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Understanding ED performance after the implementation of activity-based funding.

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TITLE PAGE

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Understanding ED Performance in the context of Activity Based Funding

SUMMARY

Objective

The aim of this study was to describe emergency department (ED) activities and staffing after the introduction of activity-based funding (ABF) to highlight the challenges of new funding arrangements and their implementation.

Methods

A retrospective study of public hospital EDs in Queensland, Australia, was undertaken for 2013-2014. The ED and hospital characteristics are described to evaluate the alignment between activity and resourcing levels and their impact on performance.

Results

Twenty EDs participated (74% response rate). Weighted activity units (WAUs) and nursing staff varied based on hospital type and size. Larger hospital EDs had on average 9076 WAUs and 13 full time equivalent (FTE) nursing staff per 1000 WAUs; smaller EDs had on average 4587 WAUs and 10.3 FTE nursing staff per 1000 WAUs. Medical staff was relatively consistent (8.1-8.7 FTE per 1000 WAUs). The proportion of patients admitted, discharged, or transferred within 4 hours ranged from 73% to 79%. The ED medical and nursing staffing numbers did not correlate with the 4-hour performance.

Conclusion

Substantial variation exists across Queensland EDs when resourcing service delivery in an activity-based funding environment. Historical inequity persists in the staffing profiles for regional and outer metropolitan departments. The lack of association between resourcing and performance metrics provides opportunity for further investigation of efficient models of care.

Key words: Emergency department, Activity based funding, Medical workforce, Models of care, Nursing workforce

INTRODUCTION

Internationally, emergency departments (EDs) are getting busier. Within Australia, attendance numbers have increased from 5.7 million in 2008-2009 to 7.2 million in 2013-2014.[1, 2] There are well-recognised implications such as longer hospital length of stay and increased risk of in-hospital mortality, when patient admission from ED is delayed.[3, 4] The increased demand and pressure to meet time-based performance targets within the ED (ie, see, treat, admit, and/or discharge patients) have added another dimension for clinicians and managers already striving to deliver safe, high-quality healthcare for patients in a cost-efficient manner.[5-9] In Australia, soon after the introduction of the National Emergency Access Target (NEAT) (ie, the proportion of patients expected to be admitted, discharged, or transferred from EDs within 4 h of presentation),[10] there was a national move towards activity-based funding (ABF).[11]

The main rationale, from an international perspective, for the introduction of ABF is to make transparent the link between activity and funding, so that clinical complexity (ie, case-mix) is accounted for and not obscured in the same way as in capitated or global (ie, block funded) payment models.[12, 13] Whilst often discussed in the context of inpatient care, many European systems, including the UK, implemented ABF models to drive activity to improve access, reduce length of stay, and drive efficient service delivery.[13] The unintended consequence has driven volume, as “fee for service” is known to do, without having the safeguard of adequate outcome measurement in place. As payment systems change incrementally, there is a shift to value-based payment models, with improved outcome measurement, being implemented in the United States, for example, with “pay for performance,” “bundled payments,” and “performance incentivised global payment” structures.[12, 14]

A major component of the ABF model in Australia, including Queensland, is a National weighted activity unit (WAU), which measures health service activity expressed as a common unit, against which the national efficient price is paid.[15] It provides a way of comparing and valuing each public hospital service, whether it is an admission, ED presentation, or outpatient episode, by weighting it for its clinical complexity. For EDs, urgency-related groups provide a summary of the complexity and type of patients treated, based on triage category, admission disposition, and diagnostic grouping, whereas Diagnostic-Related Group classify admitted patient episodes of care, including short-stay unit (SSU) admissions.[16] This construct has many similarities with the UK “payment by

results” model, a form of ABF, although differs in that 3 levels for ED patients are described and are independent from admission or discharge disposition.[17]

