AHA/ASA Guideline

Risk Adjustment of Ischemic Stroke Outcomes for Comparing Hospital Performance

A Statement for Healthcare Professionals from the American Heart Association/American Stroke Association Council on Stroke

Writing Committee

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Stroke Council Professional Education Committee

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Outline

- Background
- Methods
- Statistical Considerations
- Outcomes
  - 30-day mortality
  - 30-day all-cause re-admissions
  - 30-day functional status
- Future research recommendations

Background

- Stroke is the 4th leading cause of death and a leading cause of long-term major disability in the United States.
    - Measuring outcomes after stroke has important policy implications.

Background

- Evaluating patient outcomes is a major part of optimizing the quality of patient care.
- Regulating bodies have begun to measure outcomes following hospitalization in order to improve health outcomes.
- Stroke is among the top 10 costliest conditions for CMS (Medicare and Medicaid).
- Accurately measuring and comparing hospital outcomes is complex.

Background

- Many outcome determinants are out of the provider's control (e.g., age, severity of illness, comorbid conditions, and treatment preferences).
- Areas that could be potentially controlled are relationships between providers within the community:
    - EMS services, hospitals, nursing support, rehabilitation services and home environment, hospice availability, and the types and skills of providers)
    - Hospitals have control over use of acute and chronic treatments.

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Background

- Challenge: Using outcome measures to account for unmodifiable factors so that variations in outcomes between providers are attributable to the processes of stroke care and more accurately reflect the quality of care given.

The primary goals of this consensus statement are

- Review statistical considerations when evaluating models that define hospital performance in providing stroke care.
- Discuss the benefits, limitations, and potential unintended consequences of using various outcome measures when evaluating the quality of ischemic stroke care at the hospital level.
- Summarize the evidence on the role of specific clinical and administrative variables, including patient preferences, in risk-adjusted models of ischemic stroke outcomes.
- Provide recommendations on the minimum list of variables that should be included in risk adjusting ischemic stroke outcomes for comparing quality at the hospital level.
- Provide recommendations for further research.

Methods

- Statistical considerations for evaluating hospital-level outcomes after stroke
- Systematic review of the literature for the following outcomes at 30 days:
    - Functional outcomes, mortality, re-admissions
- Use of best available data for hospital-level outcomes.

Methods

- Based on best available data, the following should be included in models of hospital-level risk-adjustment:
  - Age, gender, stroke severity, comorbid conditions, vascular risk factors, and pre-stroke function.
  - ***Stroke severity*** *is the most important prognostic factor for individual patients and appears to be a significant predictor of hospital-level performance for 30-day mortality.*
  - Inclusion of a stroke severity measure in risk-adjustment models for 30-day outcome measures is recommended.
  - Risk-adjustment models that do not include stroke severity or other recommended variables must provide comparable classification of hospital performance as models that include these variables.
  - Stroke severity and other variables that are included in risk-adjustment models should be standardized across sites (so that reliability and accuracy are equivalent).

Statistical Considerations

- Methodological standards are needed for risk-adjustment models used for hospital profiling. These should include the following:
  - Model development and application of risk-adjustment models for hospital profiling, and
  - Assessment of model fit (calibration) and discrimination.
- Other methodological issues in the development of risk-adjustment models for stroke are
  - Limited sample size
  - Quantification of outcomes as a graded response
  - Hospital profiling – identification of outlier hospitals

30-Day Mortality

- The review of 30-day mortality models involved studies of predictors of 30-day mortality at the patient level. The following is suggested as a minimum list of variables that should be considered for inclusion:
    - Age, gender, stroke severity, co-morbid conditions, and vascular risk factors.
- Stroke severity is the most important prognostic factor for individual patients and appears to be a significant predictor in hospital-level performance. Inclusion in the prediction model is therefore recommended, particularly if it can be captured among all the patients and is reliably recorded by all hospitals.

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Conclusions: 30-Day Mortality

- Implementation without a measure of stroke severity will increase the occurrence of hospital misclassification.
- Risk-adjustment models of stroke mortality that do not include stroke severity or other recommended variables must provide comparable classification of hospital performance as a model that includes stroke severity or other missing variables.
- Stroke severity and other variables that are used in hospital-level risk-adjustment models of mortality after ischemic stroke should be standardized across sites so that their reliability and accuracy are equivalent.

30-Day All-Cause Readmissions

- Strengths and weaknesses of using 30-day readmission as an outcome for evaluating hospital quality of care were reviewed.
- Timeframe and exclusions are reviewed.
- Evidence on models predicting readmissions after ischemic stroke was reviewed.
- Minimum standards for model discrimination and calibration for models of 30-day readmission for evaluating hospital quality of care were reviewed.

Conclusions: 30-Day All-Cause Readmissions

- Data on the predictors of 30-day readmission for evaluation of quality at a hospital level are limited. Based on the review of available data, which involves primarily studies of models designed for patient-level prediction, the inclusion of the following minimum list of variables is probably indicated:
  - age, gender, stroke severity, comorbid conditions and risk factors, and pre-stroke physical function.

Conclusions: 30-Day All-Cause Readmissions

- Assessments for significance in models that evaluate performance at the hospital level should be done.
- As discussed previously, stroke severity appears to be a significant predictor in hospital-level performance of mortality after stroke, although no data are available for hospital-level performance of 30-day readmissions after ischemic stroke. Using the same rationale as for the mortality outcome, inclusion in the prediction model is recommended.

