# Stop Stroke© Acute Care Coordination Medical Application: A Brief Report on Postimplementation Performance at a Primary Stroke Center

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*Background:* The objective of our study was to evaluate the effect of the Pulsara Stop Stroke© medical application on door-to-needle (DTN) time in patients presenting to our emergency department with acute ischemic stroke (AIS). The secondary objective was to evaluate the DTN performance of dedicated neurohospitalists versus private practice neurologists covering emergency department stroke call. *Methods:* We conducted a retrospective cohort study of the Good Shepherd Health System stroke quality improvement dashboard for an 18-month period. The primary outcome was mean DTN time performance in cases with and without Stop Stroke© usage. Secondary outcome was mean DTN time between neurohospitalist and private neurologists with and without use of Stop Stroke©. *Results:* During the study period, there were 85 stroke activations receiving tissue plasminogen activator (63 with Stop Stroke©, 22 without Stop Stroke©). In cases where the app was used, we observed a reduction in mean DTN time of 40 minutes (87-47 minutes), a 46% reduction. There was no significant difference in DTN time observed between the neurohospitalist and private neurologist performance independent of app usage. Mean DTN less than 60 minutes improved with app use from 18% to 85% with Stop Stroke©. *Conclusions:* In patients arriving to our primary stroke center with AIS, use of Pulsara Stop Stroke© acute care coordination app decreased mean DTN time by 40 minutes, a significant 46% improvement in this metric and is consistent with other studies of the app. We further observed a 3.7× improvement in DTN less than 60 minutes with use of the app. **Key Words:** Stroke—acute care coordination—tissue plasminogen activator—therapy—medical application—time to therapy—emergency medical service.



## Introduction and Objectives

Acute ischemic stroke (AIS) is a debilitating and costly disease with few treatment options. On average in the United States, a stroke occurs every 40 seconds and a death related to stroke occurs every 4 minutes.[1] To date, tissue plasminogen activator (TPA; Activase) has been the only FDA-approved treatment demonstrating improved clinical outcomes for AIS.[2-5] There are compelling new data in carefully selected patients that mechanical clot retrieval along with TPA may have a profound effect on the morbidity and mortality associated with AIS.[6-9] It is clear from the existing literature that time is tissue and

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outcomes for AIS patients receiving thrombolytic therapy are optimized when time to definitive therapy is minimized.[6-15]

In our study, we wanted to analyze the effect of the Stop Stroke© medical application on door-to-needle (DTN) times in patients presenting with an AIS to our level II emergency department (ED). The secondary objective was to evaluate the DTN performance of dedicated neurohospitalists versus private practice neurologists covering ED stroke call, with and without Stop Stroke© app usage. Our ED is certified as a primary stroke center and has annual volumes of 90 K visits. Stop Stroke© is a novel medical application developed by physicians to enhance the coordination and communication tasks essential to the rapid assessment and care of the patients suffering from AIS.

Medical personnel activate the application when a stroke is identified (Fig 1). The app can be activated by emergency medical services (EMS), the ED, or a rapid response team for inpatients suspected of AIS. An image is taken of the patient's clinical appearance and, along with the patient details, is transmitted to all members of the stroke care team (EMS, ED, radiologist, neurologist on call, etc.). When the app is activated, these members are immediately alerted by a siren tone on the application notifying them of a new case. All members of the care team have instant access to the relevant patient information and updates in real time (Fig 2).

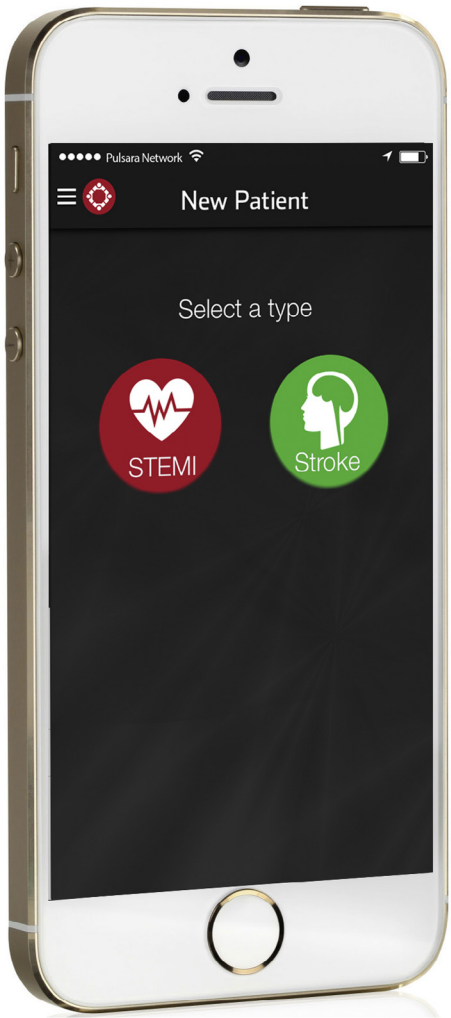


**Figure 1.** *Stop stroke main frame.*


**Figure 2.** *Stop Stroke© Patient Data Screen.*

When each link in the care team is in position to receive the patient, their readiness status is updated on the application to facilitate coordination of care (Fig 3). No specialized hardware is required, as the application is compatible with iOS and Android devices (Fig 4). Stop Stroke© provides immediate feedback on elapsed time by utilizing a universal clock comparing the current case against national benchmarks (Fig 5).

