A Review of Discharge-Prediction Processes in Acute Care Hospitals

Une étude sur les processus de prédiction de congés de patients des hôpitaux de soins de courte durée

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Abstract

Aims and Objectives: Discharge prediction is designed to streamline inpatient flow and reduce hospital overcrowding without adding capacity. This study's objective was to describe the literature on discharge prediction and assess its usefulness in evaluating the implementation and outcomes of discharge prediction projects.

Methods: The authors reviewed the current peer-reviewed and grey literature on discharge prediction projects in acute care hospitals. Project descriptions were analyzed using Donabedian's structure–process–outcome model for evaluating complex healthcare innovations.

Results: The review revealed a paucity of literature on the use and effectiveness of discharge prediction. There is high variation in its use and generally poor reporting of both implementation and outcomes.

Conclusions: The literature on discharge prediction generally lacks the descriptive detail that would be useful to parties considering or planning a discharge prediction initiative. Further study is required to determine how best to integrate these prediction tools into acute care hospitals.

Résumé

Objectifs : La prédiction de congés est conçue pour rationaliser la venue de patients et réduire l'engorgement dans les hôpitaux sans ajouter de nouveaux lits. L'objectif de cette étude était de faire un survol de la littérature, et de vérifier son utilité dans l'évaluation de projets de prédictions de congés et de résultats.

Méthodes : Nous avons revu la littérature scientifique et la littérature grise sur les projets de prédiction de congés dans les hôpitaux de soins de courte durée. Les descriptions de projets ont été analysées en utilisant le modèle structure–processus–résultat de Donabedian, qui évalue la complexité des innovations en soins de santé.

Résultats : L'étude a révélé la rareté de la littérature sur l'utilisation et l'efficacité des prédictions de congés. Il existe une variation élevée dans son utilisation, et en général, la documentation sur l'implantation et les résultats est plutôt incomplète.

Conclusions : La littérature sur la prédiction de congés manque habituellement d'explications qui pourraient être utiles à ceux qui considèrent ou planifient des projets de prédictions de congés. Davantage de recherches sont nécessaires pour déterminer comment mieux intégrer ces outils de prédictions dans les hôpitaux de soins de courte durée.

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Introduction

We use the term "discharge prediction" (DP) to refer to a family of operational techniques, which involve assigning a predicted date of discharge to patients upon their admission to hospital. These predictions are made by the medical team based on the patient's clinical status at time of admission and are typically updated throughout the hospital stay. Patient care services and operations can then be aligned around this date, with the goal of minimizing delays and inefficiencies during the patient's stay (Rodi et al. 2006), reducing their length of stay (LOS) (Li et al. 2012) and helping to alleviate overcrowding through improved patient flow (Carratalà et al. 2012).

There are many reasons why hospital administrators and other decision-makers might find DP attractive. Hospital overcrowding is a common problem, with adverse consequences for both the quality of patient care and for healthcare costs, where shorter lengths of stay have been associated with reductions in the total cost of a hospital admission (Clancy 2009; Clarke et al. 1996). Overcrowding has been associated with decreased patient satisfaction, as well as a higher risk of in-hospital complications and mortality (Clements et al. 2008; Fatovich et al. 2005; Ospina et al. 2007; Virtanen et al. 2011; Welch 2010). Overcrowding occurs when the demand for admissions exceeds inpatient bed capacity; capacity in turn is a function of the number of inpatients and their average length of stay (ALOS).

Hospital overcrowding is a complex phenomenon, involving factors relating to admission (input), efficiency of care delivery during hospital stay (throughput) and discharge (output). Many of these factors, such as emergency department demand or patient complexity, are not under a hospital's control. By contrast, DP potentially offers greater control over the efficiency of the discharge process. It can theoretically improve both throughput and output by aligning clinical and operational services during a patient's hospital stay and during discharge planning. The intent is that the resulting efficiencies will reduce LOS, thereby increasing the bed capacity available to meet admission demands and improving overcrowding. In this way, DP may also offer the potential to mitigate hospital overcrowding without the increased operating costs incurred by adding staff and beds.

While improving the discharge process may lead to reduced LOS and reduced acute care costs (Greenwald et al. 2007; Li et al. 2012; Walters et al. 2007), the specific contribution of DP itself remains unclear. Moreover, although it is in use in many hospitals, the most effective way to use DP is unknown. Decision-makers who have heard of DP and are contemplating adopting it therefore face two questions: does it really work? And how is it implemented? Many of them will turn to the literature for answers. Thus, we sought to examine literature that describes actual DP initiatives, and we assess how useful these reports are in addressing these two questions.

