J R Coll Physicians Edinb 2018; 48: 108–13 | doi: 10.4997/JRCPE.2018.202 **PAPER**

Reliable consultant level data from an Acute Medical Unit: a powerful tool for improvement

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Abstract

The development of a novel database interrogating the patient management system in the Acute Medical Unit at Forth Valley Royal Hospital, Scotland, has allowed, for the first time, acquisition of reliable individual consultant-level process and outcome data over a 2-year period. These data have a number of uses, including understanding the level of variation between consultant physicians in AMU across key indicators, such as direct discharge percentage (67.5–44.3%), and readmission percentage (4.0–6.8%). Looking at overnight admissions only effectively excluded case mix as a confounder to identify variation in 30-day mortality (0–2.8%). This has allowed benchmarking, and exploring of relationships between volume of work, physician experience, and patient outcomes. For example, no significant relationship was seen between direct discharge percentage and readmission percentage. Furthermore it is extremely useful for individual clinician appraisal and governance. Finally it has practical uses when designing consultant rotas in order to minimise system variation. A key consideration throughout this work has been clear provenance and local clinical ownership of these data, unlike centrally generated data that may not accurately reflect Acute Medical Unit activity.

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Introduction

Use of individual consultant's outcome data, if done correctly, has the potential to improve care through benchmarking and identifying outliers. Data on individual surgeons' performance across 13 specialities in England has been available and published in the public domain since 2014[1] in an effort to drive quality, give patients the option to make an informed choice, and provide a national overview of surgical resource. However this has not been without controversy as some of these data have been taken out of context by the national media[2] and debate remains whether these analyses can genuinely identify outliers[3] or whether their publication encourages risk-averse behaviour.[4]

Undoubtedly analysis of individual consultant- and unit-level data has demonstrated outcomes for many procedures being better when carried out by higher volume centres and clinicians.[5,6]

Individual consultant-level outcome data are rarely available for medical specialities, in contrast to general and cardiothoracic surgeons. The exception is interventional cardiology which lends itself readily to this process and, as a result, outcome data have been published since December 2015.[1] There are many potential reasons for the lack of outcome data for other medical specialities. Inpatients may be looked after by more than one consultant during their admission, and variation between patient cohorts can make meaningful comparisons almost impossible. There are a myriad of other confounders, including variation in the patient journey. Extended stays in the emergency department, being boarded out due to medical bed pressures, and spending an extended period in hospital due to lack of availability of social care, might all impact on outcomes. Therefore the lack of transparency regarding outcomes for physicians is not due to lack of candour, but usually due to a lack of reliable data.

In common with most other medical specialities, consultant-level outcome data for acute medicine is not routinely available. However Acute Medical Units (AMUs) are generally well circumscribed, and the Royal College of Physicians of London[7] recommends that patients should be looked after by a single consultant while on the AMU, with any transfer of care being based on clinical need. In circumstances where this recommendation is met, a dataset of reliable consultant-level AMU outcome data, contingent on a robust electronic patient management system, is possible.

Forth Valley Royal Hospital (FVRH) is a large district general

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hospital in Larbert, central Scotland, serving a population of 300,000. It has a 54-bed mixed acute medical/surgical unit with an additional 16 assessment beds and ambulatory care area. Since December 2014, patients admitted under General Medicine (aged < 75) have been under the care of a single consultant physician from admission to transfer to a general medical ward or discharge. This model has allowed generation of reliable consultant-level data covering the acute admission period.

Methods

A consultant-level quality improvement file was developed using Microsoft Excel 2007. This software is widely used within NHS Forth Valley and therefore was the obvious choice of front-end tool to view data from the patient management system.

The quality improvement file was populated using Microsoft's Open Database Connectivity. This allows Excel to access different databases and retrieve the required data to Excel. In this instance it allowed the retrieval of data from NHS Forth Valley's Information Services Microsoft SQL Server. SQL is a special-purpose programming language designed for managing data held in a relational database management system, or for stream processing in a relational data stream management system.

NHS Forth Valley's Information Services Microsoft SQL Server contains all the required data tables from the eWard system, which clinical staff use as the patient/bed management system. It also contains other tables, including the list of deaths supplied by General Registry Office Scotland, which is updated weekly.

