Original Contribution

Disparities and Trends in Door-to-Needle Time

The FL-PR CReSD Study (Florida-Puerto Rico Collaboration to Reduce Stroke Disparities)

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Background and Purpose—In the United States, about half of acute ischemic stroke patients treated with tPA (tissue-type plasminogen activator) receive treatment within 60 minutes of hospital arrival. We aimed to determine the proportion of patients receiving tPA within 60 minutes (door-to-needle time [DTNT] ≤60) and 45 minutes (DTNT ≤45) of hospital arrival by race/ethnicity and sex and to identify temporal trends in DTNT ≤60 and DTNT ≤45.

Methods—Among 65 654 acute ischemic stroke admissions in the National Institute of Neurological Disorders and Stroke-funded FL-PR CReSD study (Florida-Puerto Rico Collaboration to Reduce Stroke Disparities) from 2010 to 2015, we included 6181 intravenous tPA-treated cases (9.4%). Generalized estimating equations were used to determine predictors of DTNT ≤60 and DTNT ≤45.

Results—DTNT ≤60 was achieved in 42% and DTNT ≤45 in 18% of cases. After adjustment, women less likely received DTNT ≤60 (odds ratio, 0.81; 95% confidence interval, 0.72–0.92) and DTNT ≤45 (odds ratio, 0.73; 95% confidence interval, 0.57–0.93). Compared with Whites, Blacks less likely had DTNT ≤45 during off hours (odds ratio, 0.68; 95% confidence interval, 0.47–0.98). Achievement of DTNT ≤60 and DTNT ≤45 was highest in South Florida (50%, 23%) and lowest in West Central Florida (28%, 11%).

Conclusions—In the FL-PR CReSD, achievement of DTNT ≤60 and DTNT ≤45 remains low. Compared with Whites, Blacks less likely receive tPA treatment within 45 minutes during off hours. Treatment within 60 and 45 minutes is lower in women compared with men and lowest in West Central Florida compared with other Florida regions and Puerto Rico. Further research is needed to identify reasons for delayed thrombolytic treatment in women and Blacks and factors contributing to regional disparities in DTNT. **(*Stroke*. 2017;48:00-00. DOI: 10.1161/STROKEAHA.116.016183.)**

Key Words: achievement ■ ethnicity ■ healthcare disparities ■ quality improvement ■ race ■ risk factors ■ stroke

Stroke is the fifth cause of death in the United States[1] and a leading cause of long-term adult disability.[2] Many advancements have been made in the treatment of acute ischemic stroke (AIS) through programs that promote evidence-based best practices. The American Heart Association/American Stroke Association developed Get With The Guidelines-Stroke (GWTG-S), a quality improvement program that has successfully improved acute stroke care, thus reducing morbidity and mortality after stroke. The FL-PR CReSD study (Florida-Puerto Rico Collaboration to Reduce Stroke Disparities) is a National Institute of Neurological Disorders and Stroke-funded multicenter initiative, specifically designed to address race, ethnic, sex, and regional disparities in stroke care in a diverse population with significant Hispanic representation. The FL-PR CReSD established the Florida-Puerto Rico (FL-PR) Stroke Registry, a voluntary registry of GWTG-S–participating hospitals in Florida and Puerto Rico, to specifically address identified disparities in acute stroke care and to develop culturally

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tailored, targeted interventions to reduce stroke disparities in these understudied US regions.

Rapid administration of thrombolytic therapy is a prominent aspect of quality care for AIS. Stroke morbidity and mortality are lower in patients with faster treatment times; however, this benefit has not been shown to persist beyond 4.5 hours of stroke onset.[3,4] An important component of time to treatment is door-to-needle time (DTNT; time from hospital arrival to administration of tPA [tissue-type plasminogen activator]). Shorter DTNT has been associated with fewer tPA complications,[5,6] better ambulation at discharge,[6,7] and lower in-hospital mortality.[5,6,8] In 2014, the American Heart Association/American Stroke Association initiated Target: Stroke Phase II to optimize achievement of DTNT ≤60 and to introduce the new goal of DTNT ≤45.[9] Nationally, about 53% of tPA-treated AIS patients receive tPA within 60 minutes of hospital arrival,[8] and presumably, even fewer are treated within 45 minutes. Although tPA administration rates have increased over time,[10] a large proportion of patients eligible for thrombolysis are still not treated within 60 minutes of hospital arrival.

