Predicting length of stay for acute medical admissions using the ALICE score: a simple bedside tool

D Wilding & K Evans

Abstract

Background: *Early identification of patients likely to have a short admission permits best use of limited resources to facilitate rapid discharge where possible. The ALICE score is a simple bedside tool developed in one hospital as a decision aid. This study sought to confirm its widespread applicability.*

Method: *Retrospective review of 250 consecutive admissions at five acute hospitals. Clinical records were reviewed for a total of 1003 patients. ALICE score was calculated for each patient and compared to LoS data.*

Results: *There was a statistically significant positive correlation between rising ALICE scores and increasing length of stay irrespective of final diagnoses.*

Conclusion: *The ALICE score provides a simple bedside tool to predict length of stay.*

Keywords

length of stay, medical admissions, short stay unit, geriatric medicine, patient flow

Key points

- Predicting length of stay (LoS) helps guide patient placement within the hospital
- The ALICE score provides a simple bedside tool which can be readily utilised by the entire AMU team
- The ALICE score is calculated from 5 domains: **A**ge, **L**iving alone, **I**llnesses, **C**onfusion and **E**xisting package of care
- There was a positive correlation between rising ALICE scores and increasing length of stay irrespective of final diagnoses
- A lower ALICE score correlates with a higher early discharge rate

Introduction

The National Health Service has seen progressively increasing pressures placed upon emergency services;[1] approximately two thirds of all hospital bed days are now the result of unplanned admissions. Predicting length of stay (LoS) helps guide patient placement within the hospital: to ambulatory care, short stay ward, frailty unit and so on. Early identification of patients most likely to have a short admission permits best use of limited resources to facilitate rapid discharge where possible, and to provide early additional support when a prolonged stay seems more likely.

The ALICE score was developed locally, based on observations of staff involved in the care of acute medical patients. The tool has five domains – **A**ge, **L**iving alone, **I**llnesses, **C**onfusion and **E**xisting package of care, from which the ALICE score is calculated (Table 1). In 2008, recognising the increasing demand for targeted early physical/occupational therapy input to facilitate early safe discharge, the ALICE score was introduced in one hospital as a pilot scheme, allowing the multidisciplinary team to focus on patients with the highest likelihood of discharge. Results of an interim service evaluation (a convenience sample of 220 inpatients) demonstrated a statistically significant correlation between ALICE score and LoS for these patients, with higher scores predicting increased time in an acute hospital bed (Figure 1). However by the time of this service evaluation, ALICE scoring had been established within the local setting for several years and it was acknowledged that the tool itself may

Table 1. The ALICE score and its calculation

	Component	1 point scored, if
A	Age	>75 years of age
L	Living alone	Patient lives alone
I	Illnesses	Patient has 1+ significant co-morbidities as defined by Charlson co-morbidity index[2]
C	Confusion	Patient has established cognitive impairment or acutely is confused, assessed through AMTS (score <8)
E	Existing package of care	Patient has pre-existing care package or is in nursing or residential care

AMTS = abbreviated mental test score

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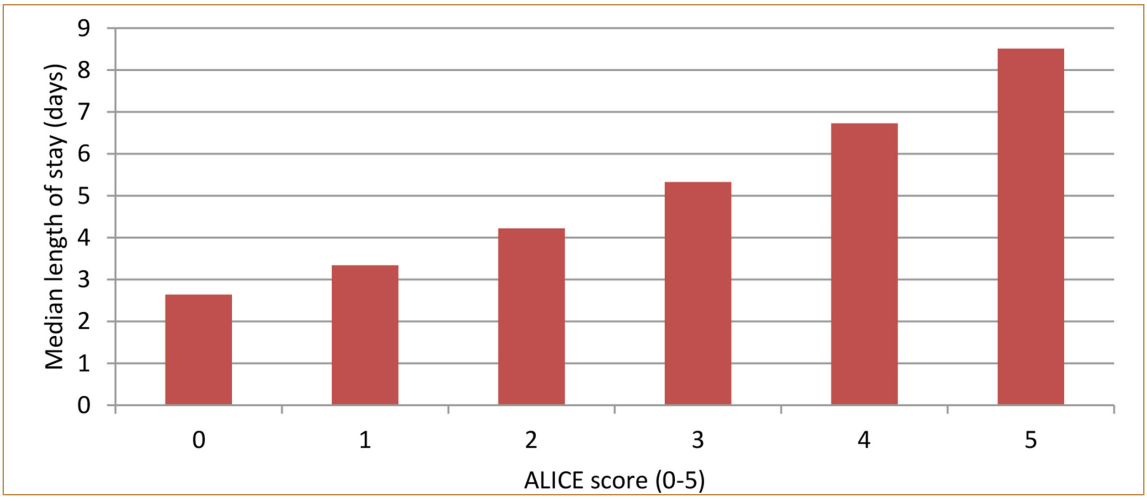