Conclusions: 30-Day All-Cause Readmissions

- Risk-adjustment models of readmission after stroke that do not include stroke severity or other recommended variables must provide comparable classification of hospital performance as a model that includes stroke severity or other missing variables.

- Stroke severity and other variables that are used in hospital-level risk-adjustment models of readmissions after ischemic stroke should be standardized across sites so that their reliability and accuracy are equivalent.

30-Day Functional Status

The following areas were addressed in this statement:

- Strengths and weaknesses of functional status as a measure of hospital-level quality of care in ischemic stroke,
- Definitions of functional status after ischemic stroke,
- Review of evidence on models evaluating predictors of functional outcomes after ischemic stroke, and
- Choice of functional status measure.

Conclusions: 30-Day Functional Status

- With full acknowledgment of the limitations of making a firm recommendation, the use of the mRS as a global measure of functional status, administered by a trained mRS rater, may be considered to assess function at 30 days.
- Ideally, dichotomizing outcomes should be avoided; however, until additional research can help determine the best approach, the assessment of hospital quality using a mRS score of 0-2 at 30 days as a conservative estimate of “good” outcome may be considered, knowing that many patients continue to improve over time.

Conclusions: 30-Day Functional Status

- The following minimum list of variables should be included in risk-adjustment models: age, gender, stroke severity, comorbid conditions and risk factors (including prior stroke or TIA, prior MI, CAD, atrial fibrillation, diabetes mellitus, hypertension, hyperlipidemia, smoking, alcohol use), pre-stroke physical function (most commonly measured with the mRS), and stroke type. Assessment for significance in models that evaluate performance at the hospital level should be performed.

Conclusions: 30-Day Functional Status

- Premorbid functioning and stroke severity are not collected in a uniform fashion in patients with stroke. They appear, however, to be significant predictors of functional outcomes at 30 days in patient-level performance of mortality after stroke, although no data are available for hospital-level performance of functional outcomes after stroke. Using the same rationale as for the outcome mortality, inclusion in the prediction model is recommended.

Conclusions: 30-Day Functional Status

- Risk-adjustment models of functional status after ischemic stroke that do not include stroke severity or other recommended variables must provide comparable classification of hospital performance as a model that includes stroke severity or other missing variables.
- Stroke severity and other variables that are used in hospital-level risk-adjustment models of functional status after ischemic stroke should be standardized across sites so that their reliability and accuracy are equivalent.

Future Research

- There is a pressing need for research in multiple areas to better identify methods and metrics to evaluate outcomes of stroke care. In addition to the focused research needs described within each outcome measure section, the following areas are highlighted in order of priority:
  - There is a profound lack of data demonstrating the impact of quality of hospital care on stroke outcomes. Defining modifiable aspects of stroke care that can improve outcomes is critically important.
  - Along similar lines, there is a pressing need to determine whether current case-mix adjustment methods can adequately discriminate quality of care provided by hospitals.

Future Research - Continued

- Defining the factors, including stroke severity, that are most important to include in risk adjustment of hospital-level models of mortality, readmissions, and functional outcomes 30 days after a stroke is a critical research priority.
- Research is urgently needed to evaluate the ability of models without the recommended list of variables (particularly stroke severity) to produce comparable discrimination in hospital performance to models that are otherwise similar but include these variables.

Future Research - Continued

- Future work should be directed toward understanding patient and family preferences for different treatment approaches in the setting of severe stroke disability, limited prognosis or both, and how these preferences should be quantified and incorporated into risk-adjustment methods. Developing methods for incorporating patient preferences and provider adherence to patient preferences into risk modeling schemes is a priority.
- The roles of depression, family functioning, and caregiver support as intervening variables between acute care and post-stroke functional status, mortality, and readmissions need to be explored.

Future Research - Continued

- Future research is warranted to understand what variables after “time-zero” should be included in risk-adjustment models for outcomes after stroke
- Research is needed to identify the predictive ability of risk-adjustment models based on automated data collection without manual chart review. These models could include information derived from administrative billing codes or electronic health records.
- Research is needed on the distribution of patients with varying stroke severity, such as the NIHSS, and other mortality predictors across hospitals and of the referral patterns for patients with severe stroke.

Future Research - Continued

- Research is needed to identify the most appropriate way to deal with patients transferred into or out of hospitals. Because of the current lack of data, these high-risk patients are typically excluded from determinations of hospital risk-adjusted outcomes. These patients represent an important subgroup as systems of care for stroke develop in the United States and transfers increase.
- Combining multiple endpoints, such as dependence or disability and death, is common in randomized, controlled trials as a method to gain statistical power. However, including this as the primary outcome measure reduces the interpretability of the outcome. Research is needed to evaluate the use of composite endpoints as outcome measures.

Future Research - Continued

- The difficulties in coalescing the data from literature reviewed for this statement highlight the need for greater clarity in reporting of prediction models. Clinical, health services, and outcomes research need to more clearly report how data were collected, the variable structure, and how all variables performed in a model.
- There is a need for further study of the consistency in coding across sites of key prognostic variables used in risk-adjustment models.
- More research is needed to understand the impact of using in-hospital measures as proxies of the more desirable but often impractical longer term outcomes.