | No discharge delay, mean (SD) $n=139$ | Discharge delay, mean (SD) $n=218$ | Mean difference (95% CI) | $t$ statistic ($df$) | $P$ value* |
|-----------------------------------|--------------------------------------|-------------------------------------|--------------------------|----------------------|------------|
| Charlson comorbidity index        | 1.7 (2.40)                           | 3.1 (2.68)                          | 0.05 ($-1.19,-0.89$)     | $-5.14$ (355)        | $<0.001$   |
| Katz index                        | 5.8 (0.94)                           | 5.6 (1.16)                          | 0.05 ($-0.03,0.41$)      | $1.69$ (334)         | 0.093      |
| SOFA score on admission           | 0.3 (1.14)                           | 0.8 (1.30)                          | 0.05 ($-0.66,-0.15$)     | $-3.12$ (321)        | $0.002$    |
| Length of stay (days)             | 2.3 (0.73)                           | 7.3 (4.79)                          | 0.05 ($-5.64,-4.34$)     | $-15.12$ (233)       | $<0.001$   |

*Independent $t$-test (equal variance assumed).

### Table 4. Comorbidities and complications associated with discharge with and without delays ($n=357$).

| Variable                          | $n$ | Discharged with no delay, $n$ (%) | Discharged with delay, $n$ (%) | $P$ value* |
|-----------------------------------|-----|----------------------------------|-------------------------------|------------|
| Comorbidities                     | 281 | 102 (36.3)                       | 179 (63.7)                    | 0.049      |
| Hypertension                      | 165 | 50 (30.3)                        | 115 (69.7)                    | 0.002      |
| Diabetes mellitus                 | 115 | 29 (25.2)                        | 86 (74.8)                     | 0.001      |
| Obesity metabolic syndrome        | 50  | 10 (20.0)                        | 40 (80.0)                     | 0.003      |
| Hyperlipidemia                    | 47  | 8 (17.0)                         | 39 (83.0)                     | 0.004      |
| Hyperlipoproteinemia              | 32  | 13 (40.6)                        | 19 (59.4)                     | 0.837      |
| Others                            | 95  | 50 (52.6)                        | 45 (47.4)                     | 0.001      |
| Complications                     | 110 | 20 (18.2)                        | 90 (81.8)                     | 0.001      |
| Acute kidney injury               | 14  | 5 (35.7)                         | 9 (64.3)                      | 0.801      |
| Anaemia                           | 10  | 1 (10.0)                         | 9 (90.0)                      | 0.057      |
| Electrolyte imbalance             | 9   | 1 (11.1)                         | 8 (88.9)                      | 0.083      |
| Type 1 respiratory failure        | 7   | 0 (0.0)                          | 7 (100.0)                     | 0.046      |
| Type 2 myocardial infarction      | 5   | 0 (0.0)                          | 5 (100.0)                     | 0.161      |
| Hospital acquired pneumonia       | 5   | 0 (0.0)                          | 5 (100.0)                     | 0.161      |
| Others                            | 63  | 13 (20.6)                        | 50 (79.4)                     | 0.001      |

*Chi-square test for independence.

as shown in Table 2 and Table 3. Factors showing a significant difference with discharge delays include medication reconciliation, polypharmacy, modified early warning score (MEWS) on arrival, seen by AMU staff or senior medical officer within 4 hours, seen by AMU consultant within 14 hours, Charlson comorbidity index, sequential organ failure assessment (SOFA) score and length of stay in AMU ward. The mean (SD) length of stay for patients with discharge delays was 7.3 (4.79) days ($P<0.001$).