The actual indicators in the consultant-level quality improvement file were generated by stored procedures saved in the Information Services Microsoft SQL Server. A stored procedure is the SQL code which queries the database tables and is saved so it can be reused repeatedly. Stored procedures were used rather than the SQL code being held in Excel so that the quality improvement file had the ability to pass parameters to the stored procedure and return very specific indictor data, based on the user's requirements. For example, the indicators can be set to return data for specific specialties, days of the week, or times of the day, based on the parameters of interest the user enters into the Excel file front-end drop down list and check box options.

Indicators

The file provides the following data on a monthly basis for the AMU (Clinical Assessment Unit and Acute Admissions Unit) at FVRH by consultant. These data can be viewed by specific specialties, days of the week, times of the day, or age groups:

- **Total patients leaving AMU** = Number of patients exiting AMU either transferred to downstream ward or discharged home, by named consultant
- **Direct discharges** = Number of patients discharged home from AMU by named consultant/number of patients exiting AMU either transferred to downstream ward, or home, by named consultant
- **Readmission rate** = Number of patients discharged home from AMU by named consultant who were readmitted within 7 days of discharge/number of patients discharged home from AMU, by named consultant
- **Mortality rate** = Number of patients who died in AMU, or died within 30 days of being discharged home from AMU by named consultant/number of patients exiting AMU either transferred to downstream ward, or home, by named consultant

There is also a drill down table that provides a list of all the patients under a named consultant, with individual patient outcomes (readmission/mortality).

Results

Twenty-two substantive consultants were on the general medical receiving rota at FVRH from December 2014 to November 2016. Eighteen of these had a 'full' slot and 4 a 'partial slot' due to, for example, medical management responsibilities. During this time 21,570 patients were assessed in AMU under their care. These patients provide the database for these analyses (patients under the care of locum consultants or substantive consultants not on the rota for the full two years have been excluded).

Figure 1 shows the number of patients seen per consultant physician. Figure 2 shows the discharge percent per consultant physician. The letters allocated to each physician remain constant throughout the manuscript.

The AMU direct discharge percentage varied from 44.3–67.5%. However, there was some concern that this might reflect differences in case mix and consultant 'cherry-picking', subconsciously or otherwise. In order to eliminate the effect of case mix, we selected only patients admitted on weekdays after 8pm. These patients are the sole responsibility of the following day's on-call physician and therefore case mix should not be a factor over a 2-year period.

Once case mix is eliminated (by selecting weekday overnight admissions only), the variation between physician direct discharges remains similar (range 23.8–46.8%) although the percentage of patients discharged is lower. We were also interested in examining variability between medical subspecialties, which are segmented in Figure 3.

There was a long held belief that those physicians who discharged more patients were also likely to have more unplanned readmissions. We examined this by charting individual consultant discharge rate vs. 7-day unplanned readmission rate (Figure 4). The AMU operates an ambulatory care model but without reliable data capture of ambulatory care patients. This artificially inflates unplanned readmission rates. We excluded all patients readmitted to our assessment area within 24 h of discharge in an attempt to control for

Figure 1 Number of patients seen in AMU per consultant physician, Dec 2014–Nov 2016 (n = 21,570)

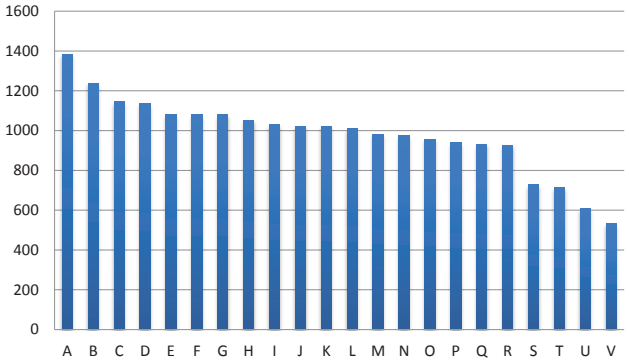


Figure 3 AMU direct discharge percent, per consultant physician, case mix eliminated, Dec 2014–Nov 2016 (n = 3774)