Women and race/ethnic minority groups less frequently receive tPA and other life-saving GWTG-S interventions compared with men and Whites.[11–13] Furthermore, achievement of DTNT ≤60 may be lower in women and Blacks.[8] Using FL-PR Stroke Registry admissions to 84 GWTG-S hospitals from January 2010 to June 2015, we assessed race/ethnic and sex disparities in achievement of DTNT ≤60 and DTNT ≤45 and predictors of DTNT ≤60 and DTNT ≤45. We also assessed regional and temporal trends in the achievement of DTNT ≤60 and DTNT ≤45.

Methods

As of June 2015, the FL-PR Stroke Registry comprised 84 hospitals, 69 in Florida and 15 in Puerto Rico. The Registry includes retrospective and prospective hospital-collected GWTG-S data on patients with a primary diagnosis of ischemic stroke, transient ischemic attack, subarachnoid hemorrhage, intracerebral hemorrhage, and stroke not otherwise specified. Out of 65 654 AIS cases enrolled in the Registry from January 2010 to June 2015, records were excluded from analysis if last known well time, arrival time, or treatment time was undocumented (Figure). Records were also excluded if arrival time was beyond 4.5 hours of stroke onset. In addition, patients transferred from another hospital were excluded because treatment time could not be determined. Patients with contraindications to thrombolytic treatment were also excluded. Patients with a documented eligibility or medical reason for not initiating IV tPA within 60 minutes of hospital arrival were included. The final study sample consisted of 6181 tPA-treated cases. Complete data collection methods have been previously reported.[14]

Statistical Analysis

DTNT was analyzed as a binary outcome: DTNT ≤60 versus DTNT >60 and DTNT ≤45 versus DTNT >45. Continuous variables were summarized as means with SD, or as medians with interquartile range (IQR) for those with non-Normal distributions. Categorical variables were reported as frequencies with percentages. Patient groups were compared using Student *t* test for continuous variables and Pearson χ^2 test for categorical variables. With generalized estimating equations to account for within-hospital clustering, multivariable logistic regression models were used to examine disparities and factors related to DTNT ≤60 (or DTNT ≤45 alternatively) in a sequence of 3 models. Model 1 included sociodemographics: age, sex, race/ethnicity, and insurance status. Model 2 included model 1 variables and hospital characteristics: stroke center certification, number of beds, proportion of minority treated, and years in GWTG-S. Model 3 included model 2 variables and ambulation status before stroke, arrival by emergency medical services (EMS), National Institutes of Health Stroke Scale (NIHSS; measure for stroke severity with increasing score indicating greater severity), EMS prenotification, and cardiovascular risk factors: dyslipidemia, hypertension, diabetes mellitus, atrial fibrillation, smoking, coronary artery disease, peripheral vascular disease, and history of stroke or transient ischemic attack. Patients were placed in 1 of 4 race/ethnic categories based on region of residence and self-identification: White, Black, Florida Hispanic, and Puerto Rico Hispanic. A race/ethnicity by sex interaction was tested in the fully adjusted models.

In a separate analysis, patients were stratified into 2 groups based on time of admission. Regular working hour admissions were from Monday to Friday 7:01 AM to 5:59 PM, and off-hour admissions were anytime before 7 AM or after 6 PM Monday through Friday, all day Saturday, all day Sunday, and government holidays. Generalized estimating equations logistic regression was performed for both groups to identify predictors of DTNT ≤60 and DTNT ≤45 for regular and off-hour admissions. SAS v9.3 was used to perform all statistical analyses.