Once implemented in Australia (in 2012), ABF provided an opportunity to reframe how emergency care may be delivered because it introduced the prospect that actual, rather than forecast, clinical service delivery adjusted for resource intensity could be allowed for in addition to funding being redistributed in a whole of system sense.[13, 18] With high fixed workforce costs (ie, salary and wages) and small marginal costs (ie, consumables, pathology, and radiology), ED budgets had been historically average cost based, aggregated, and capped[18] with adjustments calculated as the additional workforce (ie, inputs) required to meet rising demand. This is reflected in the considerable variation in how specific EDs value their available resources with many different models of care reported in the literature.[19]

In the face of ABF implementation, this study sought to understand whether Queensland's publicly funded EDs have adapted to the change by assessing the degree of variation in time-based performance, clinical productivity, and operational measures. The aim of this study is to provide a comprehensive description of ED activities associated with staffing profiles, treatment space, and NEAT performance in the context of ABF.

METHODS

A retrospective study of Queensland public hospital EDs activity in 2013-2014 was undertaken. All 27 Queensland public hospital EDs were invited to participate in this study. Data were collected via the following sources and techniques:

1. Emergency Department Information System (EDIS): Routinely collected and reported ED presentations and WAU data for 2013-2014 (generated from EDIS) were provided in summary form by a delegated representative from the Queensland Emergency Department Strategic Advisory Panel.
2. Survey: A questionnaire was developed by an expert panel to collect detailed information about the hospital and EDs' capacity, activities, staffing, and operational models of care pertaining to the 2013-2014 financial year. The ED Medical Directors and Nurse Unit Managers were initially invited to participate in writing, via email and telephone.

Data were analysed using descriptive statistics including measures of central tendency, such as median and interquartile range or mean and standard deviation (depending on data distribution) to describe the participating sites. Frequency distributions were used for categorical variables (eg, triage category and admission status). Pearson *r* and one-tailed significance levels were used to analyse the bivariate correlations between the number of staff and treatment spaces with NEAT. MS Excel and SPSS 21.0 were used to analyse data. Multisite ethics approvals were provided by health service and University Human Research Ethics Committees (HREC/12/QGC/189; QUT: 1300000701). A Participant Information and Consent sheet was provided to the participating hospitals. The return of the completed survey questionnaire was accepted as an indication of their consent to participate in the project.

RESULTS

Twenty of the 27 invited EDs participated in this study (Response Rate: 74%). Of note, the 2 tertiary children's hospitals merged during the study period, and another ED was redeveloped during the study period making them subsequently ineligible. Of the 20 participating EDs, 10% (*n* = 2) were located in outer regional areas, 35% (*n* = 7) in inner regional areas, and 55% (*n* = 11) in major cities, as defined by the Australian Institute of Health and Welfare (AIHW).[20]

Table 1 shows hospital information and selected ED characteristics of the participating hospitals based on their AIHW Peer Group classification in 2012-2013.[20] The number of ED presentations and activity by peer group varies considerably across the departments, ranging from 69495 to 83015, 28052 to 60259, and 22383 to 59431 ED presentations to Principal Referral EDs, Group A EDs, and Group B EDs, respectively. These presentations translated to ABF activity ranges of 7669 to 11869, 3610 to 8683, and 2151 to 6893 WAUs for Principal Referral EDs, Group A and Group B hospitals, respectively. Treatment spaces averaged 6.2, 5.2, and 4.1, per 1000 WAU. Staff productivity-defined as full-time equivalent (FTE) staff undertaking 1000 WAU-was 8.7, 8.1, and 8.7 FTE/1000WAU medical staff and 13.0, 10.8, and 10.4 of nursing FTE per 1000 WAU, for Principal Referral, Group A and Group B hospitals, respectively. The absolute number of weighted activity units undertaken by individual medical and nursing staff for 2013/14 shows considerable variation within and between peer groups and is shown in Figure 1.