Methods

We realized early in the study that a traditional systematic review was unlikely to yield a meaningful synthesis of study results. Initial exploratory searches of several databases (PubMed, Scopus, Cumulative Index to Nursing and Allied Health Literature [CINAHL], Cochrane), which we conducted to refine our search terms, suggested there was a very small body of literature on the topic. Discussions with a quality improvement consultant who specializes in discharge planning reinforced this impression and further indicated that quality of reporting would be inconsistent. Therefore, we chose not to conduct a systematic review.

We decided instead to produce a high-level overview of the current reporting on DP. Our goal was to identify and describe any apparent trends or patterns in DP practices, which seemed to us a reasonable way to assess the utility of this literature from the standpoint of hospital administrators interested in DP, or of a planning committee or implementation team interested in DP's practicalities. Indeed, we think it important to offer such high-level commentary not only to document any detectable trends but also to draw attention to this literature's current state: a synthesis of study results via traditional systematic review will be useful to decision-makers only if the quality of reporting improves.

With this objective in mind, we searched PubMed and Google. For completeness, we performed similar searches of CINAHL, Cochrane and Scopus, which did not return additional records. However, these databases are specialized and/or have a strong academic focus. Some hospitals (e.g., small, rural, non-academic) may not subscribe to these databases, so even if relevant records were present, they would be inaccessible to project staff. Therefore, we limited ourselves to publicly available sources to which any hospital can reasonably be assumed to have access.

We used PubMed for peer-reviewed literature and Google to access grey literature. We used Google's standard search engine as opposed to Google Scholar to maximize our chances of returning reports from the websites of individual hospitals, health authorities and related organizations. Our search terms were refined over the course of several exploratory searches and discussions with the quality improvement consultant. The final set of terms includes the one relevant MeSH term ("discharge planning"), terms recommended by the consultant and terms that appeared in the grey literature sources. This process helped ensure we adequately accounted for synonymous or related terms (e.g., "anticipated," "expected" and "estimated date of discharge"). Our search terms and search results are outlined in Figure 1.

FIGURE 1. Search terms and search strategy
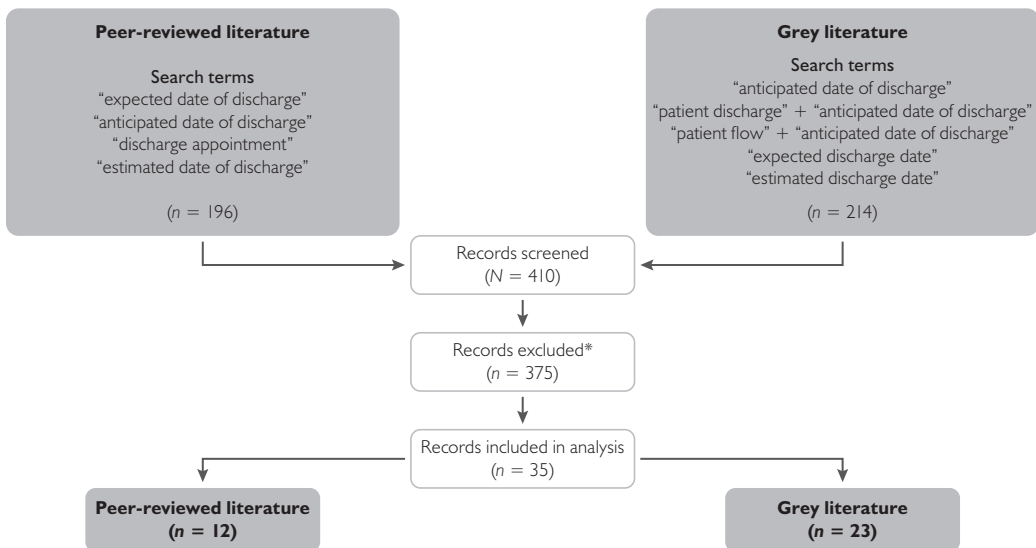
*Records were excluded for one of two reasons (see text for details):
(a) on review, they did not actually describe a DP project;
(b) they did not contain a description of the project which could be analyzed.

Based on title-review, peer-reviewed articles that discussed a DP process were selected for full-text review. Google search results were scanned sequentially until the items became repetitive or irrelevant (typically about 6–10 pages into the results). Additional resources were obtained from the quality improvement consultant. Any articles that did not elaborate upon the use of DP as it related to discharge planning in an acute care setting were excluded. The authors collectively developed a standardized system to guide the process of record selection and the extraction of descriptive data from the included records. One author (A. de G.) performed the review of titles and abstracts, and then conducted the descriptive review of each included article to obtain details of the discharge initiatives they discussed. The other authors consulted on the selection and review process, and all authors reviewed the resulting descriptive data.

