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Time Study in an Emergency Department of a Tertiary Care Teaching Hospital

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Abstract

A reliable emergency department (ED) workload measurement tool would provide a method of quantifying clinical productivity for performance evaluation and physician incentive programs; it would enable health administrators to measure ED outputs; and it could provide the basis for an equitable formula to estimate ED physician staffing requirements.

Objective: Our objectives were to identify predictors that correlate with physician time needed to treat patients.

Methods: During 30 days, evening, night and weekend shifts, researcher shadowed emergency physician, documenting time spent performing clinical and non-clinical functions for 585 patient visits. The recorded key predictors included patient gender, age, vital signs and Glasgow Coma Scale (GCS) score, and the mode of arrival, triage level assigned, comorbidity and procedures performed.

Results: The strongest predictor variables were: procedure required, triage level, arrival by ambulance, GCS, age, any comorbidity, and number of prior visits. Conclusions: This study clarifies important determinants of emergency physician workload.

Keywords: Emergency Department; Workload

Introduction

In 2003, the British Columbia Ministry of Health devised a simple emergency department (ED) staffing model, allocating one physician full time equivalent (FTE) per 3000 patients for "high acuity" departments and 1 FTE per 3500 patients in "moderate acuity" departments. In similar fashion, the British Association for Emergency Medicine has proposed a simple formula for estimating ED workforce requirements, defining one workload unit as 3000 patients per physician per year, with adjustments based on whether the cases are "normal, heavy or minor."1 While patient volume is the primary determinant of physician workload, case mix and complexity are also important, and neither model specifies the factors that define heavier workload. Several authors noted that ambulance patients, referred patients, mental health patients and older patients reflect a more demanding case mix that requires more emergency physician (EP) time per patient [1-4].

Workload is also influenced by socio-demographic factors, site-specific ED processes and available resources (e.g., stretchers, nursing staff), and it is clearly related to procedural requirements, administrative duties, parallel expectations for teaching, documentation and communication with patients, physicians and families [2,3]. We were unable to find any published literature quantifying the impact of complexity factors on ED workload and time needed to provide physician-related services. In the absence of such information, Britain's National Healthcare System quantifies

ED physician workload by dividing the number of emergency visits per annum by the number of doctors [5]. The British Association for Emergency Medicine document1 suggests an ED with "average" case mix has an admission rate of 15%–20%, with 25% paediatric cases and 50% adult "minor" cases.1 It is tempting to use triage levels as a measure of workload, but triage levels reflect acuity-not complexity-and inter department triage reliability is uncertain and has not been studied [5,7]. In addition, if triage levels are allowed to determine remuneration, gaming may cause triage creep, which will generate unrealistic staffing levels and invalidate important triage and case mix information. A valid ED workload measurement tool would facilitate ED and physician productivity assessment, and could form the basis for an equitable method of estimating physician staffing needs.

Objective

Our objectives were to identify predictors that correlate with physician time needed to treat patients.

Methods

Study Design

A prospective cohort study was conducted in the Emergency Department.

Study Procedures

A researcher was oriented to the clinical and non-clinical tasks of an Emergency physician. The Researcher was aware the study was a time analysis of EP activity. During each study shift, the Researcher shadowed the attending physician for the duration of the shift and measured, with a stopwatch, the time (to the nearest 15 seconds) that the physician spent performing all clinical and non-clinical duties. Using structured data collection forms specific to each individual patient treated, the Researcher recorded predictor and outcome variables, and EPs documented comorbidity variables for every patient treated.

Outcome variable: The primary outcome variable was total physician-time involved in caring for each patient. Secondary outcome variables included the amount of physician time (per patient) spent on the following activities: history and physical exam, charting and documentation, test ordering, communications (with nurses, referring and consulting physicians, other health professionals and families), reviewing charts and test results, performing procedures, direct bedside care, looking up clinical references, teaching students or residents, and other duties (non-physician functions, problem-solving and phone calls). Key patient and utilization outcomes, including time to physician assessment, consultation and lengths of stay were also tracked.

Statistical analysis Data were collated and entered into an Excel spread sheet Statistical analyses were performed using Statistical and SAS statistical software. Descriptive statistics, including means, medians and standard deviations were determined where appropriate.

Results and Discussion

This prospective cohort study documented actual physician time spent per patient in a large study cohort during a representative sample of ED shifts. It identified the strongest determinants of EP workload (defined as time spent per patient visit). The strength of these findings is bolstered by the detailed prospective data collection; by the inclusion of representative shifts, consecutive emergency patients and every ED physician working during the study period; by the precise time tracking and analysis of many candidate predictor variables; and by the 2-step validation process used.