[Table 1 about here]

[Figure 1 about here]

Table 2 summarises presentations by triage category, paediatric vs. adult, ambulance arrivals and admissions to wards or SSUs. High acuity presentations (ATS 1-2) comprised about 12% of all ED presentations and were higher in the Principal Referral hospital group. Most ED workload (82%) was ATS 3 and 4 patients with some intergroup variability. Ambulance arrivals ranged from 24% to 34% as hospitals increased in size. Paediatric presentations comprised 1 in 5 ED attendances across the State. Admission rate to the SSU varied by peer group, acknowledging that three facilities did not have a SSU (2 in Group A and 1 in B). Admission rate to wards was similar between Principal Referral and Group A hospitals (22%) but much lower (13%) in Group B hospitals.

[Table 2 about here]

NEAT and Did Not Wait (DNW) outcome data are presented by peer group in Table 3. Overall NEAT ranged from 73% to 79% (against an 80% target at the time). Admitted NEAT (composed of inpatient and SSU NEAT) ranged from 51% to 59% and was higher in B hospitals. Non-admitted NEAT ranged from 84% to 88% and was higher in Group B hospitals. DNW rates ranged from an average of 2.4% (Group A) to 4.4% (Group B).

[Table 3 about here]

Associations between number of staff and treatment spaces with NEAT

Ratios of medical staff, per 1000 WAUs, when correlated with admitted and non-admitted NEAT, by peer group, were not positively correlated. For admitted NEAT, more medical staff as a single variable did not improve NEAT; there was a moderate negative correlation for overall medical staff ($R = -0.44$, $p = 0.027$), senior and specialist staff ($R = -0.38$, $p = 0.048$), and registrar/PHO level staff ($R = -0.46$, $p = 0.02$). There was no statistically significant association with the non-admitted NEAT. Ratios of nursing staff, per 1000 WAUs, with admitted and non-admitted NEAT, by peer group, revealed only weak and no statistically significant correlation between the variables.

DISCUSSION

Activity-based funding has the potential to couple clinical activity to funding, to achieve a more equitable distribution of funds that could have a normative effect on resourcing of departments in any given jurisdiction. At the time of data collection, there remained wide variability in the resourcing (ie, nursing and medical FTE/1000 WAU) and distribution of that resourcing within and across peer group hospitals. Furthermore, activity-based staffing profiles did not positively correlate with NEAT performance, emphasising NEAT as a whole of hospital target. As historical funding allocations have been carried forward, it is clear that there has not been adequate rebasing of budgets, across the system, to align with the potential revenue available under ABF.

One of the limitations of ABF itself, in an ED context, is the disconnect between the fact that patient care is delivered episodically, which should allow for bottom up, patient level costing to accurately reflect the cost structure of such departments, but those budgets have been delivered in a top down fashion.[13] Price setting is formed on the basis of WAUs, standardised measures of activity, attached to a national efficient price, and delivered as urgency-related groups (based on triage category, disposition, and body system). The historical basis for resourcing EDs based on the input model of full time equivalent staff and specified budgets did not appear to translate in the ABF environment, as considerable variation exists in reported staff workloads, using FTE/1000 WAUs, across the State. Potential explanations for this include that budgets were based on forecast and not actual activity or that the ABF has not adequately accounted for supplementary payments for additional patient demand or complex patient cohorts.[13]

Simplistically, it could be argued that the same type of staff member working in any ED, should expect to undertake a similar amount of activity on a per person basis, assuming scope of practice is the same. Within and between peer group variation exists, and optimal staffing levels cannot be determined based on NEAT performance alone in the ABF context. The Australasian College for Emergency Medicine (ACEM) provides guidance on constructing an ED workforce but still bases this on numbers of presentations, not weighted activity.[21] Geographically, regional and outer metropolitan hospitals fare worse in this regard, according to our survey results, and represent a challenge for those departments moving forward. Contribution to nonservice delivery activities such as education, training, and research, and the legacy effect of staffing profiles pre-ABF would account for at least some of the variation and requires

further funding, development, and investment to meet the ACEM Quality Framework standards.[22]

