# Stroke Mortality (with NIHSS) Attachment 1: Summary of Empirical Evidence

Stroke continues to be a leading cause of mortality and morbidity in the United States, with an estimated 795,000 people having a stroke each year (CDC, 2020). Stroke remains the nation’s fifth leading cause of death (CDC, 2020). Among patients 65 and older, both stroke burden and subsequent mortality varies considerably by geographic region (CDC, 2020; Thompson et al., 2017). Most of these strokes are ischemic in nature and increase in prevalence with advancing age (CDC, 2020; Benjamin et al., 2019; Benjamin et al., 2020). Some projections estimated that more than 3 million adults, representing almost 4% of the US adult population, will have had a stroke by 2030 (Ovbiagele et al., 2013). It is estimated that stroke costs $34 billion each year in direct and indirect medical costs (Mozaffarian et al., 2015; CDC, 2020). As such, stroke mortality is a priority condition for outcomes measure development.

Many current hospital processes have been associated with lower stroke mortality rates within 30 days of hospital admission. In particular, post-stroke mortality rates have been shown to be influenced by critical aspects of care at the hospital such as response to complications, speediness of delivery of care, organization of care, coordinated transitions to the outpatient environment, antihypertensive and anticoagulant therapies, and appropriate imaging (Hacke et al., 2004; Smith et al., 2006; Fang et al., 2008; Reeves et al., 2009; Lingsma et al., 2008; Hong et al., 2008; Fonarow et al., 2014; Bekelis et al., 2016; Xian et al., 2019; Jahan et al., 2019). This research demonstrates the relationship between hospital organizational factors and performance on the acute ischemic stroke mortality measure and supports the ability of hospitals to impact these rates. For example, hospitals participating in quality improvement registries like Get With The Guidelines (GWTG) had lower in-hospital mortality rates among stroke patients than hospitals not participating in similar programs (Fonarow et al., 2014). Another study found that patients being treated at hospitals participating in the GWTG quality improvement registry for stroke were significantly more likely to receive multiple evidence-based care interventions, such as tissue plasminogen activator (tPA) administration and evaluation by a neurologist (Howard et al., 2018). Risk-adjusted measures of patient outcomes, specifically mortality, can highlight variations in the provision of care, and thus support improvements by highlighting institutions that provide exceptional care for stroke patients.

Stakeholders have previously stressed the importance of including stroke severity in mortality measures for risk adjustment, as several studies have demonstrated that initial stroke severity is the strongest predictor of mortality in acute ischemic stroke patients (Smith et al., 2010; Nedeltchev et al., 2010; Fonarow et al., 2012; Lichtman et al., 2019). This update to the current publicly reported measure responds to stakeholder preference to include the National Institutes of Health (NIH) Stroke Scale as an assessment of stroke severity in the risk-adjustment model, thereby accounting for stroke severity at the time of admission to assess the condition of the patient before care has been administered. Moreover, the inclusion of the NIH Stroke Scale has been shown to improve model discrimination for the publicly reported stroke mortality measure (Schwartz et al., 2017).

## Figure 1. Stroke Mortality with Adjustment for Stroke Severity Logic Model



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