Productivity measurement and manpower estimation Emergency physician remuneration is increasingly based on alternate payment plans that specify physician compensation levels and the expected number of working hours per annum. In the face of competing demands from multiple emergency groups, health funders need equitable, transparent allocation models and also need to assure value for their investment. Patient volume is the default productivity measure, but volume alone does not predict workload or manpower needs, a fact that is increasingly apparent as ED case mixes become more complex. Our premise is that "time needed to provide necessary service" is the key measure of workload-particularly when discussing ED staffing models. In designing the study, we included clinical, administrative, educational and supervisory functions in our model development because all of these are components of workload [1,12]. In 1990, Graff described the need for multivariable complexity assessment and found that a workload formula incorporating volume, patient length of stay, service intensity and service type more accurately estimated the amount of time EPs spent with patients than a volume alone formula.8,13 Previous authors have noted that mental and physical effort, difficulty, urgency and psychological stress are also important factors [4,8-14].These are less objective and more difficult to quantify, and we did not incorporate them in our methodology. A practical workload measurement tool The key predictors retained in the proposed workload formula, including age, gender, arrival mode, number of previous visits, and CTAS level are already captured in most EDs. Glasgow Coma Scale score can be recorded at triage and incorporated in the ED triage database, and procedures performed are often part of "shadow billing" requirements for contract EDs. This makes automatic electronic workload scoring feasible for each patient visit, and for the ED as a whole. Tracking

quantitative workload over time in this manner allows ED directors to more precisely tailor shifting patterns to clinical need. Common data capture mechanisms between hospitals would enable benchmarking and inter-site productivity comparison.

Physician evaluation and incentive systems given an established level of physician staffing, increased physician productivity correlates with increased throughput and reduced patient waiting times. To enhance productivity and achieve these objectives, physician incentive programs are increasingly being described in the quality literature and implemented in various medical disciplines. Increased productivity is desirable; however excessively rapid throughput may be associated with medical error, compromised patient-physician interaction, adverse outcomes and patient dissatisfaction; hence the American College of Emergency Physicians established maximum productivity benchmark of 2.5 patients per EP per hour [15-17]. Effective incentive systems will increase physician efficiency without jeopardizing other important outcomes, but tracking physician performance and managing incentive programs will depend on the ability to measure workload and productivity in a meaningful way. ED manpower estimation the model derived in this study is one possible workload measurement tool that could be used to compare the relative productivity of 2 EDs or 2 EPs but, because of ED patient arrival variability, it cannot be used as an ED staffing formula. To illustrate, many departments have low volume periods (e.g., nights) which, according to the formula, would justify less than a complete EP. Regrettably, EPs come only in integer values, and one is the usual minimum staffing level. Similarly, in using data from this study to determine staffing needs during higher volume periods (e.g., evenings) it might be tempting to conclude, based on the ~20 minute average TPPV in this sample, that 1 physician could see 24 patients in an 8-hour (480 min) shift, with little or no waiting time. Funding agencies may logically be tempted to multiply the average TPPV by the annual ED census to determine the total number of annual physician hours (and physician FTEs) required. Such a staffing mechanism would enable timely physician assessment for patients-but only if the physician worked continuously, if all arriving patients were of the same (average) complexity, and if there was a constant 19.7-min time interval between each patient registration. In reality, there is wide variability in ED patient arrival rate and complexity. Clearly, if several high acuity patients arrive within minutes of each other, more than one physician is required to provide timely medical response to all of them; hence it is necessary to fund physician "overcapacity" to deal with high volume/high complexity inflow periods. Consequently, if a formula like the one proposed here is used to estimate overall department workload and staffing needs, a correction factor (multiplier) is required to address variability-related concerns. The required degree of physician "overcapacity" will depend mainly on the level of input variability (which can be described using basic data available in most EDs) and on the tolerance for how many arriving patients can be allowed to wait, and for how long. High input variability and high expectations for physician timeliness (e.g., 90% of Emergent and Urgent patients seen within CTAS time frames) will lead to a relatively large "overcapacity correction factor" and a need for more funded EPs. Less extreme input variability and lower expectations for prompt service would generate a lower "overcapacity correction factor" and fewer funded EPs. These concepts illustrate how less urgent patients can actually enhance ED efficiency and cost-effectiveness by providing a buffer of patients who can safely be queued for longer time periods. Statistical considerations this study is based on the use of linear regression for the prediction of total physician TPPV. It may be that the relationship of certain variables with physician time is not linear. For example, age may have a "U-shaped" association with physician time, such that the very young and the very old require more physician time. We investigated this possibility for all of the continuous variables by including higher-order polynomial equations during the model development phase, but these did not improve the predictive ability, so they were excluded from the final models. However, we had few young children and infants in our sample, so these data should not be extrapolated to settings that see a large proportion of children. The clinical relevance of R2 in this study is 2-fold. First, it represents the proportion of variance in total physician time that is explained by the predictor variables. In the biologic and social sciences, an R2 value of 0.3 (30%) is clinically important, and is considered to represent a moderate amount of variance.9 Cross-validation R2 shrinkage-difference in the amount of variation in the dependent variable (physician time) that is explained by the same model in a different set of patients — is important because it reflects the stability (or reliability) of the model when tested in a new sample. The shrinkage R2 between these 2 samples was about 10% of the total variation explained by this model. Shrinkage values less than 20% indicate a reliable model.

Conclusion

This prospective study clarifies important determinants of EP workload. An evidence-based workload estimation tool like that described here could facilitate ED productivity measurement, benchmarking, physician performance evaluation, and provide the substrate for an equitable formula to estimate ED physician staffing requirements.

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