Empirical evaluations of ABF implementation are scarce,[13] and this is compounded by the complexity of a system that was simultaneously transitioning from a centralised health department to a federated model of statutory health services. Other changes included the introduction of NEAT and local State-wide clinical redesign investments including a Short Stay Unit Guideline and Implementation Standard [23] (restricting allowable SSU to inpatient ward admission conversion rate to <15%) and an Inpatient Admission Facilitation Protocol [24] (promoting a 2-h referral time from ED to inpatient teams and direct admission processes if inpatient review was delayed).

The impact of ABF implementation may be considered in the context of existing ED profiles and crude activity, ED weighted activity, the ED-inpatient interface, and ED performance:

ED profile and crude activity

In general, hospital size and degree of specialisation were reflected in acuity (ie, ATS), admission rates, and proportion of ambulance arrivals. The proportion of ATS Categories 1 to 3 patients increased, whilst the proportion of Categories 4 and 5 patients decreased as hospitals increased in size. The Queensland triage profile for ED presentations are overall consistent with national data.[2] Whilst the overall admission rates are consistent with the national average of 29.5%,[2] the larger hospitals had higher admission rates than the smaller hospitals. Ambulance arrivals were higher than the national average of 24%, with larger hospitals having a higher proportion of ambulance presentations.

EDs and weighted activity

If viewing NEAT performance in isolation, our data would suggest tertiary departments underperform on NEAT compared to their Groups A and B counterparts. However, this is a complex set of interactions where activity (under the current system) tends to only be thought of as clinical activity by administrators. Teaching and research endeavours are not counted within the construct of weighted activity and add to the demands placed on departmental clinical staff. Even though we do not know the optimal workload for a given clinician, we do see clear examples from our research, particularly those within Group B, where clinical workloads appear much higher for nurses and all levels of medical staff. By extension, where workloads are high, additional consideration needs to be given to supporting clinical activity, clinical support roles, and training requirements.

ED-inpatient interface

The number of funded inpatient beds for total ED treatment spaces was, on average, 13:1 for Principal Referral, 8.5:1 for Group A, and 8.1:1 for Group B hospitals. This is commensurate with a noted increase in the number and complexity of specialist inpatient services in each Peer Group. Whilst average NEAT performance for admitted patients (inclusive of SSU admissions), in all hospital cohorts was consistently between 50% and 60%, smaller less complex hospitals (Group B) tended to perform better on this metric with intragroup variations. The SSU admissions remain within the scope of influence of the ED clinical team [21] and, in our study, may have had an effect on the overall admitted NEAT, masking the inpatient team contribution to NEAT, which remained low for the surveyed hospitals.

Despite efforts to improve NEAT, not all available hospital beds were funded and open in the surveyed hospitals. Whilst outside the scope of this discussion, the reasons for having unfunded beds include macro level funding considerations, workforce availability, and opportunity costs associated with funding alternative services. In addition, the subspecialist elective surgical admission and interhospital transfer burden in Principal referral hospitals impact upon available inpatient beds for emergency admissions. Elective to emergency admissions in those hospitals were 3.27:1 compared to 0.74:1 in Group A and 0.91:1 in Group B hospitals.

ED performance

Considering the lack of association between resourcing and performance metrics such as NEAT, DNW rates, and unplanned representations, it is difficult to make recommendations about ABF allocations without further analysis of the impact on efficiency. The characteristics of the more conspicuous outliers may provide clues as to the particular models of care or local circumstances that contribute to under- or over-achievement in this regard. For example, one principal referral hospital had the worst admitted NEAT compliance of its peer group despite comparatively high levels of resourcing, whereas another in Group A achieved the second highest result in its class despite having relatively less FTE per 1000 WAU. Further details are required to address these discrepancies and to provide recommendations in relation to effective application of funding.

