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Anticipating care needs of patients after discharge from hospital: Frail and elderly patients without physiological abnormality on day of admission are more likely to require social services input

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Highlights

- Severity of illness and frailty on admission predict care needs post discharge
- Decision tree analysis generates simple rules for clinicians
- Results might depend on local support of frail elderly patients outside hospital

Keywords

Frailty, Hospital, Patient discharge, Social work, Triage

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Conflicts of interest

None of the authors has got a conflict of interest related to this study

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ABSTRACT

Background

Acute admissions to hospital are rising. As a part of a service evaluation we examined pathways of patients following hospital discharge depending on data available on admission to hospital.

Methods

We merged data available on admission to the Wrexham Maelor hospital from an existing data-base in the Acute Medical Unit with follow up data from local social services as part of a data sharing agreement. Patients requiring support by social services post-discharge were matched with patients not requiring social services from the same post-code.

Results

Stepwise logistic regression analysis identified candidate variables predicting likely support need. Decision tree analysis identified sub-groups of patients with higher likelihood to require support by social services after discharge from hospital. We found patients with normal physiology on admission as evidenced by a value of zero for the National Early Warning Score who were frail or older than 85 years were most likely to require support after discharge.

Conclusions

Information available on admission to hospital might inform long term care needs. Prospective testing is needed. The algorithms are prone to be dependent on availability of local services but our methodology is expected to be transferable to other organizations.

BACKGROUND

Frail elderly patients often get admitted with seemingly minor illnesses, yet end up staying in hospital for a long time. Part of the reason for this is that rehabilitation often starts late during the course of the hospital stay, at a time when patients have already lost significant strength and confidence. Early recognition and treatment of frailty is therefore a concept that might reduce length of hospital stay and increase patients' independence and satisfaction.

Acute Medicine is the port of entry to UK hospitals for 50% of patients and an even higher proportion of the frail elderly(1). Frailty, if not detected and supported in a timely fashion leads to prolonged hospital stay, higher levels of dependency and higher mortality(2,3).

In 2014 we showed with the help of a SHINE grant from the Health Foundation that a navigator supported triage system based on parameters available on admission to hospital can drive selection of patients for early discharge and reduce hospital length of stay (4). Data from a small subset of patients suggested that time to referral for intermediate care services was cut by 14 days with the usage of the Clinical Frailty Scale (CFS) (5) without an increase in futile referrals.

Our previous research did not include follow-up after discharge from hospital.

In order to improve the patients experience of hospital and to optimize usage of resources we hypothesise that is possible to recognize frailty on admission to hospital, that this recognition will lead to earlier referral to the multi-disciplinary intermediate care or rehabilitation team and therefore to earlier discharge to patients' own homes with a greater degree of independence.

Fy Nhaid aimed to develop locally applicable simple criteria for earlier recognition of patients at risk of increased care needs post-hospital discharge that allow prospective testing in our local environment.

METHODS

Fy Nhaid (Frailty: timelY recognition of Need for Home support After In-patient Discharge) is a service evaluation that was developed as a collaboration between clinicians from Primary care, Secondary Care and Social Services within the Betsi Cadwaladr University Health board. Fy Nhaid aims to use existing data sources to develop decision rules that help service managers and clinicians to identify patients likely to require support after discharge from hospital.

Data sources

Electronic point of care (EPOC) is a data-base in the Acute Medical Unit at Wrexham Maelor Hospital that is being used to triage patients on admission to hospital. The data base contains vital signs on admission to hospital, previous medical history in ICD codes, medication as well as a measure of frailty (Clinical Frailty Scale (5)) from over 10.000 patients admitted to the Maelor Hospital. Value of the clinical frailty scale of 5 or more code for patients who are frail.

The post-discharge support data was provided by social services in North-East Wales as part of a data sharing agreement. Data from patients starting new social care packages between 1st April 2014 and 15 February 2016 were included. Social services data comprised the frequency of service use and start and finish data of support packages. Support packages included adaptation of a patient's home, provision of equipment, domiciliary support, nursing care, professional support and supported living and council residential care.

Principles of evaluation

The EPOC data were housed on a secure server at Betsi Cadwaladr University Health Board (BCUHB). Files were merged with data from social services and anonymized after merger. Anonymized files received a new study specific number. Anonymized data was then transferred to the North Wales Organisation for Randomised Trials in Health, School of Healthcare Sciences, (NWORTH) at Bangor University, where they were stored on a secure server.

