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The impact of organizational and temporal factors on acute stroke care in Sweden

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Abstract

Background Acute stroke carries a high risk of morbidity and death, but early treatment can improve outcomes. Intravenous stroke thrombolysis (IVT) is one such treatment, it is however time-sensitive and show better outcomes the sooner it is given. Most studies on time to IVT so far have looked at fixed time-intervals, and studies of short delays in clinical practice are relatively scarce. Another well-established treatment is managing acute stroke patients in stroke units (SU). Admission rates to a SU as first destination of hospital care have improved over time in Sweden. In the past decade however, the rates have leveled out at around 75-80% without further improvement. A hypothesis is that in-hospital overcrowding contributes. Previous studies have shown that outcomes after stroke differ between hospital types, and also vary depending on time of admission, with higher mortality seen for off-hours, weekend and winter admissions. The reasons behind temporal variations are not fully understood, but it has been proposed that environmental, patient-related and organizational factors contribute. The overall aim of this thesis was to study the effect of organizational factors on quality of care and outcomes after stroke, primarily focusing on the role of in-hospital overcrowding, in-hospital time to IVT and time of admission, while also studying differences between hospitals.

Methods All papers in this thesis were based on data from the Swedish stroke register (Riksstroke), a national quality register that holds data on patient related factors, acute care and outcomes. Paper I included 13,955 patient admissions from 14 hospitals in Region Norrbotten and Region Skåne from 2011-2014, enriched with data on in-hospital bed occupancy. Papers II-IV included all 72 Swedish hospitals caring for patients with acute stroke. Paper II included data from 2011-2015 (N=113,862), paper III from 2011-2016 (N=132,744) and paper IV from 2010-2017 (N=14,132). Analyses included descriptive statistics, unadjusted analyses and multivariable adjusted analyses.

Results We found that each percent increase in in-hospital bed occupancy above 85% decreased admission rates to a SU as first destination of hospital care by 1.5% (odds ratio (OR) 0.985, 95% confidence interval (CI) 0.978-0.992), with significant differences between hospitals. Admission rates were also lower off-hours, compared to on-hours (OR 0.73, 95% CI 0.70-0.75). Over time, admission rates to a SU as first destination of hospital care decreased in university hospitals, while they increased in specialized non-university hospitals and community hospitals. Each minute delay in door-to-needle time (DNT) decreased the odds of 90-day survival by 0.6% (OR 0.994, 95% CI 0.992-0.996), increased the odds of ICH within 36 hours by 0.3% (OR 1.003, 95% CI 1.000-1.006), and led to significantly higher odds of a worsening in functional outcomes at 3 months by 0.3-0.4%. DNT within 30 minutes was most likely daytime, and varied between hospital types. 90-day survival was lowest for patients admitted in January (81.5%), and highest for those admitted in May (84.1%) (OR 1.28, 95% CI 1.17-1.40).

Conclusion We found that in-hospital overcrowding decrease admission rates to a SU as first destination of hospital care, and that even short delays in DNT decreases survival, increases ICH complications and leads to a worsening in functional outcomes in routine clinical practice. We also found that quality of care varied depending on time of admission and between hospitals, indicating unequal care. Organizational differences should be accessible through quality improvement efforts aiming to implement robust local guidelines for in-hospital stroke treatment.

Keywords

Stroke. In-hospital bed occupancy. Stroke Unit. The Swedish Stroke Register. Organizational factors. Temporal variation. Stroke thrombolysis. Door-to-needle time. Quality of care. Outcomes.

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