Limitations

The aggregation of data as presented here may detract from individual departmental circumstances and lead to some generalisations of interpretation. The variability shown in input factors such as treatment spaces and staffing numbers has not been linked to an efficiency

measure defined as the cost in dollar terms for every WAU delivered as these data were not available at a departmental level. The surveyed activity data presented are actual activity and not funded activity, so it is likely that unfunded activity has been captured. Results need to be interpreted with this in mind. The survey reported process measures only, as a detailed analysis of safety and quality data (for example, patient experience, patient complaints, incident reports, or medication error rates) was not undertaken as part of the questionnaire. Furthermore, departmental level data on teaching, training, and research were not captured. And finally, not all EDs participated in the survey weakening the generalizability of the findings; nevertheless, the 20 participating hospitals represented 3 quarters of the attendances (70% in Principal Referral, 83% in Group A, and 62% in B) for Queensland in 2013-2014.[2, 25] Particularly the exclusion of the metropolitan Children's hospital may influence data in regard to children.

CONCLUSION

This evaluation reveals substantial variation across Queensland EDs when resourcing service delivery in an ABF environment. Historical inequity persists in the staffing profiles for regional and outer metropolitan departments whilst principal referral facilities deal more so with high competing demands for inpatient beds from elective patients. The lack of association between resourcing and performance metrics provides opportunity for further investigation of efficient models of care, with particular attention to: the lack of transparent and readily available cost/WAU data, the mismatch between actual and funded activity, scope for quantifying complexity adjusted workload and productivity, the alignment of models of care to acuity and complexity considerations, and 24 hour staffing profiles that optimise scheduling for demand/capacity matching.

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Table 1: Characteristics of participating hospitals and emergency departments

	Principal Referral n = 4	Group A n = 11	Group B n = 5	All Hospitals n = 20
	Mean (\pmSD)	Mean (\pmSD)	Mean (\pmSD)	Mean (\pmSD)
Hospital characteristics				
<i>No. of inpatient beds:</i>				
Total	778 (\pm 198)	269 (\pm 131)	162 (\pm 116)	337 (\pm 258)
Currently funded	647 (\pm 145)	255 (\pm 123)	147 (\pm 121)	292 (\pm 211)
<i>Average weekly admissions:</i>				
Overnight: Elective	3569 (\pm 7304)	203 (\pm 68)	91 (\pm 95)	1396 (\pm 4051)
Overnight: Emergency	1090 (\pm 1279)	271 (\pm 116)	100 (\pm 95)	432 (\pm 4051)
Overnight: Interhospital transfers	562 (\pm 1152)	28 (\pm 27)	46 (\pm 45)	186 (\pm 562)
Day only admissions	727 (\pm 244)	345 (\pm 270)	148 (\pm 56)	382 (\pm 295)
No. of specialist inpatient services	31 (\pm 6)	22 (\pm 7)	7 (\pm 3)	20 (\pm 10)
ED characteristics				
<i>ED treatment spaces:</i>				
Total	55 (\pm 12)	30 (\pm 8)	18 (\pm 6)	31 (\pm 15)
Spaces/1000 WAU	6.2 (\pm 1.1)	5.2 (\pm 1.1)	4.1 (\pm 0.6)	5.1 (\pm 1.1)
<i>ED presentations:</i>				
Total (\pm SD)	75 229 (\pm 5602)	48 645 (\pm 7386)	38 794 (\pm 15456)	51 499 (\pm 15 802)
ED activity (WAU)	9076 (\pm 1895)	5682 (\pm 1551)	4587 (\pm 2055)	6087 (\pm 2300)
<i>ED staff:</i>				
Medical/1000 WAU	8.7 (\pm 1.4)	8.1 (\pm 1.6)	8.7 (\pm 6.6)	8.3 (\pm 3.3)
Nursing/1000 WAU	13 (\pm 0.6)	10.8 (\pm 3.6)	10.4 (\pm 1.9)	11.2 (\pm 2.9)

Source: Survey data.