NWORTH provides research support to BCUHB. NWORTH supported the merger of the files described above as part of the Health and Care Research Wales Clinical Research Centre and Research Infra-structure and Technical Support Group and undertook the primary analysis.

Ethics

The analysis of data was undertaken as part of a service development program between the department for General, Specialist and Community Medicine that comprises adult inpatient services and primary care provision throughout North Wales and Wrexham Social Services. The process was approved by the local data governance officer.

Selection of patients

We included patients admitted through the Acute Medical Unit (AMU) at Wrexham Maelor Hospital and seen by social services in the Wrexham area within 60 days after discharge. These were compared to a sample of patients who were admitted to the same unit but were not registered as having received social service support. Controls were matched by post-code.

Data analysis

Logistic regression analysis with forward and backward selection was used to identify significant predictors of support by social services. Subsequently decision tree learning was applied. The analysis was run using the chi-square automatic interaction detector (CHAID) method (6). A significance level of 0.05 was applied for either splitting or merging categories. Additionally cross-validation was conducted.

All analysis was conducted using SPSS version 22.

Selection of candidate variables

The binary logistic regression analysis included the following variables. With the exception of the number of medications on discharge all data were from the admissions data set:

- Age in years
- Nursing Home admission
- Prior Illness
- Diagnosis of diabetes
- Smoking status
- Alcohol excess
- Respiratory rate
- Clinical Frailty Scale (5)
- Systolic blood pressure
- Diastolic blood pressure
- Heart rate
- Simple Clinical Score (7)
- Number of medications as recorded on discharge
- National Early Warning Score (NEWS) (8)

RESULTS

The group of patients that required social services comprised 264 patients with a mean age of 80.4 (SD=9.9) years. The matched group of patients receiving no social services comprised 152 patients with a mean age of 67.5 (SD=14.2) years.

The variables remaining in the binary logistic regression model following forward and backward selection are listed in table 1. The forward model achieved a 93.9% classification accuracy and the backward model achieved a 94.1% classification accuracy, based on using the entire dataset. The result demonstrates that important variables are age, clinical frailty scale and visit number. Because NEWS is more widely used this was selected for the classification analysis rather than the Simple Clinical Score.

Table 1: The variables remaining in the binary logistic regression model following forward and backward selection

Forward Model	Backward Model
Age Clinical Frailty Scale Simple Clinical Score Visit Number (number of admissions) Constant	Age Clinical Frailty Scale Heart rate Visit Number (number of admissions) NEWS Score Constant

The decision tree classification analysis was run with all continuous variables left as continuous. The results of this analysis suggested categorizing these variables in the manner shown in figure 1. The odds ratios are listed in Table 2. The visit number and the NEWS score have low odds ratios whereas clinical frailty scale and age have higher odds ratios.

Running the decision tree classification resulted in the model shown in figure 1. The classification of the model is recorded in table 3. The model achieved an 85.4% classification accuracy for the training data and 84.1% accuracy for the test data.

Results from the decision rules can be summarized as follows: Social service input after discharge is common in patients with a NEWS value of 0 and age over 80 or significant frailty (CFS>4) and only one admission.

Figure 1: The output of the decision tree classification analysis. The decision tree classification analysis was run with all continuous variables left as continuous. The results of this analysis suggested categorising these variables in the following manner, based on how the variables are split: ServiceYN is a variable coded as 0 for no social service support and 1 for social service support required. CAT_Age is coded as 0 for Age <=80 and 1 for Age >80 =1; CAT_CFS codes frailty as 0 for ClinicalFrailtyScale <=4 and 1 for ClinicalFrailtyScale>4; CAT_VISIT codes number of previous admissions in the data base as 0 if the admissions was the first admission and as 1 if the number of admissions was more than 1; CAT_NEWS codes severity of illness as 0 for a NEWScore=0 and as 1 for a NEWScore>0.