Figure 1. 2010 pilot study (n= 200) demonstrating relationship between ALICE scores and median length of stay for medical inpatients

have been impacting upon the results, as resources and processes were utilised in accordance with patients' ALICE scores. Recognising the likelihood of widespread applicability of the ALICE score in other acute medical units, we embarked on a multicentre study.

Methods

Five acute hospital trusts from across the south west peninsula region participated in data collection. Patients included within the study were consecutive adults (16+ years) admitted to the acute trust via the medical take from midnight on 1st July 2013. Based on statistically significant findings obtained from the 2010 convenience sample with 220 patients, the intention was to collect data pertaining to 250 consecutive admissions at each of the five centres. Ethical approval was granted by the Cornwall & Plymouth Research and Ethics Committee, with local agreement to proceed from each participating trust's Research & Development department.

Clinical records were reviewed for patient demographics, comorbidities, clinical assessment (including mental state assessment), length of hospital stay, diagnosis at discharge and discharge location. Data relating to death or readmission to the acute trust within 30 and 90 days of discharge was also collected but not discussed here.

Owing to the non-parametric nature of data pertaining to length of hospital stay with a propensity for shorter admissions for the majority of patients, statistical analysis was conducted using the Kruskal-Wallis one-way analysis of variance (Kruskal-Wallis H-test). Analysis was conducted for all patients who survived to discharge, with further subset analysis of each participating site.

Results

A total of 1003 acute medical admissions were reviewed. 31 records were excluded from the final analysis as a result of incomplete clinical information preventing calculation of a patient's ALICE score. A total of 972 admission episodes were included in the study; 51 patients died during their acute admission and were excluded from analysis pertaining to length of stay.

Patient ages ranged from 16 to 103 years, with a median age of 71 years. 49% of patients were female. Age and sex distribution for patients were not matched but were comparable across sites (Table 2).

Table 2. Demographic data for patients included in statistical analysis

Acute Trust	Patients included (n)	Median Age (years)	Age Range (years)	Female patients (n)	Female patients (%)
1	210	75.0	19-102	100	47.6
2	201	70.0	17-98	96	47.7
3	242	69.5	18-93	116	47.9
4	250	70.5	16-103	133	53.2
5	69	71.0	20-95	36	52.2
All Sites	972	71.0	16-103	481	49.5

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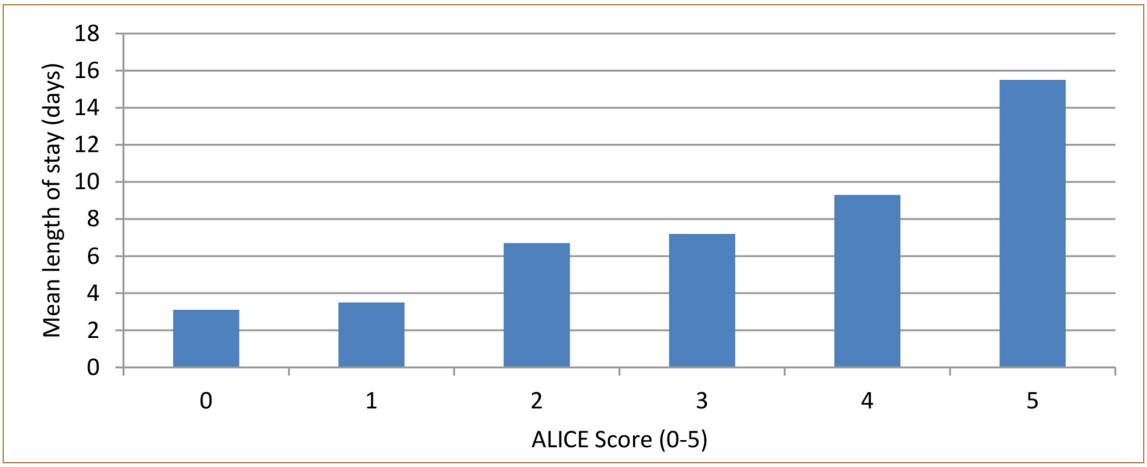