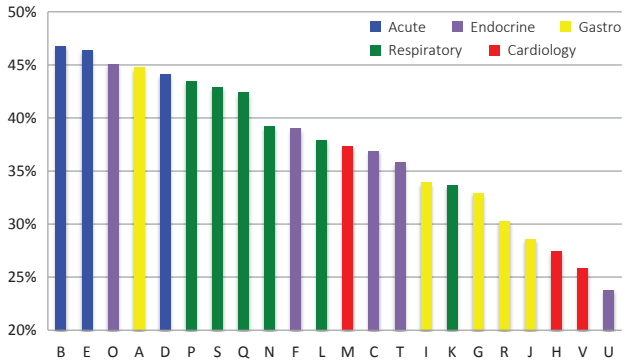


Figure 2 AMU direct discharge percent per consultant physician, Dec 2014–Nov 2016 (n = 21,570)

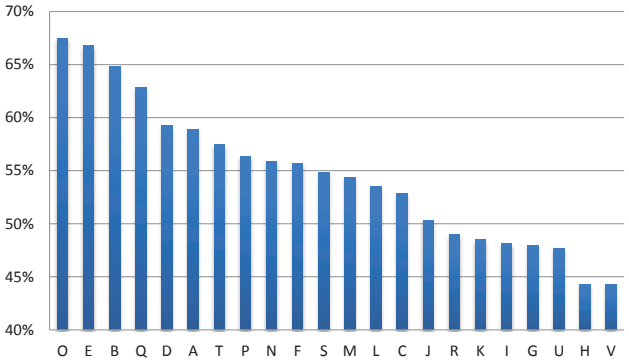
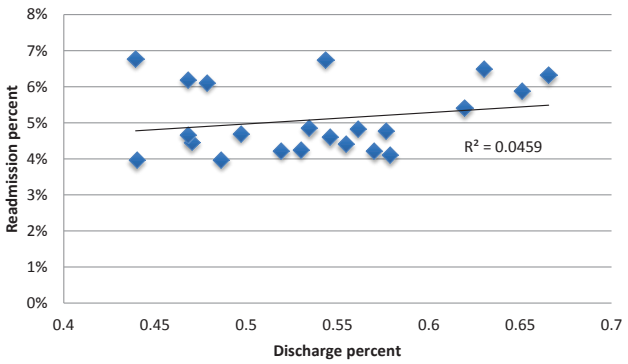


Figure 4 Discharge prevent vs. readmission percent (reattenders excluded) per consultant physician Nov 2016–Dec 2014 (n = 21,005)



this (case note review demonstrated > 90% of these to be planned re-attendances).

Finally we examined whether physician experience of the unselected general medical take (defined as number of years on the specialist register) was related to physician behaviour (discharge rate) or patient outcomes. The patient outcomes studies were readmission percent (excluding planned re-attendances) and 30 day AMU mortality (defined as death within AMU or within 30 days of discharge from AMU, but excluding in-hospital deaths following transfer from AMU). Using the case mix eliminated dataset (n = 3749 patients), no relationship was seen between physician experience and physician discharge rate (Appendix 1) or patient mortality (Appendix 2), but a weak inverse relationship was seen between physician experience and readmission rate with r^2 = 0.3 (Figure 5).

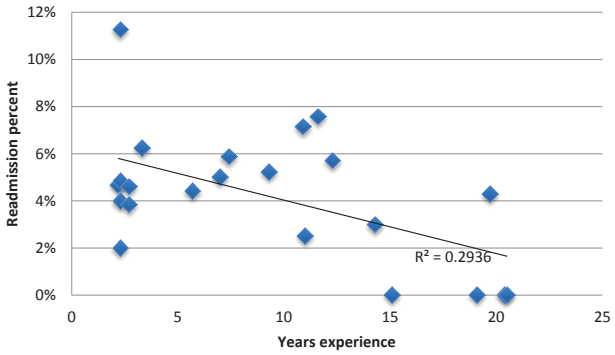
Discussion

The construction of a real time database to interrogate eWard, NHS Forth Valley's patient management system, coupled with the introduction of a general medical receiving rota based on consultant continuity of care, have allowed the generation of accurate consultant-level data reflecting acute medical receiving decision-making. The large number of patient contacts over the two years of data analysed for this paper appears to be robust and thereby provide the potential to develop hypotheses and examine drivers related to variation in outcomes in the behaviour of consultants on the medical receiving rota.