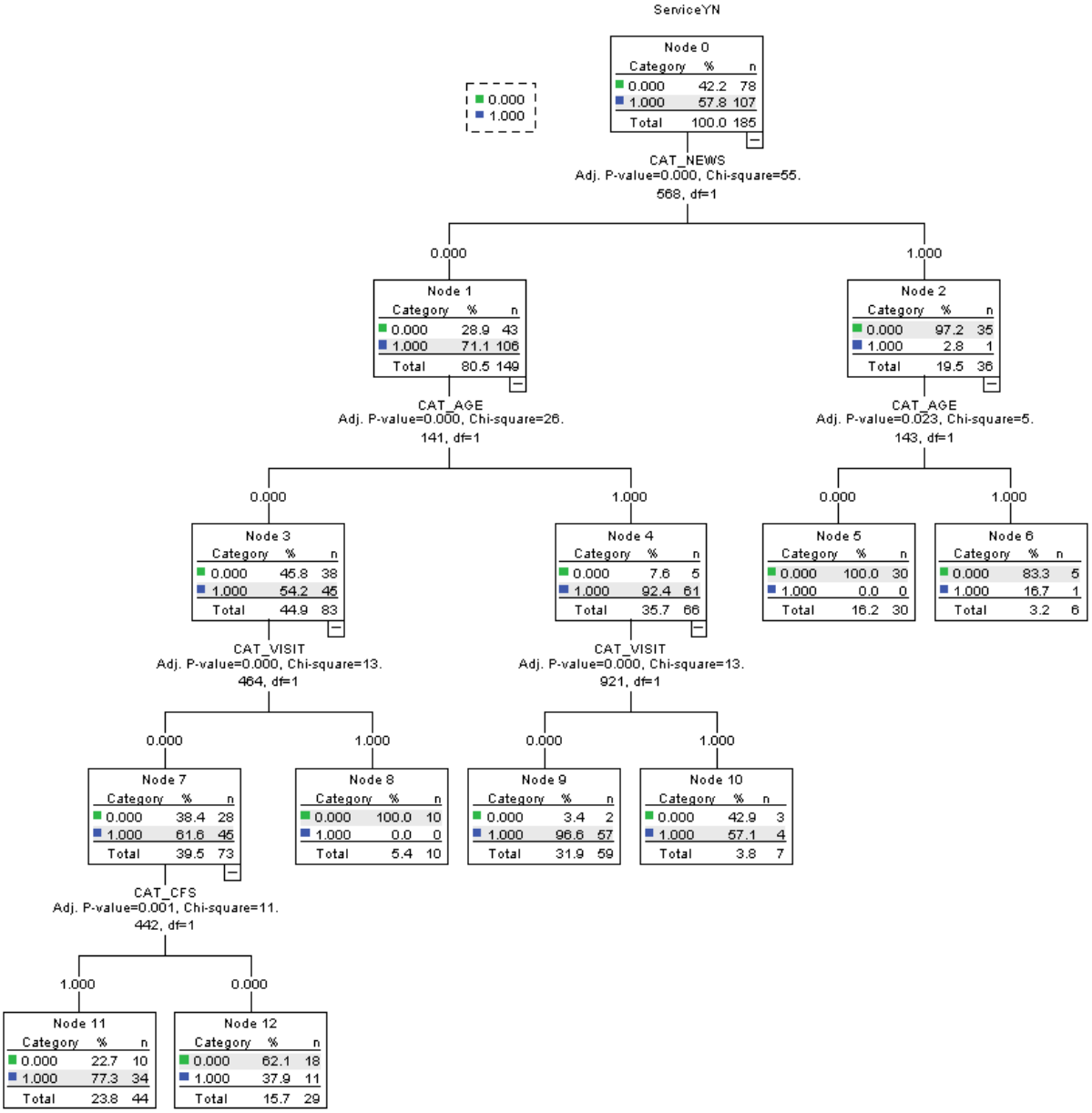

Table 2: Odds ratio for each feature in the classification model

Feature	Odds ratio	95% Confidence Interval	
		Lower	Upper
Age > 80 years	6.143	3.767	10.018
Clinical Frailty Scale >4	7.172	4.470	11.508
Visit Number >1	0.195	0.095	0.402
NEWS >0	0.007	0.001	0.049

Table 3: The classification accuracy of the decision tree

Sample	Observed	Predicted		
		No support needed	Support needed	Percent Correct
Training	No support needed	63	15	80.8%
	Support needed	12	95	88.8%
	Overall Percentage	40.5%	59.5%	85.4%
Test	No support needed	57	17	77.0%
	Support needed	13	102	88.7%
	Overall Percentage	37.0%	63.0%	84.1%

DISCUSSION

In Fy Nhaid (Welsh for ‘My Granddad’) project we intended to look at the patient's journey from admission to hospital to discharge home. We wanted to explore whether in our local setting smart screening can be used on admission to hospital to identify those patients likely to require support after discharge: Patients with normal physiology as evidenced by a NEWS value of zero who are either older than 80 years or frail might be a group of patients that require increased support after discharge.