### Comorbidities and complications

Table 4 summarises the comorbidities and complications associated with no discharge delays and with discharge delays.
delays. A patient may have multiple comorbidities and complications. Comorbidities were analysed and there was a significant difference in the proportion of total comorbidities between patients discharged with no delay and with a delay ($P=0.049$). The most common comorbidities associated with patients experiencing discharge delays were hypertension (69.7%), diabetes mellitus (74.8%), obesity metabolic syndrome (80.0%) and hyperlipidemia (83.0%). Other comorbidities included chronic kidney disease, asthma, dyslipidemia, stroke and gout. There were significant differences in the proportion of patients with complications between patients with and without discharge delays ($P<0.001$). Nevertheless, significant differences were only observed in patients with the complication of type 1 respiratory failure ($P=0.046$). Other complications included deconditioning, atrial fibrillation, diabetes mellitus, septic shock, sepsis, acute liver injury, hypotension, thrombocytopenia and pulmonary embolism.

Table 5. Diagnosis associated with discharge with delay and without delay ($n=357$).

| Variable                                      | $n$  | Discharged with no delay, $n$ (%) | Discharged with delay, $n$ (%) | $P$ value |
|-----------------------------------------------|------|----------------------------------|-------------------------------|-----------|
| Community acquired pneumonia                  | 40   | 5 (12.5)                         | 35 (87.5)                     | 0.001     |
| Lower and upper respiratory tract infection   | 32   | 14 (43.8)                        | 18 (56.2)                     | 0.558     |
| Acute gastroenteritis                         | 25   | 14 (56.0)                        | 11 (44.0)                     | 0.072     |
| Urinary tract infection                       | 25   | 4 (16.0)                         | 21 (84.0)                     | 0.015     |
| Bacteremia                                    | 24   | 6 (25.0)                         | 18 (75.0)                     | 0.147     |
| Sepsis                                        | 18   | 3 (16.7)                         | 15 (83.3)                     | 0.047     |
| Anaemia                                       | 17   | 12 (70.6)                        | 5 (29.4)                      | 0.006     |
| Acute kidney injury                           | 17   | 6 (35.3)                         | 11 (64.7)                     | 0.752     |
| Electrolyte imbalance                         | 15   | 7 (46.7)                         | 8 (53.3)                      | 0.530     |
| Abscess                                       | 10   | 0 (0.0)                          | 10 (100.0)                    | 0.010     |
| Presyncope/syncope                            | 9    | 7 (77.8)                         | 2 (22.2)                      | 0.031     |
| Gout                                          | 9    | 8 (88.9)                         | 1 (11.1)                      | 0.003     |
| Exercise induced rhabdomyolysis               | 9    | 4 (44.4)                         | 5 (55.6)                      | 0.740     |
| Infective exacerbation                        | 9    | 0 (0.0)                          | 9 (100.0)                     | 0.015     |
| Cancer                                        | 7    | 2 (28.6)                         | 5 (71.4)                      | 0.710     |
| Systemic lupus erythematosus                  | 7    | 2 (28.6)                         | 5 (71.4)                      | 0.710     |
| Bronchitis                                     | 7    | 2 (28.6)                         | 5 (71.4)                      | 0.710     |
| Cellulitis                                     | 6    | 2 (33.3)                         | 4 (66.7)                      | 1.000     |
| Hyperglycemia                                  | 5    | 0 (0.0)                          | 5 (100.0)                     | 0.161     |

Chi-square test for independence.
Fisher’s exact test.

Association between age and length of stay

Figure 1 presents the correlation between age and length of stay. There was significant association between age and length of stay ($P=0.001$). It was observed that there was significant positive linear relationship (Pearson’s correlation = 0.17) between age and length of stay.