We organized the selected articles using Donabedian's (1988) structure–process–outcome framework for evaluating complex interventions. *Structural* elements included hospital demographic information, such as size (based on number of beds), geographic location (urban or rural, as well as country) and type of hospital (academic or community). *Process* elements included details of the DP initiative such as where DP planning information was recorded, who determined the predicted discharge date, who was allowed to change it and how often it was reviewed. *Outcomes* included LOS, re-admissions, patient satisfaction and any other clinical or operational outcomes.

Results

Our search resulted in 196 peer-reviewed articles and 214 non-peer-reviewed papers, pamphlets or information booklets. After excluding materials without an actual DP component, or lacking a detailed project description as described above, 35 items were included in the study: 12 peer-reviewed and 23 non-peer-reviewed. Publication dates ranged from 1992 through 2014, with 54% of the materials reporting on initiatives that had occurred since 2009. Several of the grey literature sources did not report a project date or timeline. Tables 1 and 2 describe the 35 included DP projects.

TABLE 1. Peer-reviewed literature: Descriptive details

	Country	Setting*	Hospital type§	Hospital size¶	Who assigns predicted date	Prediction method	Location of DP date	Outcomes reported
1	Canada	Urban	Community	Medium	Physician	Clinical judgment	Patient chart	Staff compliance
2	US	Urban	Academic	Large	Physician	–	Patient chart, whiteboard	Staff compliance
3	US	Urban	Academic	Large	Physician	–	Patient chart	ALOS
4	US	Urban	Community	Large	Clinical resource manager	Algorithm	Patient chart	ALOS
5	UK	Urban	Academic	Large	Physician	–	Patient chart	ALOS
6	England	Urban	Community	Large	Physician	Clinical judgment	Patient chart	Staff compliance
7	Wales	Urban	Academic	Large	Nurses	Algorithm	Patient chart	ALOS, staff communication
8	England	Urban	Community	Large	Team	–	Patient chart, whiteboard	Staff satisfaction, compliance
9	England	Urban	Community	Large	Team	Algorithm	Patient chart	Staff knowledge
10	US	Urban	Academic	Large	–	–	Patient chart	Staff compliance
11	US	Urban	Academic	Large	–	–	Patient chart, whiteboard	Patient satisfaction
12	Australia	Urban	Academic	Medium	–	–	Patient chart	Staff communication

ALOS = average length of stay; DP = discharge prediction. *Urban vs. rural distinction is based on the given hospital's website. Totals given in text may not sum to 100% as some projects incorporated both urban and rural hospitals. §Academic vs. community distinction is based on the given hospital's website. Totals given in text may not sum to 100% as some projects included both academic and community hospitals. ¶Small (<200 beds), medium (200–400 beds), large (>400 beds). Size definitions are based on those of the Canadian Institute for Health Information (CIHI 2016) and Yergens et al. (2014).

TABLE 2. Grey literature: Descriptive details

	Country	Setting*	Hospital type§	Hospital size¶	Who assigns predicted date	Prediction method	Location of DP date	Outcomes reported
1†	Canada	Urban	Both	Large	Physician	Clinical judgment	Patient chart	–
2	Canada	Urban	Community	Medium	Team	–	–	–
3†	Canada	Urban	Both	All	Team	Judgment, checklist	Patient chart	–
4	Canada	Urban	Academic	Large	Physician	–	Patient chart, whiteboard	–
5†	Australia	Both	Both	All	Team	Judgment, checklist	Patient chart	–
6†	Australia	Both	Both	All	Senior medical officer	Algorithm	Patient chart	–
7†	Australia	Both	Both	All	–	–	–	–
8	Scotland	Urban	Academic	Large	Senior medical staff	–	–	Patient satisfaction
9†	UK	Both	Both	All	Team	Clinical judgment	Patient chart	–
10	Scotland	Urban	Community	Large	Consultant	–	Patient chart	–
11†	UK	Both	Both	All	Physician	Unit benchmarks	Patient chart	–
12	Scotland	Urban	Community	Large	Team	–	–	–
13	England	Urban	Academic	Large	–	Clinical judgment	–	–
14†	Scotland	Both	Community	All	–	–	Patient chart	–
15	US	Urban	Academic	Medium	Nurse	–	Patient chart	Patient satisfaction
16	US	Rural	Community	Medium	Team	Clinical judgment	Patient chart	–
17	US	Urban	Community	Medium	–	–	–	Patient satisfaction, reduced costs
18	US	Urban	Academic	Large	Physician	Clinical judgment	Patient chart	Staff compliance, patient satisfaction
19	Australia	Urban	Academic	Large	–	–	–	Staff compliance, patient satisfaction
20	Canada	Urban	Academic	Large	Team	Clinical judgment	Patient chart	–
21	US	Urban	Academic	Large	Physician	Clinical judgment	Electronic	–
22	Australia	Urban	Academic	Large	Team	–	Patient chart	–
23†	Australia	Both	Both	All	Team	–	Patient chart	–