Principal referral: Public acute hospitals that provide a very broad range of services have a range of highly specialised service units and have very large patient volumes. Group A: Hospitals that provide a wide range of services typically including a 24-hour emergency department, intensive care unit, coronary care unit, and oncology unit but do not provide the breadth of services provided by Principal referral hospitals. Group B: Hospitals that do not have the service profile of the Principal referral and Group A hospitals but do have a 24-hour emergency department; they typically provide elective surgery and have specialised service units such as obstetric, paediatric, and psychiatric unit.²⁶

Abbreviations: ED, emergency department; SD, standard deviation; WAU, weighted activity unit.

Table 2 Presentations to the participating emergency departments by peer group

Peer Group	Principal Referral n = 4	Group A n = 11	Group B n = 5	All Hospitals n = 20
ED presentations	Mean (\pmSD)	Mean (\pmSD)	Mean (\pmSD)	Mean (\pmSD)
% of ATS Cat 1	1.0 (\pm 0.4)	0.5 (\pm 0.4)	0.5 (\pm 0.4)	0.6 (\pm 0.4)
% of ATS Cat 2	13.1 (\pm 2.4)	11.4 (\pm 3.3)	9.8 (\pm 3.1)	11.3 (\pm 3.2)
% of ATS Cat 3	44.7 (\pm 6.4)	40.7 (\pm 4.7)	36.3 (\pm 11.1)	40.4 (\pm 7.2)
% of ATS Cat 4	35.6 (\pm 7.8)	42.2 (\pm 7.4)	44.8 (\pm 9.0)	41.5 (\pm 8.1)
% of ATS Cat 5	5.6 (\pm 4.1)	4.6 (\pm 1.6)	7.3 (\pm 4.5)	5.5 (\pm 3.1)
% of Paediatric (<14 yr)	15.9 (\pm 10.7)	18.2 (\pm 4.1)	21.1 (\pm 1.2)	18.5 (\pm 5.6)
% Admitted to SSU	12.6 (\pm 2.9)	9.6 (\pm 6.3)	7.6 (\pm 6.1)	9.7 (\pm 5.8)
% Admitted to ward	21.8 (\pm 3.6)	21.7 (\pm 6.2)	13.4 (\pm 6.2)	19.5 (\pm 6.6)
% Brought in by ambulance	34.2 (\pm 6.9)	30.7 (\pm 6.3)	24.1 (\pm 7.6)	29.7 (\pm 7.4)

Source: Survey data

Abbreviations: ED, emergency department; SD, standard deviation; SSU, short-stay unit.

Table 3 Performance indicators of ED activities by peer group

Peer Group	Principal referral	Public acute (Group A)	Public acute (Group B)	All hospitals
ED Performance				
Total presentations (n) *	300917	535101	193969	1029987
	Mean (±SD)	Mean (±SD)	Mean (±SD)	Mean (±SD)
Total NEAT % *	73.3 (4.7)	76.4 (6.3)	79.2 (7.6)	76.0 (6.6)
<i>Admitted NEAT % *</i>	51.3 (3.6)	53.0 (14.0)	59.5 (17.6)	53.3 (12.9)
<i>Non-admitted NEAT % *</i>	84.5 (7.0)	87.5 (3.9)	88.3 (5.8)	86.8 (5.4)
Did not wait % *	3.9 (3.2)	2.4 (1.3)	4.4 (1.3)	3.2 (2.0)
Represented<48 hrs % †	5.8 (2.0)	6.4 (1.5)	5.3 (1.2)	6.0 (1.5)

Source:

*Annual ED Report data.

†CARU data.

Denominator (i.e. All Presentations) excludes “Patient in transit,” “Dead on arrival,” “Admitted to hospital,” “Referred to other hospital” and “Died in Emergency.”

Abbreviation: NEAT, national emergency access target.

