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## CLINICAL QUALITY INDICATORS, PATIENT DEMOGRAPHICS AND PREDICTORS OF EARLY DISCHARGE FROM ACUTE MEDICAL UNIT IN BRUNEI DARUSSALAM.

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### ABSTRACT

**Background:** The study's objective was to assess patient demographics, clinical quality indicators and clinical outcome of patients admitted to Brunei's Acute Medical Unit (AMU) based on criteria listed by the British society of Acute Medicine. **Methods:** A retrospective cohort study of patients admitted to the AMU was undertaken. Clinical quality indicators (Seen by AMU consultant [within 14 hours], by AMU medical doctor [within 4 hours] and received Modified Early Warning Scores [MEWS] upon arrival), clinical outcomes (Length of stay, discharge within 72 hours and 30 day in-hospital mortality, readmission rates at 1 month) with Charlson co-morbidity index and Katz index of independence were collected from Brunei Health Information Management Systems (BruHIMS), from September to December 2018. **Results:** There were 356 admissions including male (45.2%) and female (54.8%) patients with a mean age of 51.6 (SD 18.8) years. The most common presenting complaint was fever (35.7%) and majority of patients were diagnosed with sepsis (13.5%). The median Charlson co-morbidity index and Katz index of independence were 2 (IQR 4) and 6 (IQR 0) respectively. 66.9% of patients were seen by an AMU consultant within 14 hours, 6.7% were seen by a medical doctor within 4 hours and 73.6% had their MEWS upon arrival in AMU. The 30 day in-hospital mortality rate was 0.8% and readmission rates at 1 month were 5.8%, whilst the median length of stay was 4 (IQR 3) days. Lastly, 38.3% of patients were discharged within 72 hours. **Conclusion:** Patients admitted to AMU were relatively fit with a low burden of disease, most commonly presenting with pneumonia, respiratory tract infections and sepsis. Patients who were assessed earlier by experienced AMU staffs (AMU consultants and doctors) and had a MEWS score on arrival to AMU were associated with improved discharge rates. There is room for quality improvement in the AMU with earlier specialized review of patients, shorter length of stay and earlier discharge of patients.

**Keywords:** Acute Medical Unit, clinical quality indicators, patient demographics, clinical outcomes.

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**Keywords:** Acute Medical Unit, clinical quality indicators, patient demographics, clinical outcomes.

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## INTRODUCTION

Acute medicine has evolved to become a medical specialty since early 2000s.<sup>1</sup> The acute medical unit (AMU) is a short stay department run by medical physicians and is a gateway between the general practitioner, the

emergency department and the general wards of the hospital. The AMU was established at RIPAS Hospital in 2011 in the hope of improving clinical outcomes, length of hospital stay (LOS) and satisfaction for patients.<sup>2,3</sup> The AMU in RIPAS Hospital has over 1000 AMU patients admitted annually to the two wards of 60 bed capacity.

The Society of Acute Medicine has established certain clinical quality indicators as a benchmark for the AMU. There are four clinical quality indicators as follows; (i) a Modified Early Warning Score (MEWS) should be undertaken upon arrival, (ii) patients should be seen by a competent decision maker within 4 hours of arrival on the AMU, (iii) all patients should be reviewed by the admitting consultant within 14 hours of arrival, and (iv) all AMU's should collect mortality rates for all patients admitted via the AMU, proportion of patients discharged directly from the AMU and readmission rates of patients discharged from the AMU within 7 days.<sup>1</sup>

The objectives of this study are to describe the sociodemographic background of patients being admitted to the AMU (such as age, sex, smoking status, presenting complaints and diagnosis, Charlson co-morbidity index and Katz index of independence) as well as assess their clinical quality indicators and determining the relationship between clinical quality indicators of patients in AMU to their clinical outcomes which then can provide helpful insight on how to improve the care that is being provided at the AMU more cost-effectively and efficiently. Furthermore, this information can provide an insight for training future doctors who are training to specialize in acute medicine.

## METHODS

### Study design

This was a retrospective cohort study of patients admitted to the AMU, who were fol-

lowed up from admission, through discharge and also readmission within 30 days. The cohort was retrospectively traced from the hospital records.