Figure 2. Relationship between ALICE scores and mean length of hospital stay across all sites

There was a positive correlation between rising ALICE scores and increasing length of stay (Figure 2 and Table 3), irrespective of final diagnoses, which was statistically significant ($p<0.05$).

Subgroup analysis for individual Trusts confirmed this statistically significant relationship between ALICE scores and length of stay for each of the five sites (see figure 5). One of these sites failed to collect sufficient patient data (n=69) and although a relationship between ALICE scores and length of stay was implied, a positive correlation between the two variables was not clearly demonstrated.

Further review of data for each ALICE score group was conducted to determine the proportion of patients who were discharged in less than three days and those who were admitted for more than one week. A far greater proportion of patients with lower ALICE scores were discharged within the first 72 hours of hospitalisation than those with higher scores; similarly rising ALICE scores were suggestive of an increased likelihood of a prolonged hospitalisation (Figure 3).

Discussion

Within our study, over 50% of the total hospital bed days were attributable to just 122 patient care episodes (12.6%). An understanding of the determinants of rapid discharge or prolonged hospitalisation may support clinical decisions about the location of continued medical care.

There are a multitude of prognostication tools which may be used by clinicians to make decisions about admission, disease severity and ongoing management, for example the CURB65 score for pneumonia.[3] Many of these tools are disease specific and may not be so readily applied during the first few hours or days of a patient's hospital care when there is ongoing diagnostic uncertainty. Early warning scores are useful in determining the acuity of illness and establishing appropriate triage and escalation plans, and would seem to correlate with inpatient mortality and need for critical care admission, but may not necessarily correlate with increased length of hospitalisation.[4,5] Dent *et al* suggest that clinicians working within frontline services are often able to predict the need for acute hospitalisation for most patients, but their ability to predict the likely length of stay is much less accurate.[6] Internationally, several tools and scoring systems have been proposed as a means for predicting length of stay for medical patients.[7-9] The practical application of these tools is not always straightforward owing to the need

Table 3. ALICE scores and mean length of stay for all sites

		Mean length of stay (days) for ALICE score:						Statistical analysis (Kruskal-Wallis H test)	
Acute Trust	Patients (n)	0	1	2	3	4	5	H value	P value
1	200	4.4	3.6	8.2	7.4	7.3	1.0	27.0	<0.005
2	187	3.3	4.0	6.2	7.1	16.1	23.3	23.4	<0.005
3	227	3.6	4.0	7.1	4.9	8.5	19.3	27.4	<0.005
4	237	1.8	2.7	4.6	7.9	9.1	15.7	37.4	<0.005
5	69	1.8	2.6	8.5	11.0	5.8	4.0	15.5	<0.05
ALL	920	3.1	3.5	6.7	7.2	9.3	15.5	99.4	<0.005

