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PATIENT CHARACTERISTICS ASSOCIATED WITH LONGER EMERGENCY DEPARTMENT STAY: A LITERATURE REVIEW - 2019

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Abstract:

Prolonged emergency department (ED) stays make a disproportionate contribution to ED overcrowding, but the factors associated with longer stays have not been systematically reviewed. Objective: To identify the patient characteristics associated with ED length of stay (LOS) and ascertain whether a predictive model existed. Methods This rapid systematic review included published, English-language studies that assessed at least one patient-level predictor of ED LOS (defined as a continuous or dichotomous variable) in an adult or mixed adult/pediatric population within an Organization for Economic Cooperation and Development country. Findings were synthesized narratively. We identified 35 relevant studies; most included multiple predictors, but none developed a predictive model. The factors most commonly associated with long ED LOS were need for admission (10 of 10 studies) and older age (which may be a proxy for age-related differences in health condition and severity; 9 of 10), receipt of diagnostic tests or consults (8 of 8) and ambulance arrival (4 of 5). Acuity often showed a bell-shaped relationship with LOS (ie, patients with moderate acuity stayed longest).

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INTRODUCTION:

The pervasive problem of emergency department (ED) overcrowding has prompted efforts to better understand the drivers of ED usage. There are two types of potentially conservable usage: potentially preventable visits (frequent visits, non-urgent visits) and potentially reducible visit duration. Many studies and two recent systematic reviews have focused on the former, noting that preventable visits may worsen ED congestion by increasing patient volumes [1,2]. However, evidence suggests that it is not frequent or non-urgent but lengthy visits that make the greatest contribution to ED congestion; [3,4] therefore, it is at least equally important to examine the determinants of protracted ED length of stay (LOS).

Upon discovering that the literature in this area had not previously been reviewed, we conducted a systematic review of the patient characteristics that predict long(er) ED LOS. This work was undertaken to inform the development of our health region's patient flow strategy. This region compared unfavorably with its peers on ED LOS and had yet to make progress towards patient flow targets for which its Board had set a 2015 deadline.

Our primary stakeholders were managers of the Emergency Program, who wished to identify priorities for using the extensive data collected on ED visits. Having collaboratively identified ED LOS as a priority outcome, we needed to discover what was already known about its determinants, whether there existed a predictive model we could use and if not, what variables should be included in developing such a model. Predictive models can be used by health professionals to flag patients who may require special attention or expedited linkage to other services to avoid a protracted stay; they may also enable real-time forecasting of the requisite level of ED resources.

Modelling may also help planners identify high-risk populations who may benefit from targeted interventions or increased availability of certain services outside the ED. Our stakeholders were particularly interested in the determinants of extremely long stays (>24 h); the region had committed itself to eliminating these, but the prevailing rate hovered around 7%.

METHODOLOGY:

Given the urgency of moving forward, it was important to provide evidence to stakeholders within 4 months; therefore, we undertook a rapid review, a type of systematic review in which certain activities are streamlined or eliminated in the interests of speed [5]. When developing our protocol, we made several methodological choices to ensure prompt completion: restricting the search to one database, having certain tasks performed by one rather than two reviewers, and using narrative rather than quantitative synthesis. This article presents an updated version of the review (search update conducted December 2018); we note, however, that the nine articles added during the update did not alter the original conclusions. The protocol was not registered but is available from the authors. Inclusion/exclusion criteria were as follows:

- Population: Adult or mixed adult–paediatric patient populations (not paediatric-only) in countries belonging to the Organization for Economic Cooperation and Development (OECD).
- Outcomes: ED LOS, defined as either a continuous or a dichotomous variable (ie, ED LOS in minutes/hours or ED LOS >cut-off point).
- Predictors: At least one patient characteristic; studies that assessed only non-patient-level factors (eg, hospital features, crowding, time of day) were excluded.
- Study types: Bivariate, multivariate and/or cluster analysis to identify predictors of long(er) ED LOS, with or without the development of a predictive model (no qualitative studies, intervention studies, reviews or commentaries).

- Source types: Published, peer-reviewed journal articles written in English (to limit the time required for searching and assessment).

RESULTS:

Study characteristics We identified 35 relevant studies; of these, 15 included all patients in the ED, 2 included only non-admitted and 2 only admitted patients, 15 included only patients with a certain type of problem (eg, mental health, critical illness, trauma) and 1 included only older adults.

Most of the studies came from the USA (18) or Canada (7), with 3 from Australia, 2 from France and 1 each from Germany, Ireland, Japan, Turkey and the UK. Most studies treated ED LOS as a continuous variable; a few used a cut-off point (most frequently 4 h for the general population; 24 h in two studies of psychiatric and one study of critically ill populations).