### Participants

The study target population was all patients admitted to AMU, RIPAS hospital, from September to December 2018. The timeframe of four months was considered adequate to obtain baseline data for comparison with future audits. All patients were included without any exclusion criteria. Anticipated number of patients with the timeframe was 350 to 400. The following sample size calculation for estimating a proportion, which suggested 462 patients to be recruited, essentially led to the decision of including all available patients, during the study period, without sampling. Using a sample size calculator, SSCPS version 1.0.03<sup>2</sup> sample size of 462 participants was required to achieve a precision of 5%, in estimating proportions with 95% confidence, for an expected proportion of 50%, considering additional 20% for attrition and missing data.

### Data collection

Data were collected from the Brunei Health Information Management Systems (BruHIMS) by two principal researchers to reduce any information and selection biases and recorded in a self-designed data collection form.

### Research Instruments

A data collection performa was designed by researchers, and contained variables namely patients' demographics such as age, sex, smoking status; clinical information such as presenting complaints, diagnosis, clinical quality indicators and clinical outcomes such as 30 day in-hospital mortality, length of stay, readmission within 30 days and discharge within 72 hours. Length of stay was calculated from patient admission to AMU until discharge from Hospital.<sup>1</sup>

### Outcome measure Targets

The targeted parameters ideally to be achieved were for all patients (100%) to meet the clinical quality indicators, however there were many factors that might limit this. Hence, study outcome measure targets were compared to standards achieved from a survey conducted in 88 hospitals by The Society of Acute Medicine (SAM) in the United Kingdom.<sup>3</sup> From this survey, just over 90% of hospitals reported >90% of patients had MEWS upon arrival, 90% of hospitals reported >75% of their patients were seen by a consultant within 14 hours and 96% of hospitals reported >50% of their patients were seen by a medical doctor within 4 hours of arrival.<sup>3</sup>

### Statistical analysis

All statistical analyses were carried out using RStudio version 1.1.463 (for Mac). Numerical data were described with mean and SD if they were normally distributed, otherwise, median and IQR. Categorical variables were described with count and percentages. Independent t-test was used to compare the means of two groups and chi-squared test was used to compare proportions. When assumptions were not met, Mann-Whitney or Fisher exact test were used respectively. For all statistical tests were two-sided hypothesis tests and a *P* value of less than 0.05 was considered statistically significant.

### Ethical considerations

The study proposal was approved by the joint IHSREC-MHREC ethics committee with a reference number of UBD/PAPRSBIHSREC/2019/6.

## RESULTS

### Sociodemographic data and clinical presentations

During the study period, a total of 356 patients were admitted to the AMU. The mean age of patients admitted were 51.6 years (SD 18.8) with slightly more female proportion

(54.8% vs 45.2%). A total of 21 (5.7%) were active smokers and 2 (0.6%) ex-smokers, with 95% of active smokers being male. With regard to presenting complaint, the main symptoms were fever (35.7%), cough (16.3%), musculoskeletal pain (14.0%), abdominal pain (14.0%) and dyspnoea (8.7%). The most common diagnosis was pneumonia (13.5%), followed by sepsis (13.2%) and lower respiratory tract infections (9.2%). Other diagnoses were gastroenteritis (7.6%) and Urinary Tract Infections (8.1%) (Table I).

### Clinical Quality Indicators & Clinical Outcomes

The results of clinical quality indicators and clinical outcomes are presented in Table II. Majority (73.6%) of patients were given a MEWS upon arrival at the AMU and 66.9% were also seen by an AMU consultant within 14 hours of arrival at the AMU. However, only a small percentage of patients were seen within 4 hours by an AMU medical doctor (6.7%). All three clinical quality indicators were significantly lower when compared to SAM UK standards. Patients had a median length of stay of 4 days (IQR 3), readmission rate within 30 days and 30 day in-hospital mortality rates were both low at 5.8% and 0.8% respectively.