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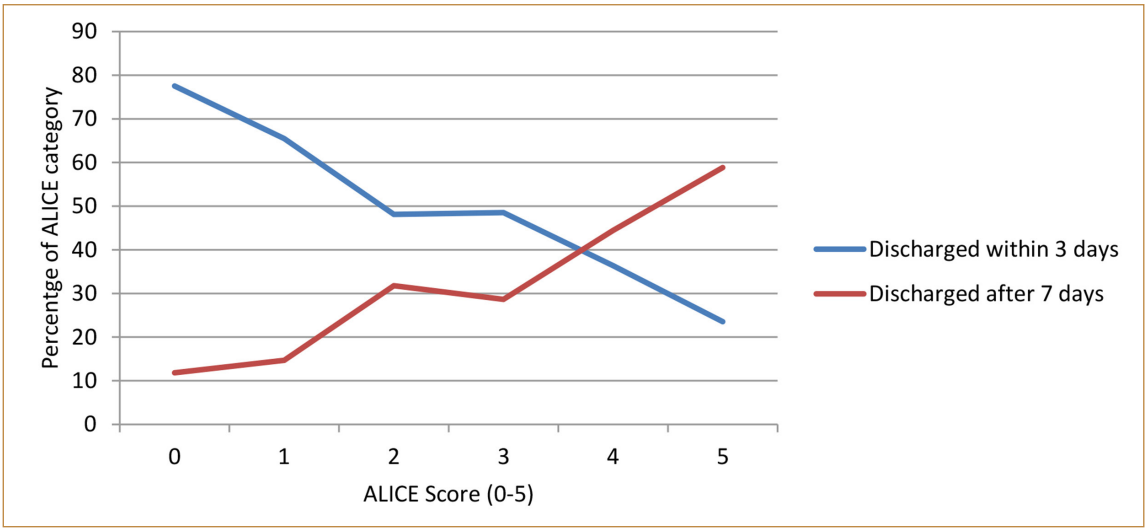

Figure 3. Proportion of patients in each ALICE category discharged within 3 days of admission or requiring hospitalisation for more than one week

for invasive investigations, physiological measures or detailed functional assessments; as a result, such tools have limited usability for front-line clinical staff when planning a patient's onward care.

Although the ALICE score was initially founded upon "common sense" and experience of local hospital staff, a review of published studies provides supporting evidence for an association between various domains of the ALICE scoring system and LoS: younger patients have an increased likelihood of a short (i.e. less than 3 days) hospital admission independent of other patient characteristics,[5,6] whilst the presence of confusion at the time of admission will adversely affect the LoS for which a patient may be hospitalised.[5]

Short stay units have been developed within secondary care to ensure optimal care for patients who are likely to have a short length of hospital stay, including early and frequent consultant review, and the presence of dedicated junior medical, nursing and wider healthcare professionals to facilitate timely discharge.[10] Downing *et al* demonstrated the ability to redirect a significant proportion of their medical admissions through a dedicated short stay unit with 71% of patients discharged home within 48 hours, although it was acknowledged that patient selection was often based upon the intuition of the admitting doctor, and as such not always reliable.[11] Being able to reliably determine patients with a likely short LoS aids appropriate patient placement, for example, to ambulatory care, AMU or a short stay unit and a low ALICE score could form part of the assessment for patient suitability for such pathways of care.[12] A low ALICE score could form part of the assessment for patient suitability for a short stay unit.

With an increasingly elderly population, age alone cannot dictate who should be prioritised for a Comprehensive Geriatric Assessment (CGA) or the inpatient geriatric bed base.[13] A high ALICE score may be useful in directing therapists and geriatricians to the more frail patients with the most to gain from their input.[14] Many tools have been developed to help clinicians make a decision as to whether patients may indeed be frail and literature would suggest that frailty is associated with an increased likelihood of a longer hospital stay and its acknowledgement is therefore very important.[15-17] CGA requires time and a certain skill set; there may also be challenges in completing a detailed assessment at the time of admission owing to acuity of illness. Presence of an existing package of care – either at home or placement in a care facility – may act as a rudimentary guide to the existence of frailty, whilst social circumstances, such as living alone or being socially isolated may influence a team's decision to discharge a patient back to their usual place of residence owing to concerns about their ability to cope following a period of acute illness. It is impossible to uncouple the close relationship between acute care trusts and social care and the components of the ALICE score acknowledge patient factors which may increase the time taken for patients to become "medically fit for discharge", but also social factors which may predict challenges to safe discharged from the acute hospital setting.

Conclusions

The ALICE score provides a simple bedside tool which can be readily utilised by the entire team working with acute medical patients. As the information needed to calculate the score should be contained within a medical clerking, it will often

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take less than a minute to calculate. For front-line clinicians, it can be utilised as a supplement to clinical decision making when selecting a location for ongoing clinical care. The ALICE score can also help predict length of stay for unselected general medical patients admitted to hospital.