Few studies featured univariate analyses only; most presented some type of regression model assessing the impact of each factor while controlling for the others. To compensate for the fact that ED LOS typically shows a skewed distribution, most studies log-transformed this variable, used proportional-hazards regression or set a cut-off point and used logistic regression. Nearly all of the multisite studies that incorporated hospital characteristics correctly used a mixed model with a random intercept term for site; so did one study whose authors were concerned that site factors might confound the analysis as different sites served distinct patient populations. A few studies focused on only one predictor (eg, substance use) and did not analyse, or did not report results for, other factors.

Unfortunately, no studies used cluster analysis or similar methods to identify subtypes of patients with long(er) LOS. Although all the studies were concerned with the predictors of ED LOS, none involved the development and evaluation of a predictive model to identify patients at risk of long(er) LOS. Indeed, many studies included patients' disposition (admitted/ non-admitted) as a variable, eliminating the possibility of using the findings for advance prediction. Studies were heterogeneous in terms of the number of EDs studied (from 1 to over 300), the period of data collection and the number of predictors included in the analysis. However, as findings were generally consistent across studies, results were synthesized through simple 'vote counting', with no attempt to weight the findings by study size, quality or other characteristics

DISCUSSION:

Findings from a variety of countries confirm that ED LOS is meaningfully related to patient characteristics. The factor most commonly studied is patient age, which is frequently associated with long ED LOS. The age effect, given that it tends not to appear in condition-specific studies, may be largely explained by age-related differences in presenting complaint and need for admission.

Severity/acuity is also associated with longer stays, although the effect of acuity is offset to some extent by the fact that higher-acuity patients are seen more quickly. The variability in findings related to acuity may reflect differences in practice patterns among hospitals and health systems. Social determinants of health, such as low socioeconomic status and minority race/ethnicity, may also predict longer LOS, although this too seems variable. While these findings are valuable, they lack sufficient detail to inform the identification of at-risk patients or populations in a clinical or service-design context. Analysis of the specific patient conditions that may predict longer ED LOS has thus far been limited; further work in this area is needed.

Such analysis might permit the development of a predictive model for long ED LOS, which is currently lacking. A limitation of the literature is that large studies are restricted to the variables included in administrative data sources, which may not be fully comprehensive, precise or comparable across different health systems. However, we suspect that data on patient complaints may have been left unexplored even when available, due to the difficulty of meaningfully incorporating a categorical variable with so many categories. In future, it would be reasonable to begin with simple descriptive analysis of the most common complaints among all, short-stay and long-stay patients, in order to identify a manageable list of specific complaints to include in multivariate analyses (perhaps in addition to broad complaint categories).

A useful term for encapsulating what we know about the determinants of long ED LOS might be 'complexity'. Part of the picture is patient complexity: The well-established effect of patient age (or rather, of the health conditions and other factors for which age is a proxy) and the observed bell-shaped relationship between LOS and acuity may suggest that long stays are especially likely when patients present with multiple or illdefined problems that are therefore difficult and time consuming to address. Findings also point to the importance of treatment complexity, some of which may be a function of patient complexity,

some of overuse of diagnostic tests or procedures. Indeed, an analysis of the dramatic rise in American ED occupancy over the years 2001–2019 concluded that the most responsible factor was an increase in practice intensity; population changes (ie, increasing age and burden of illness) also played a role, but a smaller one.

A trend towards increased use of diagnostic tests, in particular imaging, has also been observed in Canada; this trend is not unique to EDs but has occurred throughout the health system.53 The idea of (ever-increasing) complexity may be valuable to bear in mind when appraising potential system responses to the problem of long ED LOS. Two types of response are possible: those in which clinicians target individual patients on the basis of screening (eg, case management) and those in which planners redesign services for all patients in a broad category (eg, care pathways, direct-to-treatment arrangements). Unlike service redesign interventions, those that depend on screening demand a predictive model that has high sensitivity and specificity and is feasible to apply at the point of care; such a model does not yet exist, but may emerge from future analyses.

A deeper question, however, concerns the extent to which individually directed solutions can suffice for system problems. If ED LOS is indeed a function of complexity, then trends in population characteristics and clinical practice have created a perfect storm: Patient problems are becoming increasingly complex, and the ED is increasingly a place to diagnose and manage complex problems. To go further, if the root cause of increasing LOS is that EDs are doing what they were never intended or designed to do, then attempting to address this issue patient-by-patient seems likely to prove cumbersome and inefficient.

CONCLUSION:

Despite a sizeable body of literature on the patient-level predictors of long ED LOS, the available information is insufficiently precise to facilitate application by clinicians or service planners. There is a need for a more detailed understanding of the determinants of long ED stay, and an opportunity to develop predictive model(s), especially for extremely long stays (which have not yet been studied in the general patient population). Further research should incorporate previously studied variables—at minimum, age, sex, acuity and arrival by ambulance—as well as specific patient complaints. Such work will permit the identification of individuals at risk of protracted stay, supporting exploration of the prospects for patient screening; even more important, it will aid in determining how to develop better solutions for populations of patients with complex health needs.

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