### Charlson Co-Morbidity Index & Katz Index of Independence

The Charlson co-morbidity index (CCI) of patients as well as their Katz index of independence (KI) had comparative results. 34.2% of patients had a CCI of 0 and 84.8% had a KI of 6. The distribution of the CCI's and KI's of patient's can be seen in Figure 1 and 2. The median CCI was 2 (IQR 4) which indicates a low burden of disease for majority of patients, KI had a median of 6 (IQR 0), which shows that most patients were independent with daily tasks of living as presented in Table II.

**Table I: Sociodemographic and clinical data of patients admitted to AMU.**

Variable	n (%)	Mean (SD)
Age (year)		51.6 (18.8)
<b>Sex</b>		
Male	161 (45.2)	
Female	195 (54.8)	
<b>Smoking Status</b>		
Smoker	21 ( 5.7)	
Ex-smoker	2 ( 0.6)	
Non-smoker	333 (93.5)	
<b>Presenting Complaint</b>		
Fever	127 (35.7)	
Dyspnoea	31 (8.7)	
Lethargy	29 (8.1)	
Musculoskeletal Pain	50 (14.0)	
Abdominal Pain	50 (14.0)	
Cough	58 (16.3)	
Various other symptoms*	11 (3.2)	
<b>Diagnoses</b>		
Lower Respiratory Tract Infection	33 (9.2)	
Pneumonia	48 (13.5)	
Gastroenteritis	27 (7.6)	
Sepsis	47 (13.2)	
Urinary Tract Infection	29 (8.1)	
Neurological cases	21 (5.9)	
Acute rheumatologic cases	14 (3.9)	
Acute cancer and complications	6 (1.7)	
Allergy and anaphylaxis	7 (2.0)	
Others**	124 (35)	

\* Footnote: These various other symptoms includes transient loss of consciousness, stroke symptoms, seizures, confusion, neck lumps, gastrointestinal bleeding, epistaxis, acute poisoning, deliberate self-harm, acute allergic reactions and anaphylaxis.

\*\* Footnote: Other diagnoses includes psychiatric diagnoses, acute poisoning, deliberate self-harm attempts, exercise induced rhabdomyolysis, abscess of various sites, diabetic foot infections, zoonotic infections, hypertensive urgencies, renal failure and other rare and/or atypical presentations including acute nephrotic syndrome due to primary amyloidosis, decompression spinal cord injury, myocardial infarction, hyperglycaemic crises.

### Relationship between Clinical Quality Indicators & Clinical Outcomes

The results showed that there was a significantly higher discharge rate within 72 hours of admission among patients seen by AMU consultant within 14 hours than those who

were not seen within 14 hours (44.1% vs 28.0%,  $p=0.003$ ). The discharge rate was also significantly higher among those seen by AMU medical doctors within 4 hours than those who were not seen within 4 hours (58.3% vs 37.4%,  $p = 0.042$ ). MEWS upon arrival was also significantly associated with the discharge rate ( $p=0.004$ ). However, 30 day in-hospital mortality rate, Readmission rates within 30 days, and length of stay did not show any significant relationship with clinical quality indicators (Table III).

## DISCUSSION

From this study, it was found that the most common diagnoses for patients presenting to the AMU in Brunei were pneumonia and sepsis followed by LRTI, UTI and gastroenteritis similar to other wards in Europe.<sup>4</sup> However, there were also patients with sporadic cases of complex undifferentiated issues such as autoimmune diseases and malignancy as well as various degrees of associated destabilization of medical comorbidities occurring simultaneously with primary diagnosis/es. By identifying the common diagnoses present in the local AMU, this would be able to enhance the scope of knowledge that should be acquired for training future doctors specializing in acute medicine as well as improve quality of care healthcare services are provided.

The majority of patients did not meet their clinical quality indicators while in AMU when compared to SAM UK clinical quality standards.<sup>3,5</sup> With an increase in senior AMU doctors predicted to commence work at RIPAS hospital, the implementation of an ambulatory care section as well as optimizing the collaboration between the emergency department and AMU physicians during the next five years, these two quality indicators are likely to improve significantly.