Other than those consultants having a partial slot on the general medical rota, workload was equitably distributed and there did not appear to be any correlation between number of patients seen in AMU and proportion discharged. Having said that, there was significant variation in the percentage of patients discharged directly from AMU by individual consultants. This is a poorly studied and understood area, which is largely devoid of data despite the fact that, since 2010, the Society for Acute Medicine clinical quality indicators have recommended that all AMUs should collect data on direct discharge rate and 7-day readmission rate. The recent Society for Acute Medicine Benchmarking audit, SAMBA2016[8] showed that the 7-day readmission rate across the 94 AMUs studied ranged from 0–30%, although it is not clear how these data were obtained and there is no discussion of consultant-level data.

One hypothesis put forward to explain the observed inter-consultant variation in discharge rate was that it may simply reflect case mix in that, after 5pm when two consultant physicians are on duty, some consultants may 'cherry pick' more straightforward cases to 'clear the floor' for overnight admissions but potentially leave the more complex cases (more likely to require admission) to their colleagues. Another suggestion was that the variation in discharges may have related to the method of daytime working employed by the

Figure 5 Physician experience vs. readmission percent, case mix eliminated, per consultant physician, Dec 2014–Nov 2016 (n = 3749)



acute medical consultants, whereby patients with simpler presentations would be prioritised given the likelihood of rapid turnaround and discharge. In order to eliminate these potential contributors to case mix we looked only at patients admitted after 8pm on weekdays. These patients are the sole responsibility of the following day's duty physician and, in simple terms, cannot be avoided or cherry-picked. The same level of inter-consultant variation in discharge percentages was evident in this cohort of patients, effectively eliminating case mix as a factor, increasing our confidence in the conclusions that can be drawn.

Interestingly there was significantly less variability in discharge percentages among geriatricians, under whom patients aged 75 or over are admitted (20.8–27.8%). However, unlike general medicine, patients aged > 75 in AMU for > 24 h are under the care of sequential geriatricians and therefore individualised data are too contaminated to allow any useful conclusions on variation in decision-making to be drawn.

Many factors contribute to individual clinicians' willingness to discharge patients from the AMU and analyses such as this risk over-simplifying a complex issue. Speciality training which has focused mainly on the approach to acute admission appears to have had some impact as the two consultants trained in Acute (Internal) Medicine had the highest discharge percentages (this excluded patients being managed through ambulatory emergency care). This finding suggests that an increase in the period of training focusing on appropriate decision-making in the period of the acute medical admission should be considered for medical registrar training as this may reduce variation and thereby improve pressures on patient flow and capacity. Another contributory factor might be the availability of clinic slots for follow-up (this could not be measured). Interestingly, there was no correlation between either volume of patients seen or physician experience, and propensity to discharge from AMU. It seems that the most likely explanation to account for the variation in practice is differing attitudes to risk. While this is poorly studied among physicians with regards to the acute medical take, variation in clinician risk tolerance is well studied.[9–11]

An unexpected finding was that patients admitted out-of-hours (8pm–8am) were less likely to be discharged directly from AMU than those admitted in-hours. Although there is evidence that patients admitted out-of-hours have higher 30-day mortality than those admitted in-hours,[12] we believe that this is the first time any association with lower discharge rates has been described. It seems likely that patients admitted out-of-hours might be 'sicker', a phenomenon which has been used to explain excess mortality observed in patients admitted at the weekend (the so-called weekend effect).[13]

We were relieved to see that there was no significant positive correlation between discharge rate and readmission rate (r^2 = 0.05). This included an imperfect proxy measure designed to exclude planned re-attenders (which will have also excluded some genuine readmissions but also missed planned re-attenders coming for more than one consecutive day). This finding surprised many, and understanding this requires consideration of the denominator (i.e. number of patients discharged home). If all consultants, for example, have an emergency readmission rate of 5% then, of 1000 patients, consultant O discharging 67.5% will have 34 readmissions compared to consultant V discharging 44.3% who has only 22. However consultant O has 641 patients remaining at home beyond 7 days, compared to consultant V who has 421. Clearly readmission rate is not the only valid balancing measure, but there was also no correlation between discharge rate and 30-day AMU mortality.

