

## Chapter 12

# Formal-Transfer In and Out of Stroke Care Units: An Analysis Using Bayesian Networks

**Shyamala G. Nadathur**  
*Monash University, Australia*

**James R. Warren**  
*University of Auckland, New Zealand*

### ABSTRACT

*The positive impact of stroke care units (SCUs) on patient outcome has been previously reported. In this study, long-term stroke patients that are formally admitted to teaching-hospitals are compared with and without SCUs. The authors focus on the patients' experience with ongoing care or formal transfers following current care as this cohort is often high users of the system with associated high costs. Bayesian Networks were employed to analyze routinely collected public-hospital administrative data. The results illustrate that the teaching-hospitals with SCUs, while achieving shorter length of stay, in fact deal with younger patients with lower overall patient complexity than non-SCU teaching-hospitals. Other differences include SCUs predominantly treating subarachnoid hemorrhages whereas the non-SCUs treat more cerebral infarctions. This study illustrates the power of Bayesian Networks to expose the nature of caseload and outcomes recorded in hospital-administrative data as a means to gain insight on current practice and create opportunities for benchmarking and improving care.*

### INTRODUCTION

It is rather obvious that neither cost-effectiveness nor quality-of-outcome in healthcare delivery is entirely optimal. Nonetheless, these facts are worth bearing in mind to underscore the need for persistent attentiveness to identification of areas for

health quality improvement. Routinely collected computer-based administrative data provides rich opportunities for exploration of the health delivery process, to characterize and quantify the nature of patients' care journeys. Bayesian Networks (BNs) are a convenient tool to model, and subsequent display and explore, associations among a set of variable. The aim of the study reported herein was to use hospital administrative data and BNs to compare the long term formal-transfer (in

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and out) patients, in terms of characteristics and stroke episode journey profiles, between teaching-hospitals with and without Stroke Care Unit. The study provides specific insights about Stroke Care Units, and serves to illustrate the power inherent in the combination of administrative data sets and Bayesian Networks.

Recently stroke was reported as Australia's second single greatest killer with 53,000 new events each year at a rate of 1 every 10 min (Crimmins, Levi, Gerraty, Beer, & Hill, 2009). Stroke has been acknowledged as the leading cause of disease burden to hospitals (Cadilhac, 1998; Crimmins et al., 2009; Donnan, Fisher, Macleod, & Davis, 2008; Saka, Serra, Samyshkin, McGuire, & Wolfe, 2009; Young & Tolentino, 2009). Because of the aging population the burden is likely to increase greatly during the next decades. The quality of care provided in hospitals has an impact on the outcome (Donnan et al., 2008). It is essential that stroke patients receive the most appropriate care to enhance their recovery and minimise disability (Brown, Whisnant, Sicks, O'Fallon, & Wiebers, 1996; Counsell, Warlow, Sandercock, Fraser, & van Gijn, 1995; Dion, 2004; Rudd, Hoffman, Irwin, Lowe, & Pearson, 2005; Young & Tolentino, 2009).

During the past decade there have been advances in the prevention and treatment of acute stroke; with the management in a Stroke Care Unit (as opposed to other types of wards), being one of the interventions of proven benefit (Donnan et al., 2008; Young & Tolentino, 2009). Stroke patients allocated to receive organized inpatient care in Stroke Care Units (SCUs) are more likely to survive, and experience reduction in length of stay (LOS) as well as better functional outcome than those allocated to conventional ward care (Counsell et al., 1995; Diez-Tejedor & Fuentes, 2001; Indredavik, Fjaertoft, Ekeberg, Loge, & Morch, 2000; Lorenzano et al., 2006; Seenan, Long, & Langhorne, 2007; Stroke Unit Trialists Collaboration, 2007; Zhu et al., 2009). SCU has been associated with better long-term survival in all stroke subgroups (Terent et al., 2009). The

cost benefit value of SCUs has also been reported (Fuentes & Diez-Tejedor, 2009; Launois et al., 2004; Saka et al., 2009). When compared to SCU there is some doubt cast on the benefit of a general ward based specialized stroke care team in reducing mortality and dependence (Donnan et al., 2008; Evans, Harraf, Donaldson, & Kalra, 2002; Kalra et al., 2000). Although Ronning and co-workers (Ronning & Guldvog, 1998a) confirmed the benefit of the SCUs, they reported modest and insignificant effects on clinical outcomes (Ronning & Guldvog, 1998a, 1998b). Slany et al. (2002) have reported that the outcome of stroke patients in general medical departments are fairly comparable to those in SCUs. Therefore periodic audit of the impact of SCUs would be beneficial in understanding current status, thus creating opportunities for improvement of stroke care.

In Australia, SCUs are usually found in teaching-hospitals (Read & Levy, 2005). To date there are no studies analyzing the differences in stroke care between teaching-hospitals with and without SCU. Of particular interest here are long term patients who undergo ongoing care; that is those who are formally transferred from other health care facilities for treatment of stroke, and following the current care are transferred again to other facilities for further care. These patients often use the health system for a long time and therefore can incur higher costs. There are benefits in ongoing monitoring of the process and outcome of care of especially high-cost patients using routinely collected administrative datasets (Luthi et al., 2007; Malenka, McLerran, Roos, Fisher, & Wennberg, 1994; Nadathur, 2010b). Such monitoring will allow us to identify areas of improvement.

For a number of reasons the Bayesian Network was the method of choice for this study. Bayesian Networks (BNs) provide a natural model for exploration and reasoning about complex probability distributions (Lucas, 2004; Lucas, Van der Gaag, & Abu-Hanna, 2004; Nadathur, 2009), which is amenable to population from routinely collected administrative data. The construction of a BN can

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