The analysis was undertaken in a single geographic region with a specific set-up of services. Availability of other services outside the hospital might heavily influence referral patterns into hospital. Given that patients with normal physiology were the ones more likely to require support it is likely that hospital admission indicates a ‘cry for help’ that might be amenable to alternative interventions prior to admission.

At the time of the study there was no local ‘hospital at home’ or ‘Early Supported Discharge’ service operating (with the exception of a service for patients with an admission diagnosis of Chronic Obstructive Pulmonary Disease). We are therefore unsure how much our findings would be applicable to other areas in the UK or further afield.

Frailty has been used as a predicator of failed discharge and prolonged hospital stay(9). In the same vein there is research on the effects of frailty on patients cared for outside hospitals (10). Our work is attempting to bring learning from these areas together. There is now a need to formally assess whether our initial impressions are born out in prospective testing and can be implemented locally: a first prospective case series of 12 consecutive patients that fulfilled our criteria confirmed that all required support packages.

An additional question beyond the scope of this project would be whether the decision rules can be transplanted to a different setting to identify patients likely to require support on discharge. Our results require further testing for acceptability to staff and ease of introduction into routine practice. It remains to be shown that the algorithm can be translated into appropriate clinical care to bring the date of referral to intermediate and community services forward or to prevent admission to hospital altogether.

While our study has to be interpreted in the local setting we believe that the methodology and principles are likely to be applicable to the majority of European Hospitals.

REFERENCES

1. Subbe CP, Burford C, Le Jeune I, Masterton-Smith C, Ward D. Relationship between input and output in acute medicine - Secondary analysis of the Society for Acute Medicine's benchmarking audit 2013 (SAMBA '13). Clin Med J R Coll Physicians London. 2015;15(1):15–9.
2. Keller DS, Bankwitz B, Nobel T, Delaney CP. Using frailty to predict who will fail early discharge after laparoscopic colorectal surgery with an established recovery pathway. Dis Colon Rectum [Internet]. 2014;57(3):337–42.
3. Joosten E, Demuynck M, Detroyer E, Milisen K. Prevalence of frailty and its ability to predict in hospital delirium, falls, and 6-month mortality in hospitalized older patients. BMC Geriatr. 2014;14(1):1.
4. Subbe CP, Kellett J, Whitaker CJ, Jishi F, White A, Price S, Ward-Jones J, Hubbard RE, Eeles E WL. A pragmatic triage system to reduce length of stay in medical emergency admission: feasibility study and health economic analysis. Eur J Intern Med. 2014;25(9):815–20.
5. Rockwood K, Song X, MacKnight C, Bergman H, Hogan DB, McDowell I, et al. A global clinical measure of fitness and frailty in elderly people. CMAJ. 2005;173(5):489–95.
6. Kass G V. An Exploratory Technique Large Quantities Data of Categorical. Appl Stat. 1980.
7. Kellett J, Deane B. The Simple Clinical Score predicts mortality for 30 days after admission to an acute medical unit. QJM. 2006 Nov;99(11):771–81.
8. Jones M. NEWSDIG: The national early warning score development and implementation group. Clinical Medicine, Journal of the Royal College of Physicians of London. 2012. p. 501–3.
9. Nguyen TN, Cumming RG, Hilmer SN. The Impact of Frailty on Mortality, Length of Stay and Re-hospitalisation in Older Patients with Atrial Fibrillation. Hear Lung Circ [Internet]. 2016 Jun [cited 2017 Aug 12];25(6):551–7.
10. Lacas A, Rockwood K. Frailty in primary care: a review of its conceptualization and implications for practice. BMC Med [Internet]. 2012;10(1):4.