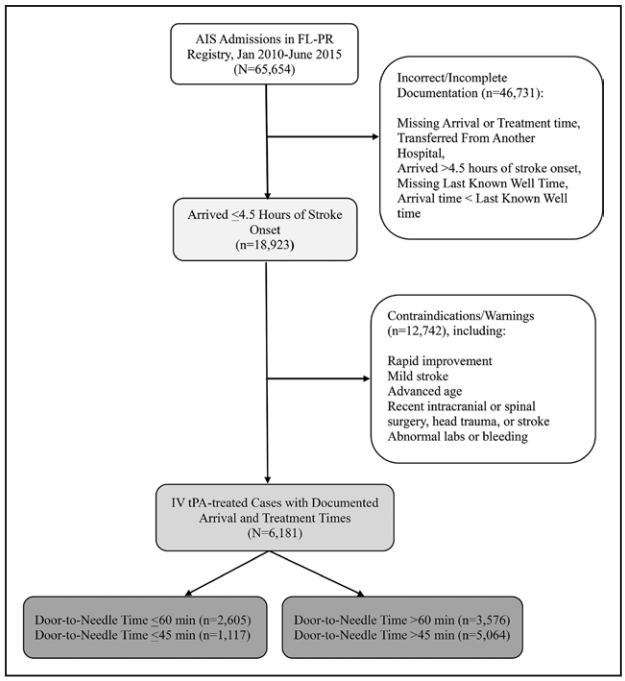

Figure. Derivation of the analytic sample. AIS indicates acute ischemic stroke; FL-PR, Florida-Puerto Rico; IV, intravenous; and tPA, tissue-type plasminogen activator.

Results

Among 65 654 AIS admissions, 6181 (9.4%) received tPA and had documented arrival and treatment times. The sample was 52% male and 64% White, 14% Black, 14% Florida Hispanic, and 8% Puerto Rico Hispanic, with a mean age of 71±14 years. Overall, median DTNT time was 67 minutes (IQR, 51–91 minutes). Among those with DTNT ≤60 and DTNT ≤45, the median was 48 and 37 minutes, respectively. Median DTNT was 68 minutes (IQR, 52–93 minutes) in women and 65 minutes (IQR, 49–88 minutes) in men. Florida Hispanics had the lowest median DTNT (58 minutes; IQR, 43–79 minutes), followed by Puerto Rico Hispanics (67 minutes; IQR, 52–88 minutes), Whites (68 minutes; IQR, 52–91 minutes), and Blacks (71 minutes, IQR, 53–95 minutes).

DTNT ≤60 was achieved in 42% of cases (Table 1) and DTNT ≤45 in 18% of cases (Table I in the online-only Data Supplement).

Table 1. Characteristics of IV tPA-Treated Acute Ischemic Stroke Cases With DTNT ≤60 Minutes and DTNT >60 Minutes in the Florida-Puerto Rico Stroke Registry, 2010 to 2015