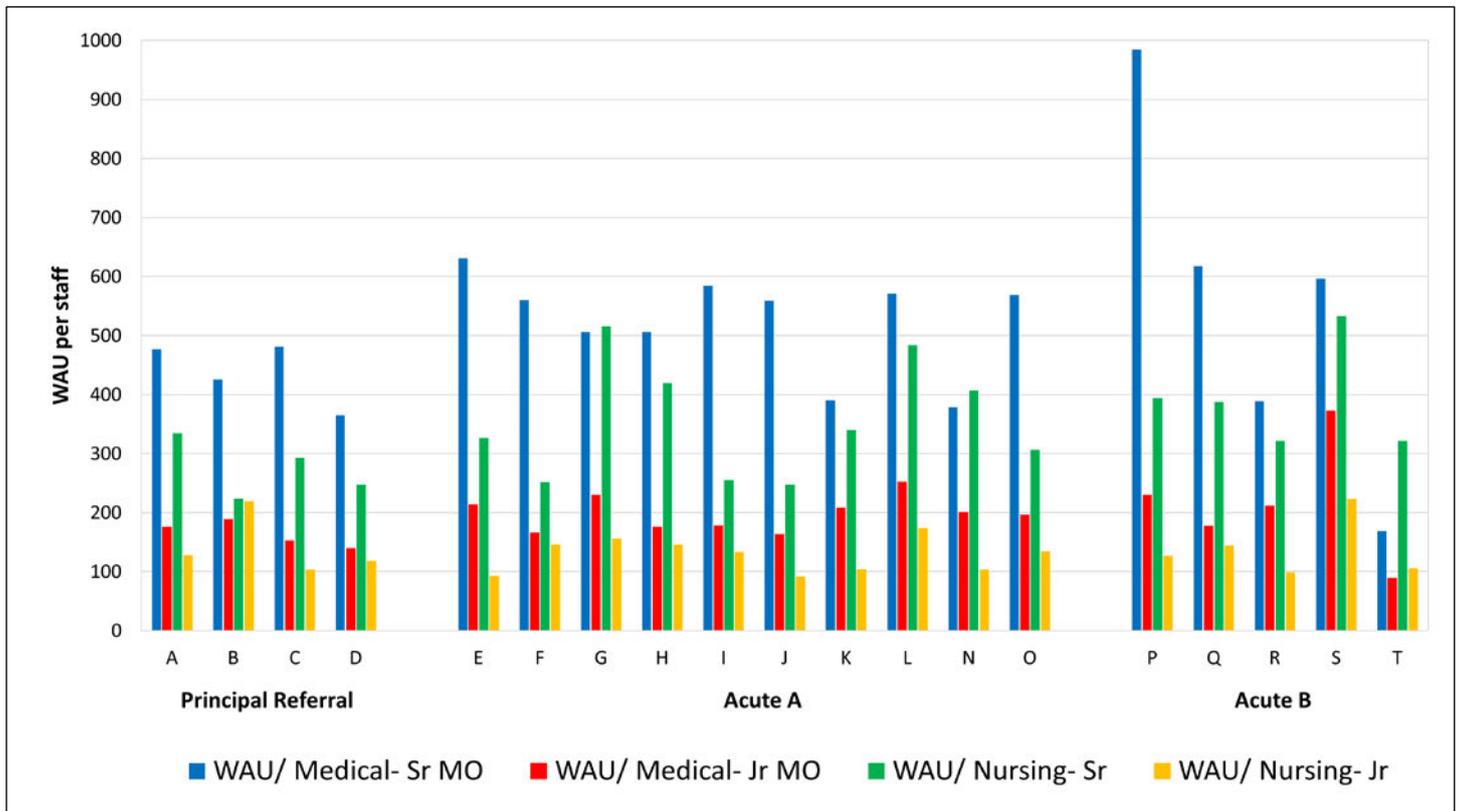


Figure 1 Amount of weighted activity undertaken by medical and nursing staff