Discussion

In this study, gender and age differences in patients have shown a pattern in discharge delays, whereby elderly female patients were more likely to have discharge delays. This showed similar results with a retrospective casenote review study in which 62.5% of female patients had discharge delays likely due to the increased medical complexity and burden of medical and psychosocial comorbidity.
This study reported that patient factors contributed more than hospital factors to the causes of discharge delays. The main cause of discharge delays for patient factors was slow recovery of the patients. There may be a number of factors contributing to the patients’ slow recovery, which include age, severity of disease, complications and comorbidity. Therefore, contribution from the intensive multidisciplinary team will be warranted to enhance recovery if indicated to prevent deconditioning. In addition, more stringent criteria are required to reduce discharge delays by ensuring careful patient selection for admission to the AMU. This would entail expanding the list of inclusion and exclusion criteria of medical conditions suitable for AMU ward admissions (e.g. gout, anaemia, syncope, as seen in Table 5) as well as redirecting the admissions of frail, elderly patients with a low index of independence (Katz activities of daily living (ADL) index <4 indicating moderate impairment) to general wards. In addition, with the creation of the ambulatory care section in the AMU, it is hoped that patients requiring long-term antibiotics or anticoagulation stabilisation may be discharged early and managed in this section of the AMU to improve the discharge delays.

Frailty was another cause of discharge delay among AMU patients. In order to assist frail patients, the management and care are commonly more complex and inclusive, especially post-hospital discharge. Complicated cases accounted for 42 patients (19.3%) with discharge delays. In addition, prolonged treatment requirement was another cause of discharge delay reported among AMU patients. Ideally, these patients could be transferred to general medical wards sooner with improvements in bed management, patient flow with the new ‘traffic light system’ and implementation of regular monitoring of AMU clinical quality indicators based on the UK Society of Acute Medicine standards.

A common outcome of hospitalisation from this study was immobilisation, or limited mobility, especially among the elderly who are liable to lose their capability to carry out daily activities. As a consequence, these patients experienced discharge delays and became deconditioned, which has been seen in the medical literature. Decreasing the chance of deconditioning could likely lessen the length of stay, in which the requirement for early commencement of physiotherapy would be needed to be identified in advance.

For discharge delays due to hospital factors, 12 patients (10.6%) experienced discharge delays due to lack of discharge instructions during weekends. This may be due to restricted weekend services, including fewer medical personnel working during weekends. Therefore, to reduce discharge delays due to weekends, early planning of discharge during weekdays could be done to assist discharges after office hours and on weekends.

With a predicted three to four additional AMU staff specialists trained overseas especially in Singapore returning by 2023 and the increase in undergraduate health professional staff produced by the local universities, it is hoped that the additional staff will be able to participate in several new workflows include expanding the working hours of the AMU, implementation of the AED/AMU collaborative rounds, earlier reviews by experienced and senior AMU staff as well as more frequent multidisciplinary team (MDT) discharge planning.

Time delays while awaiting investigations, results and sub-specialty consultation or procedures have been identified as a cause of discharge delays in this study, as seen in other AMUs. Therefore, early and effective communication with respective specialties and allied health professionals is required to overcome this type of problem (Table 7). A healthcare policy such as financial incentives or penalties such as the 4-hour admission rule may be considered as such a solution to this problem.

Other studies reported a lack of bed availability as the main cause of discharge delays. However, only one patient (0.5%) in this study was identified to have had discharge delays due to
Table 7. Summary of UK Department of Health guidance.11

| Theme                  | Description                                                                                                                                 |
|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| Proactivity            | Planning for discharge should start on or before admission, and practitioners should identify early those patients with complex needs. A clinical management plan should be developed for each patient within 24 hours of admission, with an expected date of discharge within 24–48 hours of admission. |
| Effective communication | Discharge should be coordinated through effective leadership and handover of responsibilities, with the clinical management plan reviewed with the patient and carers each day. |
| Keeping the process moving | Decisions to discharge should be made each day, with discharges planned to take place over 7 days and a checklist used 24–48 hours before discharge to make sure everything is in place. Although simple checklists may be useful, it is also recognised by some studies that much of the paperwork for discharge planning is overly complex. This not only delays discharge but also reduces the sense of professionalism of staff.12 |