There may be other possible reasons for failure to achieve the set clinical quality

**Table II: Clinical quality indicators and clinical outcomes of patients admitted to AMU.**

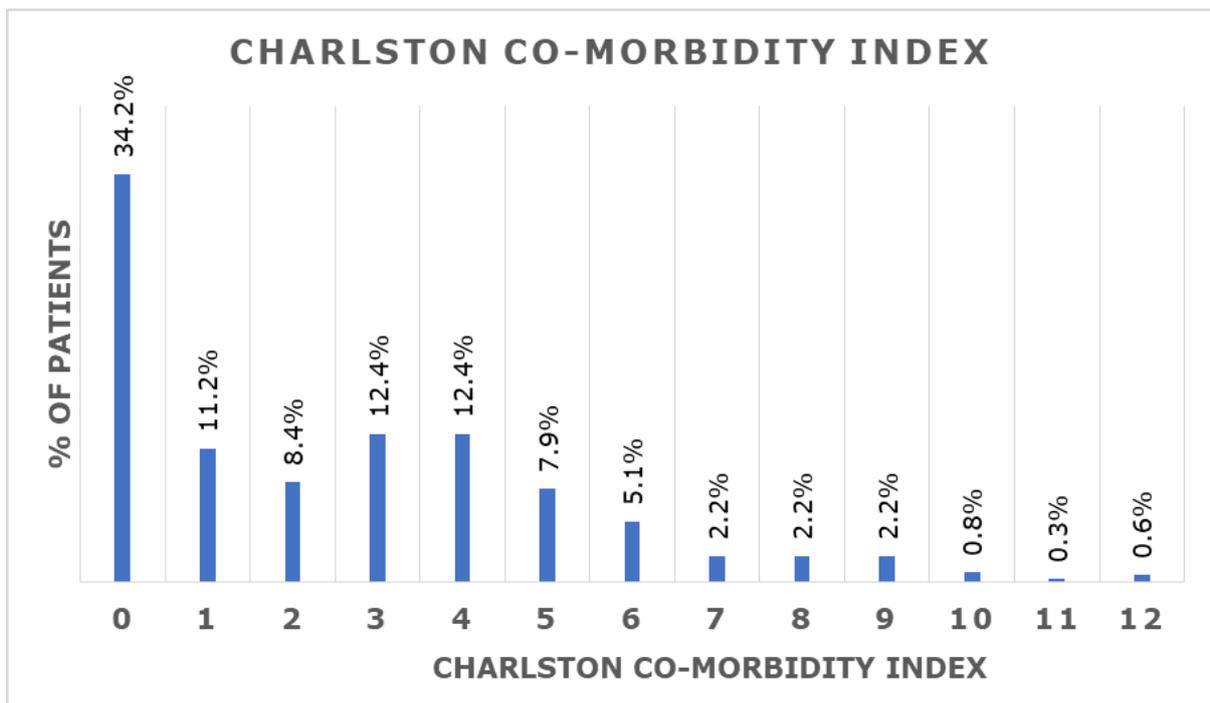
Clinical information	n (%)	(95% CI) <sup>a</sup>	P value <sup>b</sup>	Median (IQR)
Seen by AMU Consultant within 14 hours	238 (66.9)	(61.9%, 71.7%)	<0.001*	-
Seen by AMU medical doctor within 4 hours	24 ( 6.7)	(4.4%, 9.9%)	<0.001**	-
MEWS on arrival	262 (73.6)	(68.7%, 78.1%)	0.003***	-
Length of stay (days)	-	-	-	4 (3) <sup>c</sup>
Discharge within 72 hours	138 (38.8)	(33.7%, 44.0%)	-	-
Readmission within 30 days	19 (5.8)	(3.2%, 8.2%)	-	-
30 day in-hospital Mortality	3 (0.8)	(0.1%, 2.4%)	-	-
Charlson Co-Morbidity Index (CCI)	-	-	-	2 (4) <sup>c</sup>
Katz Index of Independence (KI)	-	-	-	6 (0) <sup>d</sup>