	DTNT ≤60 min (n=2605, 42%)	DTNT >60 min (n=3576, 58%)	*P* Value
Age (y), mean±SD	70.7±14.1	70.7±14.7	0.98
Women, n (%)	1187 (46)	1791 (50)	<0.0001
Race/ethnicity, n (%)			
White	1568 (60)	2382 (67)	<0.0001
Black	332 (13)	530 (15)	
FL Hispanic	499 (19)	400 (11)	
PR Hispanic	206 (8)	264 (7)	
Region, n (%)			
South FL	1251 (48)	1264 (35)	<0.0001
West Central FL	334 (13)	852 (24)	
East Central FL	398 (15)	588 (16)	
North FL & Panhandle	416 (16)	608 (17)	
Puerto Rico	206 (8)	264 (7)	
Insurance Status, n (%)			
Medicare	745 (29)	1109 (31)	<0.0001
Private	893 (34)	1393 (39)	
Medicaid/Uninsured	267 (10)	377 (11)	
Unknown	700 (27)	697 (19)	
Vascular risk factor, n (%)			
Hypertension	1539 (59)	2403 (67)	<0.0001
Diabetes mellitus	538 (21)	859 (24)	0.002
Medical history, n (%)			
AF	566 (22)	795 (22)	0.64
CAD/Previous MI	496 (19)	871 (24)	<0.0001
Previous stroke/TIA	425 (16)	806 (23)	<0.0001
NIHSS, n (%)			
≤5	512 (20)	803 (22)	<0.0001
6–15	1160 (45)	1498 (42)	
≥16	830 (32)	1030 (29)	
Missing	103 (4)	245 (7)	
Arrival mode, n (%)			
EMS	2144 (82)	2736 (77)	<0.0001
Not by EMS	222 (9)	501 (14)	
Missing/Unknown	239 (9)	339 (9)	
Ambulation status*, n (%)			
Independent	1410 (54)	2280 (64)	<0.0001
With Assistance	84 (3)	163 (4)	
Missing/ND	1111 (43)	1133 (32)	
Hospital size, n (%)			
Small (<250 beds)	337 (13)	560 (15)	0.003
Mid (250–450 beds)	797 (31)	992 (28)	
Large (>450 beds)	1471 (56)	2024 (57)	
Years in GWTG-S, mean±SD	8.2+2.2	8.5+2.5	<0.0001

AF indicates atrial fibrillation; CAD, coronary artery disease; DTNT, door-to- needle time; EMS, emergency medical services; FL, Florida; GWTG-S, Get With The Guidelines-Stroke; IV, intravenous; MI, myocardial infarction; NIHSS, National Institutes of Health Stroke Scale; PR, Puerto Rico; TIA, transient ischemic attack; and tPA, tissue-type plasminogen activator.

*Ambulation status before stroke.

Compared with men, women less often had DTNT ≤60 (40% versus 44%) and DTNT ≤45 (16% versus 20%). DTNT ≤60 was greatest in Florida Hispanics (56%), followed by Puerto Rico Hispanics (44%), Whites (40%), and Blacks (39%). DTNT ≤45 was also highest in Florida Hispanics (28%), followed by Whites (17%), Blacks (14%), and Puerto Rico Hispanics (14%). Patients with DTNT ≤60 had more severe strokes, as measured by NIHSS score of 6 to 15 (45% versus 42%) and NIHSS score of ≥16 (32% versus 29%) and were less likely to ambulate independently before stroke (54% versus 64%). They were also more likely to arrive by ambulance (82% versus 77%; Table 1). After multivariate adjustment, women were less likely than men to receive DTNT ≤60 (odds ratio [OR], 0.81; 95% confidence interval [CI], 0.72–0.92) and DTNT ≤45 (OR, 0.73; 95% CI, 0.57–0.93; Table 2). Other predictors of DTNT ≤60 and DTNT ≤45 were no history of stroke or transient ischemic attack, no history of coronary artery disease or myocardial infarction, NIHSS score of >5, arrival by ambulance, and treatment at a comprehensive stroke center (Table II in the online-only Data Supplement).

After stratification by admission time, women less likely than men received DTNT ≤60 during working hour (OR, 0.81; 95% CI, 0.70–0.94) and off-hour admissions (OR, 0.81; 95% CI, 0.68–0.96). DTNT ≤45 was less likely among women compared with men (OR, 0.72; 95% CI, 0.58–0.90) during working hours and less likely among Blacks compared with whites during off hours (OR, 0.68; 95% CI, 0.47–0.98; Table 3). There was no significant race/ethnicity×sex interaction for DTNT ≤60 or DTNT ≤45.