bed issues. Unforeseeable admissions, the practice of bed management and delays in patient flow are known to be responsible for the unavailability of beds. Hence, the process of discharge and bed management especially with the recently introduced traffic light system is hoped to have a positive impact on tackling discharge delays. On a further note, there is also a significant amount of delay from the time a patient is identified for discharge to the actual discharge from the unit, mainly explained by time delays of pharmacy dispensing of discharge medications due to the lack of a full time pharmacist in the AMU and no transit or discharge hub in our hospital. A consideration of criteria and/or nursing-led discharges may result in earlier discharges especially during the weekend. In general, these hospital factors including awaiting radiology, awaiting transfer to another department and waiting for lab results could be remedied by prompt liaison regarding the investigation or transfer of patients with appropriate departments to ensure a steady hospital flow.6 Alongside early liaisons, immediate action should also be carried out by the respective department. The UK Department of Health recommended proactive discharge planning within 24–48 hours, effective communication of discharge plans with the clinical management team, and simplifying the discharge checklist to ‘keep the process moving’ and to reduce discharge delays, particularly for no discharge instructions.11

The main limitation in this study is that it represented only a certain period of time and may not accurately reflect activity over one year; hence there may be a variation during different time periods. Other intangible factors including the staff skillset as well as experience, morale and access block from the emergency department may contribute as confounding factors that could skew our results. This study is limited by the observational study design, and we could not correct for other factors that could have affected the waiting time in the emergency department to be seen by a healthcare professional or delays in transfer to the AMU. In addition, other quality indicators, such as patient or staff satisfaction, were not included.

Recommendations to help improve further research include lengthening the period of the study to a one-year period to evaluate the circumstances during different periods of the year. Future research could involve a more comprehensive classification of the causes of discharge delay, such as patient, doctor, nurse and administrative factors and a qualitative review of patient feedback and satisfaction. A multivariable analysis of the current clinical quality indicators in the AMU with early patient discharge would also be useful to aid in improving the AMU workflow.

Conclusion

There were various causes of discharge delay identified among the 218 AMU patients (61.1%) who experienced discharge delays. Patient factors were the primary reason, including slow recovery, complicated cases, prolonged treatment requirement, frailty and complications of hospital stay and mobility issues. Hospital factors identified were composed of weekend limitations, lack of discharge instructions, delays in obtaining investigations, results and consultations or procedures (Table 6). Older, frail and patients with polypharmacy and complex medical issues are more likely to have a prolonged hospital stay in the AMU. Early senior AMU staff review as well as effective and early communication with respective specialties in a multidisciplinary manner, identification and preparation of potential discharge paperwork for patients suitable for weekend discharges as well as careful selection of patients admitted to the AMU will aid in reducing the length of stay in the AMU.

Authors’ contributions

NH and JK researched the medical literature and were involved in protocol development and data collection. NH, KA and HAR performed data cleaning and obtained ethical approval for the study. HAR performed data analyses and derived statistical associations. NH, KA and HAR wrote the first draft of the manuscript. All authors reviewed and edited the manuscript and approved the final version of the manuscript.

Availability of data and materials

The datasets generated and/or analysed during the current study are available from the corresponding author Justin Fook Siong Keasberry.

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical approval

Ethical approval to report these cases was obtained from the Joint Institute of Health Sciences Research Ethics Committee (IHSREC) and the Medical and Health Research Ethics Committee (MHREC), reference number: UBD/PAPRSBII-HSREC/2019/56.
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**Informed consent**
The author(s) declare that this research was conducted in accordance with the Declaration of Helsinki and that informed consent was not required for this type of study.

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**Appendix 1**

Definitions of the following terms:

1. Slow recovery: unexpected little progress in patient’s recovery, investigation results or inability to meet the expected date of discharge set by the multidisciplinary team and overall slower than expected for a patient with similar condition, age and comorbidity.
2. Complicated case: requiring more medical specialty input, procedures and/or multidisciplinary team input for social issues, finances, mobility and/or personal disabilities, and more than three complex medical issues requiring a longer hospital stay.