MEWS : Modified Early Warning Score; IQR : Interquartile range  
 a Binomial Confidence Interval b Binomial test (comparing with benchmark 80% of SMK UK Standard)  
 c The distribution is skewed to the left d The distribution is skewed to the right  
 \*Compared to SAM UK Standards of >75%,  
 \*\*Compared to SAM UK of >50%,  
 \*\*\*Compared to SAM UK Standards of >90%.

target based on SAM UK survey, for this audit. The initial clinical indicator i), may have been underreported due to the current workflow in RIPAS Hospital whereby patients are seen by a medical doctor whilst still in the accident & emergency department (A&E) before admission to AMU. Data collectors of this study had double checked and reviewed if all patients were seen in A&E and also upon arri-

val to the AMU specifically. Subbe et al., in his study on clinical quality indicators of AMU’s in the UK found that approximately 52% of all patients met all three indicators.<sup>6</sup> Generally, numerous hospitals have found that AMU for acute admission, has significantly improved the outcomes of acute patients.<sup>7-11</sup>

In this study, patients in the AMU



**Figure 1: Percentage of patients categorized according to their Charlson Co-Morbidity Indexes.**

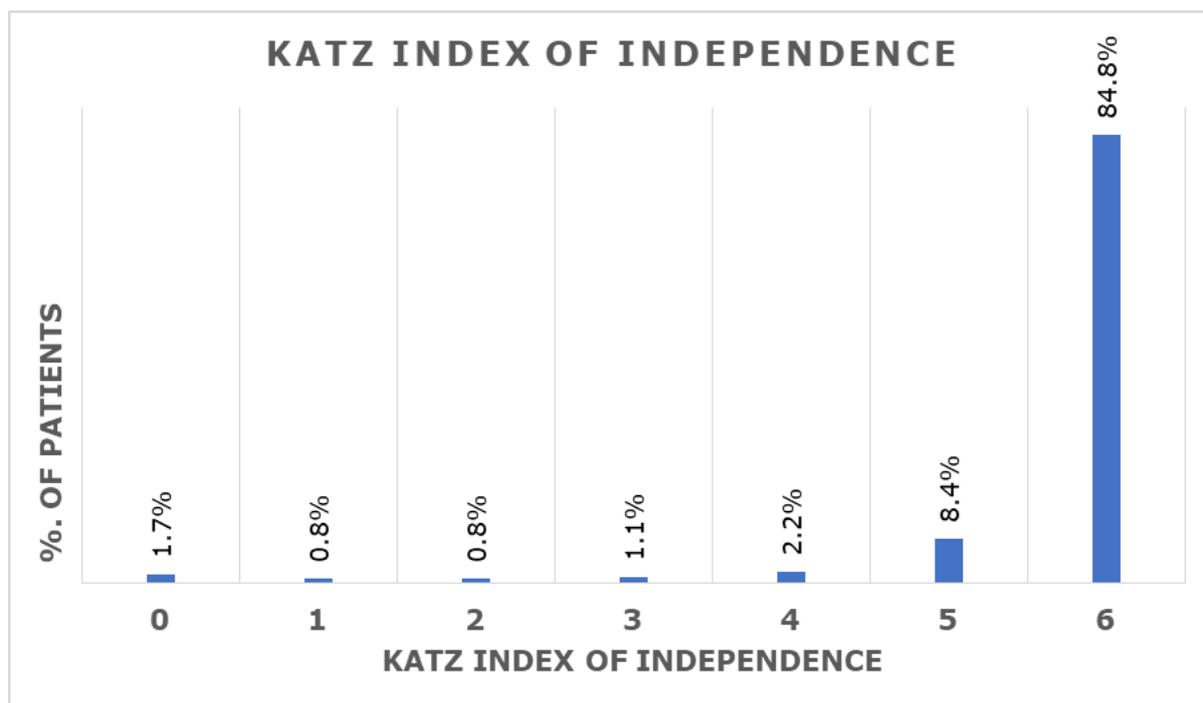


Figure 2: Percentage of patients categorized according to their Katz Index of Independence.

were observed to have a median length of stay of 4 days, which when compared to patients from the St James’ Hospital in Dublin where the median length of stay of 7 days, is considered shorter, suggesting Brunei’s AMU has a quicker discharge rate.<sup>12</sup> In a study by Scott et al., they found that there was a significant decline in median length of stay of patients from 7 to 5 days.<sup>13</sup> This is consistent with multiple studies reporting a shortened median length of stay upon reorganization of AMU.<sup>14-18</sup> It is hoped that the implementation of the ambulatory care section in AMU as well as improved bed management and patient

flow with the traffic light system into AMU workflow practices would reduce the LOS of patients further in the near future.

