CLINICAL RESEARCH STUDY

Hospital Readmissions Following Physician Call System Change: A Comparison of Concentrated and Distributed Schedules

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ABSTRACT

BACKGROUND: Physician call schedules are a critical element for medical practice and hospital efficiency. We compared readmission rates prior to and after a change in physician call system at Sunnybrook Health Sciences Centre.

METHODS: We studied patients discharged over a decade (2004 through 2013) and identified whether or not each patient was readmitted within the subsequent 28 days. We excluded patients discharged for a surgical, obstetrical, or psychiatric diagnosis. We used time-to-event analysis and time-series analysis to compare rates of readmission prior to and after the physician call system change (January 1, 2009).

RESULTS: A total of 89,697 patients were discharged, of whom 10,001 (11%) were subsequently readmitted and 4280 died. The risk of readmission was increased by about 26% following physician call system change (9.7% vs 12.2%, $P <.001$). Time-series analysis confirmed a 26% increase in the readmission rate after call system change (95% confidence interval, 22%-31%; $P <.001$). The increase in readmission rate after call system change persisted across patients with diverse ages, estimated readmission risks, and medical diagnoses. The net effect was equal to 7240 additional patient days in the hospital following call system change. A modest increase was observed at a nearby acute care hospital that did not change physician call system, and no increase in risk of death was observed with increased hospital readmissions.

CONCLUSION: We suggest that changes in physician call systems sometimes increase subsequent hospital readmission rates. Further reductions in readmissions may instead require additional resources or ingenuity.
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Medical practice is a paradox of sustainability and continuity. Sustainability means that one physician cannot be available at all times because of their own personal needs and finite stamina.[1] Continuity means that one patient prefers to have the same physician every time for building understanding and avoiding handover errors.[2-4] This paradox is pervasive in acute care medicine and particularly important following recent changes to house-staff physician

schedules in the US and Canada.[5,6] The situation has no simple solution, and a better understanding of trade-offs is necessary for thoughtful decision-making. We therefore used a popular measure of quality of care, the readmission rate, to examine the consequences of a physician call system change.[7-11]

On January 1, 2009, Sunnybrook Health Sciences Centre in Toronto implemented a complex call system change for all general medicine inpatient physician teams (**Supplementary Figure 1**, available online). The core feature of the old system, also known as the concentrated (bolus) system, was that one team was on call every fourth day and managed all admissions in that 24-hour period.[12] The core feature of the new system, also known as the distributed (drip) system, was that admissions were distributed over all teams every day.[13] This system change necessitated a cascade of additional details, including 1) the senior resident admitted with junior residents from another team rather than with their own junior residents, 2) at least one team member was absent post-call each day, 3) a different member from each team was on call each day, 4) each team received new patients each day. Staffing remained otherwise unchanged, including the challenges of rotating attending faculty and regulated limits on house-staff hours.

The physician call system change was intended to enhance quality of care by allowing at least one team member to be present each day, theoretically improving continuity and decreasing patient readmissions.[14] The purpose of this study was to determine whether the distributed call system achieved its intended purposes, avoided unwanted adverse consequences, and identified insights for further enhancements. Short-term qualitative research suggested that the distributed call system was proactive, popular, and perceived as efficient for patient care.[12] Conversely, reports elsewhere suggest no reductions in readmission rates following call system reforms.[15-19] If the distributed call system was successful, the results might inform decisions at Sunnybrook and beyond, whereas if the distributed call system was unsuccessful, the results might serve as a caution for other medical centers to learn from experience.[20]

METHODS

Study Setting

We focused on Sunnybrook Health Sciences Centre, a large teaching hospital in the University of Toronto Faculty of Medicine, with about 10,000 discharges annually from medical inpatient services. The general internal medicine clinical teaching unit is the largest admitting service and divided into 4 teams (**Supplementary Figure 1**, available online). Each team is responsible for 15-25 inpatients and staffed by an attending physician, a senior resident, 2-3 first-year residents, and 2-3 medical students. Prior to the call system change, each team was on call in a 1-in-4 schedule and responsible for all admissions to general internal medicine over a 24-hour period. No other teams received admissions. After the schedule change in 2009, each team had a junior trainee in the hospital each night and admissions were distributed among all 4 teams equally. We know of no other substantial shifts in admission practices or secular trends during the study interval unrelated to the change in call system on January 1, 2009.

> ## CLINICAL SIGNIFICANCE
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> - Patient outcomes assessed by time-series analysis after call system change from concentrated to distributed admissions (n = 89,697 patients).
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> - Readmission rates increased by 26% after call system change (9.7% vs 12.2%, P <.001).
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> - The increase was not explained by changes in patient demographics, mortality, or regional trends.
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> - Physician call system changes may lead to negative unintended consequences.

Patient Selection

We identified consecutive adults following hospital discharge from internal medicine teams at Sunnybrook Health Sciences Centre from January 2004 through December 2013 (10 years). We focused on patients originally admitted through the Emergency Department and included all cases regardless of attending service, medical diagnoses, or discharge destination. We excluded inpatients treated by obstetrics, psychiatry, or surgical services as identified by International Classification of Diseases codes.[21] Patients with more than one admission were analyzed for every hospital stay so that each readmission counted as a separate hospitalization. Patients who died were counted when assessing mortality and censored when analyzing subsequent readmission rates.

Clinical Characteristics

We identified patient age, sex, socioeconomic status, and primary diagnosis on the day of hospital discharge according to information compiled in validated health databases.[22,23] We also estimated a patient's likelihood of readmission using an established algorithm (LACE score) through comprehensive health services information on length of hospital stay, total Emergency Department visits during the prior half year, and Charlson comorbidity index.[24,25] The available databases contained no information on patient health literacy, social supports, individual preferences, home care, advanced directives, specific medications, severity of disease, overall care plan, language barriers, follow-up arrangements, discharges against medical advice, discharging physician workload, or discharging physician familiarity with the patient.[26,27]