DP = discharge prediction. *Urban vs. rural distinction is based on the given hospital's website. Totals given in text may not sum to 100% as some projects incorporated both urban and rural hospitals. §Academic vs. community distinction is based on the given hospital's website. Totals given in text may not sum to 100% as some projects included both academic and community hospitals. ¶Small (<200 beds), medium (200–400 beds), large (>400 beds). Size definitions are based on those of the Canadian Institute for Health Information (CIHI 2016) and Yergens et al. (2015). †Denotes more than one hospital involved in the DP project.

Structure
Geographically, these DP projects occurred in large, developed nations: the UK (34%), the US (29%), Australia (20%) and Canada (17%). Large hospitals (more than 400 beds) were more likely to be reporting on the use of DP initiatives (80%). DP initiatives were more commonly reported by academic centres (80%) and urban hospitals (94%).

Process
The reporting of DP use was highly variable in that many of the core aspects that make up a DP initiative (e.g., who assigns the date, how it is predicted) were not documented or were documented inconsistently across projects.

There were many different individuals and/or groups who determined these dates: physicians (44%), a multidisciplinary team (41%), nurses (7%) and a project-specific consultant or manager (7%). Twenty-eight of the 35 projects (80%) reported where the predicted date was recorded and 27 (77%) reported who determined the DP date. But none of the projects reported on whether these or other individuals were allowed to change the initially predicted date, nor did they report how frequently it was reviewed or updated.

Sixteen projects (46%) reported how the DP date was determined: 11 relied upon clinical judgment, while four used an algorithm or similar decision tool to predict a discharge date. Of those latter four projects, none used a validated LOS prediction tool.

Seven projects (20%) reported on the accuracy of their DP, ranging from 28–88% of patients discharged on or before their predicted date. Of these, one project distinguished between different patient populations, noting lower prediction accuracy for patients admitted through the emergency department (44%) as compared to elective admissions (55%). Two projects reported how many patients were assigned a predicted date (61% in both cases).

Five projects (14%) brought in additional staff to assist with DP implementation, while 22 projects (63%) made implementation the responsibility of existing staff. Eight projects (23%) adopted a phased implementation or roll-out strategy, while 18 projects (51%) did not and nine projects (26%) did not report.

Outcomes
Seventeen projects (49%) recorded patient care or operational outcomes associated with the use of DP as follows: four projects reported on LOS, ranging from a 13–19% reduction in ALOS. But this reporting was inconsistent, as some compared DP and non-DP hospital units, others the same unit pre- and post-adoption of DP and others did not specify. One project reported ALOS in days, one in percentages only, one in an inconsistent mix of days and percentages and one did not quantify the ALOS reduction.

One project reported reduced costs – a 20% reduction in the use of items per patient. Ten projects reported anecdotal improvements such as "noticeably fewer complaints," "improved staff communication" or greater compliance, confidence or knowledge of DP use by providers. Another five projects reported improved patient satisfaction, also measured

anecdotally. Fourteen projects reported time frames for their outcomes, ranging from a few weeks to a few years. No studies reported on re-admissions.

Discussion

Our results suggest there are large gaps in reporting on the design and outcomes of DP projects. As a result, this literature is far less useful for decision-makers and project staff than it could be. To make an informed decision, hospital administrators considering the adoption of a DP initiative would benefit from clear reporting about: (a) how other DP initiatives operate and (b) what their outcomes have been. Unfortunately, the reports found in our search have a very limited utility when it comes to these two areas of interest.

For the first area – reporting on structure and process – the literature is not well-suited to a readership looking for information on how to design and plan a DP initiative. Implementing such a project requires decisions about who will assign a DP date, how they will determine it, who can access it, who can change it, how often it is re-assessed or updated and where the date will be stored. In most reports, this basic information was vague, and for many projects it was absent altogether. There was similarly scant reporting on the operational quality of the initiatives themselves: very few reports mentioned the consistency with which discharge dates were assigned, how many patients were actually assigned a date or how accurate the predicted date was.

