



## Article Appraisal

**Article:** A Clinical Decision Instrument for 30-Day Death After an Emergency Department Visit for Atrial Fibrillation: The Atrial Fibrillation in the Emergency Room (AFTER) Study

**Date of Journal Club:** April 7, 2016

**Resident Reviewer Name(s) and Residency Affiliation:** Ben Tuyp EM FRCPC

**Faculty Methodology/Bio-statistics Resource Person:** Dr. Rob Stenstrom

### Background and Study Objective(s):

Atrial fibrillation (AF) is a common condition whose prevalence is expected to increase significantly as our population ages. Disposition of patients with a primary diagnosis of atrial fibrillation from the Emergency Department remains a complex decision, and there exists significant variability in admission rates for these patients (37% in Ontario vs 69% in the United States). However, the relatively low incidence of 30-day adverse events—3% mortality and 1.1% stroke—in this population suggests that many more may be candidates for discharge. This study sought to derive and validate both complex and simplified decision instruments that predict mortality after an ED visit for atrial fibrillation in an attempt to aid clinicians in identifying which patients require hospital admission and which can be managed as outpatients.

### Study Design:

A population-based, retrospective stratified-sample cohort study. Patients aged 20 to 105 who were seen by an Emergency Physician at the selected study hospitals between April 2008 and March 2009 with a primary ED diagnosis of atrial fibrillation were randomly sampled. A stratified sample of 24 variously-sized emergency departments in the Greater Toronto Area were selected for study. 3500 patients were enrolled, and the sample was randomly split into derivation and validation cohorts of 2343 and 1167 individuals, respectively. Charts were abstracted by trained physicians for 25 a-priori defined clinical variables using a data dictionary. The primary outcome was 30 day all-cause mortality, with patients identified via the provincial death registry. A complex model was derived using those variables found to be associated with the primary outcome on univariate analysis; a simplified model was derived using six pre-defined variables contributing to the acronymous “TrOPs-BAC” name. Statistical adjustments were employed to correct for overfitting and ensure parsimony of the complex model. Subjects were divided into quintiles based on achieved scores and mortality probabilities for each group were calculated. Mortalities were regressed upon the computed points score of each subject in the validation cohort. Both simple and complex rules were applied to the derivation and validation cohorts yielding receiver operating characteristic curves, and sensitivity analyses were conducted.

## Results:

3510 patients were enrolled, with corresponding derivation and validation cohorts of 2243 and 1167 patients, respectively. The groups had similar baseline characteristics. The incidence of 30-day mortality following ED visit were 2.6 and 2.7% in the derivation and validation cohorts. 12 variables were ultimately selected for the most parsimonious complex model, and the corresponding c-statistic of this rule was 0.88 in the derivation and 0.87 in the validation cohorts. When patients were divided into quintiles by total score, the primary outcome was observed in 0.44, 0.41, 0.23, 1.61 and 10.3% of patients in the first to fifth quintiles of the derivation cohort, respectively. The pre-defined TrOPs-BAC rule performed with a c-statistic of 0.81 in both cohorts. Mortality rates were 0.3, 1.1, 2.0, 2.5, and 11.3% for those quintiles with scores of 0, 1, 2, 3, and  $\geq 4$ , respectively. The author's concluded that their simplified and complex scores were highly predictive at estimating the risk of death after an ED visit for atrial fibrillation and that, if prospectively validated, they could aid emergency physicians in the disposition of these patients.

## Validity of Results:

The internal validity of the results of this study was questioned for several reasons. First, the authors did have fewer outcomes per predictor variable studied in both the derivation and validation groups than is desired (typically 15 outcomes per predictor), creating the potential risk of model overfitting. It was felt that the use of linear shrinkage estimators mitigated, but did not completely eliminate, this issue. Second, the authors did not investigate the cause of death. It is impossible to know to what degree the atrial fibrillation was a cause of the death as opposed to simply a marker of other concomitant disease. Third, deaths arising within patients with pre-existing comfort care orders were not excluded; this is inappropriate because in this population our goals of care are not to prolong life but to maintain comfort, and therefore studying a primary outcome of mortality in this subgroup is not of importance. Fourth, defining AF as a primary diagnosis in patients with multiple ED diagnosis based only upon the order it was written in the chart was not felt to be a valid and reliable indicator; many of those at journal club expressed that the order by which they listed the multiple diagnoses on an ED chart was done in a random fashion, not necessarily in order of significance.

## Generalizability of Results:

The generalizability of this paper is limited by its choice of primary outcome. While 30-day mortality is an important, measurable, patient-centered outcome, we cannot say whether these deaths occur as a result of atrial fibrillation or other medical comorbidities. We also cannot infer whether hospital admission will do anything to reduce the risk of mortality at all—fully 40% of the patients in this study were admitted, and many of the deaths occurred in this group. Those in attendance at journal club also believed the AF admission rates at their hospitals were significantly less than those seen in this patient cohort and cited in the introduction, reducing the applicability and necessity of a rule to guide disposition in these patients.

## The Bottom Line:

The simplified and complex clinical decision rules reasonably predict all cause mortality in patients presenting to the ED with a diagnosis of atrial fibrillation, but these deaths are not likely attributable to atrial fibrillation primarily, nor are they necessarily avoidable by hospital admission. Those in attendance did not feel that they would use this rule in their current clinical practice, but they did acknowledge that a prospective study addressing the aforementioned shortcomings would have the potential to influence practice.