Achievement of DTNT ≤60 and DTNT ≤45 was highest in South Florida (50% and 23%, respectively) and lowest in West Central Florida (28% and 11%, respectively). There was a rise in the achievement of DTNT ≤60 and DTNT ≤45 from 2010 to 2015. Temporal trends in DTNT by race/ethnicity, sex, and region are detailed in Tables III and IV in the online-only Data Supplement and Figures I through VI in the online-only Data Supplement.

Discussion

In our FL-PR Stroke Registry, achievement of DTNT remains low. DTNT ≤60 was achieved in 42% of cases and DTNT ≤45 in only 18% of cases. We also observed some race/ethnic and prominent sex disparities in DTNT. Blacks were less likely treated within 45 minutes during off hours. Women were less likely treated within 60 minutes regardless of admission time and also less likely treated within 45 minutes during working

Table 2. DTNT ≤60 Minutes and DTNT ≤45 Minutes by Sex and Race/Ethnicity

	DTNT ≤60 vs DTNT>60			DTNT ≤45 vs DTNT <45
	aOR_1 (95% CI)	aOR_2 (95% CI)	aOR_3 (95% CI)	aOR_3
Sex (reference: M)				
F	0.82 (0.72–0.93)	0.82 (0.72–0.93)	0.81 (0.72–0.92)	0.73 (0.57–0.93)
Race/ethnicity (reference: FL-W)				
FL-B	0.89 (0.75–1.06)	0.89 (0.75–1.04)	0.88 (0.74–1.04)	0.79 (0.59–1.05)
FL-H	1.16 (0.91–1.47)	1.15 (0.90–1.46)	1.14 (0.92–1.41)	0.94 (0.71–1.23)
PR-H	1.06 (0.69–1.63)	0.79 (0.44–1.40)	0.76 (0.42–1.39)	0.45 (0.17–1.22)

aOR_1: Model 1 adjusts for age, sex, race/ethnicity, and insurance status. aOR_2: Model 2 includes model 1+hospital academic status, number of beds, years in GWTG-S, and proportion minority treated. aOR_3: Model 3 includes model 2+smoking status, hypertension, diabetes mellitus, dyslipidemia, atrial fibrillation, coronary artery disease, peripheral vascular disease, history of stroke or transient ischemic attack, ambulation status before stroke, National Institutes of Health Stroke Scale, arrival mode, emergency medical services prenotification and stroke center certification. aOR indicates adjusted odds ratio; B, Black; CI, confidence interval; DTNT, door-to-needle time; FL, Florida; H, Hispanic; PR, Puerto Rico; and W, White.

hours. We have also identified significant regional variation in DTNT. West Central Florida had the lowest proportion of patients treated with DTNT ≤60 and DTNT ≤45. Our results add novel data to the literature on race/ethnic, sex, and regional disparities in DTNT.

We identified individual-level factors associated with DTNT ≤60 and DTNT ≤45 such as no history of previous stroke or coronary artery disease. These findings emphasize the importance of stroke and cardiovascular disease prevention. We also identified ambulance transport to the hospital and treatment in larger hospitals and comprehensive stroke centers as predictors of receiving tPA within 60 and 45 minutes. Achievement of goal DTNT may be enhanced by improving systems of care that include greater utilization of EMS and better implementation of EMS prenotification.

Table 3. DTNT ≤60 and DTNT ≤45 During Working Hour and Off-Hour Admissions by Sex and Race/Ethnicity

	DTNT ≤60	DTNT ≤45
	aOR (95% CI)	aOR (95% CI)
Working hours		
Sex (reference: M)		
F	0.81 (0.70–0.94)	0.72 (0.58–0.90)
Race/ethnicity (reference: FL-W)		
FL-B	0.99 (0.74–1.34)	0.91 (0.64–1.30)
FL-H	1.17 (0.87–1.57)	1.14 (0.84–1.56)
PR-H	0.93 (0.46–1.87)	0.50 (0.17–1.45)
Off hours		
Sex (Reference: M)		
F	0.81 (0.68–0.96)	0.74 (0.52–1.05)
Race/ethnicity (reference: FL-W)		
FL-B	0.79 (0.63–1.04)	0.68 (0.47–0.98)
FL-H	1.17 (0.89–1.54)	0.84 (0.58–1.24)
PR-H	0.60 (0.30–1.22)	0.57 (0.19–1.65)