Looking at what the projects did report, there was high variability in the way discharge dates were predicted, reviewed and recorded. Such variability could potentially benefit hospitals searching for DP ideas by providing them a menu of different approaches to choose from when designing their own approach, but only if each approach is adequately described. Most are not.

For the second area, reporting on outcomes (of any kind) was also sparse. Projects typically reported on patient or staff satisfaction, with a small minority reporting on LOS. Satisfaction was assessed anecdotally, and, while some projects noted LOS reductions, the inconsistency of reporting and lack of descriptive detail made it difficult to interpret and compare the results.

There are some potential reasons why the literature on the use and effectiveness of DP is sparse. First, DP is often one piece of larger quality improvement projects, making it challenging to separate the DP's contribution from the project's other aspects, and to determine whether an outcome is due to the project itself or to how well the project was implemented (Campbell et al. 2007; Groene 2011; Shojania and Grimshaw 2005). Second, many of the discharge initiatives identified in our search were reported as in progress, so publishable results may not have been available if an evaluation had not yet been conducted. Third, there is the possibility of publication bias: quality improvement projects are not often published (Davidoff and Batalden 2005; Ross et al. 2010), nor is work reporting negative results (Dickersin 1990). Thus, while there is a general lack of evidence around the use and effectiveness of DP, this may be due to the nature of its implementation or to other factors that are separate from the quality of DP initiatives.

Some limitations to our review exist. First is the nature of the literature itself. There was little peer-reviewed material available and only a small amount of grey literature, which we included as quality improvement projects are often reported in non-peer-reviewed sources (Crawford et al. 2002; Davidoff et al. 2008). The projects did not all report on similar aspects of DP, making it difficult to get a comprehensive view of different DP processes and how they are used. Many DP initiatives could go unreported and this may reflect in our results; for example, while we found that large, urban hospitals were more likely to report on DP use, it may be that small rural hospitals are frequent DP users but may have different infrastructure or motivation to disseminate reports on their projects.

Second, we did not adopt a systematic review methodology – though our results suggest that a systematic review is unlikely to be fruitful given the size of the literature and the poor reporting. Instead, we have provided a high-level review of discharge initiatives: the sort of initial search for recommendations and best practices that a hospital might conduct in preparation for adopting a DP project of its own. This approach allowed us to observe the variability among discharge initiatives and the state of the literature that healthcare practitioners interested in DP are likely to encounter.

Future studies could enrich these results by directly contacting hospitals that use DP, though we cannot say whether this approach would glean information beyond what those hospitals have already chosen to report. What readers who are trying to decide whether – and how – to adopt DP really deserve is a literature of a much higher reporting quality, with close analysis of both process and outcomes. Once the DP literature has grown in both size and quality, a systematic review would be a logical and useful next step. By drawing attention to the current level of reporting, we hope to encourage those who undertake DP projects to publish their reports with a view to contributing to a rich and detailed literature, which would make informed decisions about DP possible.

Conclusion

Discharge prediction has an intuitive appeal: the possibility of improving patient flow by improving efficiency without adding staff or beds. But there is a paucity of evidence regarding its use and effectiveness. The recency of publication of the majority of our included materials suggests a current interest in DP, but its use is variable. And while variable use is not necessarily a problem in itself (any care practice will need to be tailored to its local context somewhat), the pattern of reporting is less useful than it could be. The current literature, both grey and peer-reviewed, that is most readily available to decision-makers, provides neither the level of detail nor the kind of outcomes data that would help when making decisions about the adoption of a method of DP.

Our review of the available sources paints a picture of an enticing idea being explored in diverse ways. Further studies are needed to investigate the actual use of DP and its effects. A higher quality of reporting will better guide decision-makers towards informed choices regarding DP use and will help determine the role of this promising idea in efforts to improve patient care and operational outcomes.

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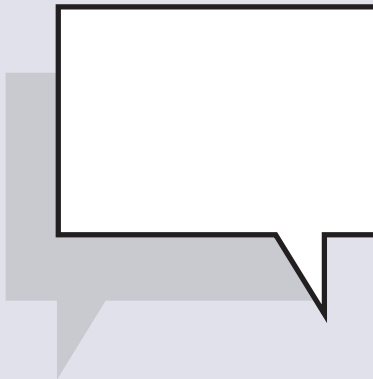
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