## Methods

We conducted a retrospective cohort study of the Good Shepherd Health System stroke quality improvement dashboard for an 18-month period between February 2014 and


**Figure 3.** *Updated alert screenshot.*

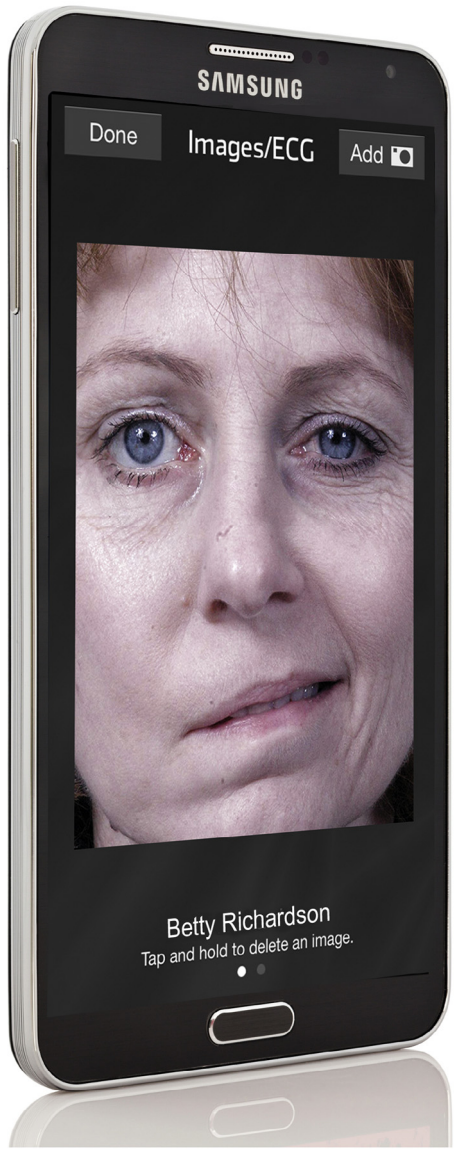


**Figure 4.** *Stop Stroke© Patient Image.*

August 2015. The dashboard tracks metrics on stroke cases receiving TPA at our primary stoke center. Investigators reviewed door and TPA administration times for all cases receiving TPA for AIS during the study period and compared cases utilizing Stop Stroke© with those not using the app along with the type of neurologist assigned the case (neurohospitalist versus private practice neurologist). All cases receiving TPA were included in the analysis. Data were analyzed using Excel software statistics package (Student's *t*-test).

## Results

During the study period, we had 85 stroke activations receiving TPA (63 with Stop Stroke©, 22 without Stop Stroke©). In cases where Stop Stroke© was used, we observed a reduction in mean DTN time of 40 minutes (87-47 minutes), a 46% reduction ($P = <.001$). There was no difference in DTN time observed between neurohospitalist and private neurologist performance independent of app usage, with a mean DTN of 47 minutes seen for both groups using the app ($P = .87$) and 88 minutes and 85 minutes respectively without app use ($P = .81$). Mean DTN less than 60 minutes improved with app use from 18% to 85% with Stop Stroke©.

## Conclusion

In patients arriving to our primary stroke center with AIS, use of Pulsara Stop Stroke© acute care coordination application decreased mean DTN time by 40 minutes. This time reduction represents a significant 46% improvement in this metric and is consistent with the effect seen in our original analysis after implementing the app at our institution.[16,17] We further observed a 3.7× improvement in DTN less than 60 minutes with use of the app.


**Figure 5.** *Screenshot with universal clock.*

## Discussion

It remains clear from the literature that timely care of AIS is associated with improved outcomes.[6-15] Acute care coordination in stroke is a complex and challenging task that many health systems struggle to master. The American Stroke Association recommendation for developing systems of stroke care emphasizes 3 main principles: effective communication among agencies, services, and providers; an organized and standardized approach to acute stroke care at each facility; and performance feedback for continual improvement.[18] There are data to suggest that comprehensive care coordination initiatives or use of mobile care coordination technology that conforms to these recommendations may improve DTN performance. In a large multicenter study that looked at the effect of Get With The Guidelines-Stroke (GWTG) care coordination or quality improvement initiative in a before and after cohort of 71,000 patients treated with TPA for AIS, only 26% in the preintervention arm was treated within 60 minutes of arrival. This study demonstrated a 15% improvement in DTN after GWTG was introduced with an improvement in DTN less than 60 minutes (26%-41%). The improvement in DTN performance was associated with improved hospital mortality, less intracranial hemorrhage, and more patients discharged home.[11] This finding is consistent with our results in this study and others looking at Pulsara Stop apps.[16,17]

Several promising trials utilizing mechanical reperfusion in addition to TPA have recently been reported. In all of these trials, there was a significant improvement in clinical outcome with the addition of mechanical retrieval along with intravenous TPA.[6-9]

These trials all demonstrated a streamlined care coordination process with impressive door to therapy times.[6-9] The SWIFT PRIME had a goal of computed tomography to groin puncture in less than 70 minutes and median time of arrival in ED to groin puncture of 90 minutes.[9] These times to reperfusion therapy represent a difficult target for most institutions with their current processes. Acute care coordination strategies have demonstrated some success in improving these difficult-to-reach goals and may play an important role in the ultimate success of this novel therapy for AIS.[11,16,17] There are inherent limitations to a study of this type. The retrospective design is prone to bias and the data set is a small cohort from a single hospital setting and may not be generalizable to other populations. Larger multicenter trials are needed to further characterize the efficacy of Stop Stroke© and any potential impact on the morbidity and mortality associated with AIS.

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