There were many advantages in using a database developed in-house. It allowed sufficient flexibility for new fields to be added within 24 hours. Additionally, eWard is widely considered to be highly (if not 100%) accurate within AMU and thus the provenance of the data was generally unquestioned. Additionally the data generated benefited from a 'clinical sense check' regarding validity. This is not necessarily the case with, for example, NSS Discovery,[14] a collaboration between Scottish NHS health boards, the Scottish Government and NHS National Services Scotland. This purports to provide consultant-level data but, in the case of NHS Forth Valley, draws its data from TOPAS (The Open Patient Administration System), a parallel in-patient management system which does not link directly with eWard. The data held on TOPAS do not accurately reflect AMU activity and therefore any consultant-level data generated from it are similarly flawed.

The database flexibility, and understanding our system, allowed segmentation of the data in order to eliminate case mix as a contributory factor in variation in physician behaviour. Using this smaller database (n = 3745 admissions) we examined whether physician experience (length of time on the specialist register) correlated with physician behaviour (direct discharge rate) or patient outcomes (30-day mortality and readmission rate). We did not find that length of time on the specialist register correlated with direct discharge rate, or 30-day mortality, but we did find a weak inverse relationship between length of time on the specialist register and patient readmission rate. The reasons behind this are not clear, but the following explanations have been suggested: more experienced clinicians are more thorough prior to discharge, and patients have greater trust in the decisions of these longer-serving consultants.

The usefulness of the database was not limited to provision of data at individual consultant level, but extended down to individual patient level. Each consultant physician can now, at any time, identify the CHI numbers of any patients discharged then readmitted within 7 days, or patients who have been discharged from AMU and died within 30 days of discharge. This is invaluable for morbidity and mortality meetings plus individual governance and appraisal.

It is crucial that these aggregated data are not misunderstood and misused in an effort to 'judge' clinicians. A high discharge rate does not equate to a good discharge rate, and likewise a low discharge rate is not bad. However it is very useful for allowing clinicians to understand where they operate within the spectrum of their colleagues, and to understand the overall level of variation within the system. Many lower discharging consultants (but not all) were surprised at this finding. Having transparency around these data may allow learning between colleagues, and although it is nonsensical to suggest that all clinicians can become 'above average' in terms of discharging, it may allow greater clustering around the mean. In practical terms we have already started using these data, pairing up weekend consultants to reduce variation, as having two low discharging consultants or two high discharging consultants on together is counter-productive.

Conclusion

The development of an in-house database, which provides accurate consultant-level data for AMU, has allowed us to better understand and define the clinical variability within our system. Consultants trained in Acute (Internal) Medicine discharged the greatest proportion of patients. There was no correlation between discharge rate and emergency readmission rate, although those consultants who had been on the specialist register the longest tended to have fewer readmissions. Individual consultant-level data on readmissions and 30-day mortality are available for governance and revalidation purposes, and can be used to reduce system variability when rota planning.

Acknowledgement

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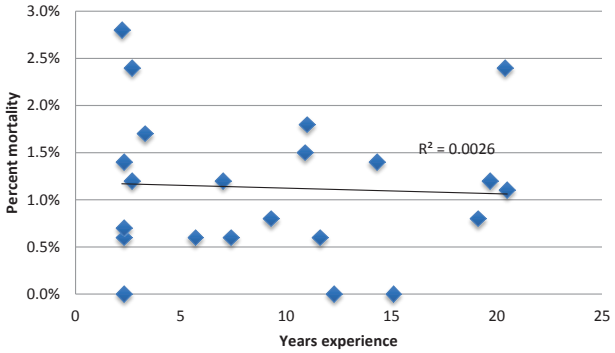
Appendix 1 Physician experience vs. mortality, case mix eliminated, per consultant physician, Dec 2014–Nov 2016 (n = 3749)



Appendix 2 Physician experience vs. discharge percent, case mix eliminated, per consultant physician, Dec 2014–Nov 2016 (n = 3749)