SAM UK recommends that patients should be discharged from the AMU within 72 hours; however only 38.8% of patients from this study were managed to be discharged within the recommended time.<sup>3</sup> The reasons for the discharge delays are complex and out of the scope of this study but likely due to older patients with multiple comorbidities requiring more complex medical planning, treatment and discharge planning. Interestingly, a

Table III: Relationship between clinical quality indicators and clinical outcomes

	n	30 day IHM	p value	D/C within 72	p value	RA within 30	P value	LOS	P value
		n (%)		hours		days		Mean (SD)	
Indicator 1									
Yes	238	2 (0.8)	1.000 <sup>b</sup>	105 (44.1)	<b>0.003<sup>a</sup></b>	12 (5.0)	0.725 <sup>a</sup>	5.13 (4.5)	0.087 <sup>c</sup>
No	118	1 (0.9)		33 (28.0)		7 (5.9)		6.03 (4.6)	
Indicator 2									
Yes	24	0 (0.0)	1.000 <sup>b</sup>	14 (58.3)	<b>0.042<sup>a</sup></b>	2 (10.5)	0.372 <sup>b</sup>	4.00 (5.0)	0.150 <sup>c</sup>
No	332	3 (0.9)		124 (37.4)		17 (89.5)		5.54 (4.5)	
Indicator 3									
Yes	262	3 (1.2)	0.569 <sup>b</sup>	90 (34.4)	<b>0.004<sup>a</sup></b>	13 (5.0)	0.599 <sup>a</sup>	5.66 (4.4)	0.130 <sup>c</sup>
No	94	0 (0.0)		48 (51.1)		6 (6.4)		4.82 (4.9)	

<sup>a</sup> Chi-square test; <sup>b</sup> Fisher’s exact test; <sup>c</sup> Independent t test (equal variance not assumed)

IHM= in-hospital mortality; D/C=Discharge; RA=Readmission; LoS=Length of Stay

Indicator 1= Seen by AMU Consultant within 14 hours

Indicator 2= Seen by AMU medical doctor within 4 hours

Indicator 3= Modified Early Warning Score on arrival

few studies on discharge delays within AMU's have found that the main cause of delays are due to patients awaiting review from a consultant, which wasn't a major issue from our study.<sup>24,25</sup> On another note, there was a scarcity of published readmission rates to hospital after discharge from AMU but this study revealed a readmission of patients within 30 days from AMU to be at 5.8% which was an improvement from a published readmission of 26.6% from a medical unit.<sup>19</sup> Additionally, it has been also shown that the introduction of an AMU had no significant negative effect on patients' readmission rates.<sup>20</sup>

It is difficult to ascertain the impact of the AMU on 30 day in-hospital mortality rates of patients, especially since majority of patients are either transferred onto medical units for further treatment or are discharge within 4-7 days. However for this study, it was 3 out of 356 patients, which was to be expected as majority of patients admitted to AMU had a low burden for disease. A study in St James' Hospital found that over the course of 5 years, the 30-day all-cause mortality rates reduced from 8.8% to 5.6% after initiating an AMU into the hospital.<sup>15</sup> Decline in hospital mortality rates have been a common trend among hospitals after implementing an AMU.<sup>12,15,21-23</sup>

Additionally, our study revealed that patients' discharge rates are statically significantly associated with i) being seen by AMU Consultant within 14 hours, ii) being seen by AMU medical doctor within 4 hours and iii) having the MEWS on arrival ( $P < 0.05$ ). However, in contrast, they do not seem to have any significant effect on other clinical outcomes such as mortality and readmission rates ( $P > 0.05$ ). Out of 356 patients, 305 (85.7%) were directly discharged from the AMU, this shows that our AMU is functioning like a general medicine unit rather than what most people perceive a AMU should function as.