The ALICE score acknowledges that comorbidities, reduced cognition and social circumstances all influence length of stay for medical patients. Traditionally, in hospitals where specialty teams operate from particular wards (and bed occupancy is now approaching 100% year round), the patient's clinical presentation and diagnosis would determine the location of ongoing inpatient care. Our work would suggest that patient and social factors may be predictive of increased length of hospital stay and may be equally useful in determining where a patient should be managed.

Although there is local anecdotal experience in how to apply this scoring system, the applications described above have not been developed into robust clinical pathways, and further work is needed to determine if the use of such a tool can positively impact upon individual patient care and overall flow of patients within an acute trust setting.

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Conflicts of interest

None.

References

1. National Audit Office (2013). Emergency admissions to hospital: managing the demand. https://www.nao.org.uk/wp-content/uploads/2013/10/10288-001-Emergency-admissions.pdf (Accessed 30 March 2017)
2. Charlson ME, Pompei P, Ales KL, *et al.* A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. *J Chronic Dis* 1987; **40(5)**: 373-383
3. Aujesky D, Auble TE, Yealy DM, *et al.* Prospective comparison of three validated prediction rules for prognosis in community-acquired pneumonia. *Am J Med* 2005; **118(4)**: 384-392
4. Subbe CP, Kruger M, Rutherford P, *et al.* Validation of a modified early warning score in medical admissions. *QJM* 2001; **94(10)**: 521-526
5. Huggan PJ, Akram F, Er BH, *et al.* Measures of acute physiology, co-morbidity and functional status to differentiate illness severity and length of stay among acute general medical admissions: a prospective cohort study. *Intern Med J* 2015; **45(7)**: 732-740
6. Dent AW, Weiland TJ, Vallender L, *et al.* Can medical admission and length of stay be accurately predicted by emergency staff, patients or relatives? *Aust Health Rev* 2007; **31(4)**: 633-641
7. Paterson R, MacLeod DC, Thetford D, *et al.* Prediction of in-hospital mortality and length of stay using an early warning scoring system: clinical audit. *Clin Med* (Lond) 2006; **6(3)**: 281-284
8. Li JY, Yong TY, Hakendorf P, *et al.* Simple clinical score is associated with mortality and length of stay of acute general medical admissions to an Australian hospital. *Intern Med J* 2012; **42(2)**: 160-165
9. Pilotto A, Sancarlo D, Pellegrini F, *et al.* The Multidimensional Prognostic Index predicts in-hospital length of stay in older patients: a multicentre prospective study. *Age and Aging* 2016; **45(1)**: 90-96
10. Ahmad A, Purewal TS, Sharma D, *et al.* The impact of twice-daily consultant ward rounds on the length of stay in two general medical wards. *Clin Med* (Lond) 2011; **11(6)**: 524-528
11. Downing H, Scott C, Kelly C. Evaluation of a dedicated short-stay unit for acute medical admissions. *Clin Med* (Lond) 2008; **8(1)**: 18-20
12. Powter L, Beale A, Probert B, *et al.* Development and validation of a tool to select patients for admission to medical short stay units. *Clin Med* (Lond) 2014; **14(4)**: 371-375
13. Stuck AE, Siu AL, Wieland GD, *et al.* Comprehensive geriatric assessment: a meta-analysis of controlled trials. *Lancet* 1993; **342(8878)**: 1032-1036
14. Fried LP, Tangen CM, Walston J, *et al.* Frailty in Older Patients: Evidence for a Phenotype. *J Gerontol A Biol Sci Med Sci* 2001; **56(3)**: M146-M156
15. Khandelwal D, Goel A, Kumar U, *et al.* Frailty is associated with longer hospital stay and increased mortality in hospitalized older patients. *J Nutr Health Aging* 2012; **16(8)** 732-735
16. Singh I, Gallacher J, Davis K, *et al.* Predictors of adverse outcomes in an acute geriatric rehabilitation ward. *Age and Aging* 2012; **41(2)**: 242-246
17. Rose M, Pan H, Levinson MR, *et al.* Can frailty predict complicated care needs and length of stay? *Intern Med J* 2014; **44(8)**: 800-805

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