There are two notable limitations associated with this study that may have impacted on the study results. Firstly, due to the wide heterogeneity of cases that are admitted to AMU at varying times of the year, a four-month snapshot of cases may not be an optimal sample to generalize the demographics of all patients admitted to AMU, a larger sample size over a longer study period would more likely be able to show more statistically significant results especially with mortality and readmission rates. Secondly, this study is limited by the retrospective study design, and we could not correct for other factors that could have affected the length of stay and waiting time in the Emergency Department.

## CONCLUSION

In conclusion, this study have found that there were equal proportions of male and female patients admitted to AMU, most of which were notably independent with low burden for disease. 30 day in-hospital mortality and readmission rates of AMU patients in RIPAS Hospital were also notably low, which indicates a quality standard of care for patients. Patients that were assessed within the clinical quality indicators; seen by AMU consultant within 14 hours, seen by an AMU medical doctor within 4 hours and given a MEWS upon arrival were significantly associated with improved discharge rates, although these clinical quality indicators were significantly lower than those set by SAM UK standards. Hence these are areas that may need further improvements and future improvements in workflow and addition of more senior and junior medical staffs would help to achieve better future standards.

Further studies with larger sample size and longer duration of study, should be conducted to fully assess the scope and the effect of implementation of an AMU in RIPAS hospital. Comorbidities of patients could also be assessed to determine if they have any significant relation to any specific diagnosis or

significant relation to any specific diagnosis or complications within admission and thus enabling specific treatment plans to provide quality health care. Qualitative and quantitative studies for staff satisfaction as well as the reasons for discharge delays would also be potential for future research.

## DECLARATION

The authors declared that there is no conflict of interest and no financial conflict.

## REFERENCES

- 1: The Society for Acute Medicine. [Clinical Quality Indicators for Acute Medical Units \( AMUs \)](#). 2011;2. [Accessed on 2020 April 11].
- 2: Naing Lin, Winn T and Rusli B. [Practical Issues in Calculating the Sample Size for Prevalence Studies](#). Arch Orofac Sci. 2006;1:9-14. [Accessed on 2020 April 11].
- 3: The Society for Acute Medicine. [Summary of Quality Indicator Survey](#). 2013. [Accessed on 2020 April 11].
- 4: Duckitt R, Palsson R, Bosanska L, Dagna L, Mine Durusu T, Vardi M. [Common diagnoses in Internal Medicine in Europe 2009: A pan-European, Multi-Centre Survey](#). Eur J Intern Med. 2010 ;21(5):449–52. [Accessed on 2020 April 11].
- 5: Armitage M. [Acute medicine: Making it work for patients \[Editorial\]](#). Clin Med. 2004;4:203-6. [Accessed on 2020 April 11].
- 6: Subbe CP, Jeune I Le, Ward D, Pradhan S, Masterton-Smith C. [Impact of consultant specialty on discharge decisions in patients admitted as medical emergencies to hospitals in the United Kingdom](#). QJM [Internet]. 2017;110 (2):97–102. [Accessed on 2020 April 11].
- 7: Watts M, Powys L, Hora CO, Kinsella S, Saunders J, Reid L, et al. [Acute Medical Assessment Units: An Efficient Alternative to In-Hospital Acute Medical Care \[Internet\]](#). Irish Medical Journal. 2011:1-4. [Accessed on 2020 April 11].
- 8: Beckett DJ, Raby E, Pal S, Jamdar R, Selby C. Improvement in time to treatment following establishment of a dedicated medical admissions unit. Emerg Med J. 2009;26(12):878–80.
- 9: Reid LEM, Pretsch U, Jones MC, Lone NI, Weir CJ, Morrison Z. [The acute medical unit model: A characterisation based upon the National Health Service in Scotland](#). PLoS One [Internet]. 2018;13(10):e0204010. [Accessed on 2020 April 11].
- 10: Goh WP, Han HF, Segara UC, Baird G, Lateef A. [Acute medical unit: Experience from a tertiary healthcare institution in Singapore](#). Singapore Med J. 2018;59(10):510-513. [Accessed on 2020 April 11].
- 11: Moloney ED, Bennett K, Silke B. [Effect of an acute medical admission unit on key quality indicators assessed by funnel plots](#). Postgrad Med J. 2007;83(984):659–63. [Accessed on 2020 April 11].
- 12: Conway R, O’riordan D, Silke B. [Long-term outcome of an AMAU-a decade’s experience](#). QJM. 2014;107(1):43–9. [Accessed on 2020 October 13].
- 13: Scott I, Vaughan L, Bell D. [Effectiveness of acute medical units in hospitals: a systematic review](#). Int J Qual Heal Care. 2009;21(6):397–407. [Accessed on 2020 April 11].
- 14: Lo SM, Choi KTY, Wong EML, Lee LLY, Yeung RSD, Chan JTS, et al. Effectiveness of Emergency Medicine Wards in reducing length of stay and overcrowding in emergency departments. Int Emerg Nurs. 2014;22(2):116–20.
- 15: Rooney T, Moloney ED, Bennett K, O’Riordan D, Silke B. [Impact of an acute medical admission unit on hospital mortality: a 5-year prospective study](#). Q J Med. 2008;101(6):457–65. [Accessed on 2020 April 11].
- 16: Vork JC, Brabrand M, Folkestad L, Thomsen KK, Knudsen T, Christiansen C. [A medical admission unit reduces duration of hospital stay and number of readmissions](#). Dan Med Bull. 2011;58(8):A4298. [Accessed on 2020 April 11].
- 17: Diepeveen BAW, Jansen-Vullers MH, Dellaert NP. Performance analysis and improvement at the acute admissions unit of Máxima Medical Centre. Technische Universiteit Eindhoven; 2009.
- 18: Ohn JH, Kim NH, Kim ES, Baek SH, Lim Y, Hur J, et al. [An acute medical unit in a Korean Tertiary care hospital reduces the length of stay and waiting time in the emergency department](#). J Korean Med Sci. 2017;32(12):1917–20. [Accessed on 2020 October 19].
- 19: Hughes LD, Witham MD. [Causes and correlates](#)

- of 30 day and 180 day readmission following discharge from a Medicine for the Elderly Rehabilitation unit. *BMC Geriatrics*. 2018;18(1):197. [Accessed on 2020 October 19].
- 20: Conway R, Byrne D, O’Riordan D, Silke B. Outcomes in acute medicine - Evidence from extended observations on readmissions, hospital length of stay and mortality outcomes. *Eur J Intern Med*. 2019;66:69–74.
- 21: Coary R, Byrne D, O’Riordan D, Conway R, Cournane S, Silke B. [Does admission via an Acute Medical Unit influence hospital mortality? 12 years’ experience in a large Dublin Hospital.](#) *Acute Med*. 2014;13:152–8. [Accessed on 2020 October 19].
- 22: Moore S, Gemmell I, Almond S, Buchan I, Osman I, Glover A, et al. [Impact of specialist care on clinical outcomes for medical emergencies.](#) *Clin Med*. 2006;6(3):286–93. [Accessed on 2020 October 15].
- 23: Li JYZ, Yong TY, Bennett DM, O’Brien LT, Roberts S, Hakendorf P, et al. [Outcomes of establishing an acute assessment unit in the general medical service of\\_a tertiary teaching hospital.](#) *Med J Aust*. 2010;192(7):384–7. [Accessed on 2020 October 19].
- 24: Reid E, King A, Mathieson A, Woodcock T, Watkins SW. [Identifying reasons for delays in acute hospitals using the Day-of-Care Survey method.](#) *Clin Med*. 2015;15(2):117–20. [Accessed on 2020 October 15].
- 25: Chandel R, Hodgson A, Stosic J, Fahimi N El. [How can we avoid delays in discharging patients from the acute medical unit?](#) *Futur Hosp J*. 2015;2(Suppl 2):s2. [Accessed on 2020 October 15].
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