Off hours was from Monday through Friday 6 PM to 7 AM, Saturdays, Sundays, and government holidays. Fully adjusted model for DTNT <60 and DTNT <45 includes age, race/ethnicity, sex, insurance status, hospital academic status, number of beds, years in Get With The Guidelines-Stroke, proportion minority treated, arrival mode, emergency medical services prenotification, ambulation status before stroke, smoking status, history of stroke, coronary artery disease, diabetes mellitus, hypertension, dyslipidemia, and atrial fibrillation. aOR indicates adjusted odds ratio; B, Black; CI, confidence interval; DTNT, door-to-needle time; FL, Florida; H, Hispanic; PR, Puerto Rico; and W, White.

Longer DTNT has been previously reported in women[6,15] and Blacks[8] and may be because of delays at the time of admission. The stroke team was unable to determine tPA eligibility in 12.1% of Blacks compared with 9.7% of Whites. In addition, uncontrolled hypertension requiring aggressive control with intravenous medications was reported in 10% of Blacks compared with 5.5% of Whites. Delayed treatment in Florida Hispanics may have been because of initial refusal of tPA, which was greatest among Florida Hispanics (5.1% compared with 3.9% in Florida Whites, 3.0% in Florida Blacks, and 1.9% in Puerto Rico Hispanics). These were noted as reasons for treatment delay beyond 60 minutes but likely contribute to delays beyond 45 minutes as well. Documented reasons for treatment delay were similar between men and women and likely did not account for sex disparities in DTNT in our study. However, women were more likely than men to present with altered consciousness (16% versus 13%), which may have prolonged stroke diagnosis and treatment. In addition, the sex disparity in this study was observed across all race/ethnic groups and most likely contributed to sex-specific differences in biological and sociocultural factors not investigated in our study.

Information gathering at the time of admission may also affect time to treatment. Family members and caretakers, if present at the time of stroke onset, EMS arrival, and hospital admission, may provide patient medical histories and act as patient advocates, potentially leading to faster treatment. Also, the presence of stroke specialists and neurologists in the emergency department at admission and treatment by an attending physician may also contribute to faster DTNT. Currently, the FL-PR Registry does not contain data about information gathering at the time of admission, physicians present in the emergency department at the time of admission, or type of physicians who provided direct care (residents, attending

physicians, etc). These data may highlight additional sources of treatment delays and should be collected in future projects.

Previous studies have identified similar patient-level characteristics related to timely treatment, including no previous history of stroke[6,8] and greater stroke severity.[6,15] In our study, a larger proportion of women and Blacks had NIHSS score of >5; however, stroke severity did not fully account for differences in DTNT <60 and DTNT <45. EMS arrival was associated with greater likelihood of DTNT ≤60 in this study and studies of national GWTG-S data.[6,16] Despite women arriving by ambulance more often, DTNT ≤60 was still less common in women. Lower use of EMS in Blacks also did not fully account for longer DTNT. Race/ethnic and sex disparities were still present after adjustment for EMS prenotification. By-pass policy[17] is another possible mediator of sex and race/ethnic differences in DTNT and should be explored in future studies.

Stroke center type was an important hospital-level predictor of DTNT. Patients treated at comprehensive stroke centers were twice as likely to be treated within 60 minutes compared with those treated at primary stroke centers. The additional resources of comprehensive stroke centers, which include 24/7 availability of personnel and imaging facilities, availability of advanced imaging techniques, and expertise in treating large ischemic strokes, facilitate faster treatment in ischemic stroke.[18] DTNT ≤60 was also more common in patients treated at larger hospitals. Hospitals with greater ischemic stroke admissions per year and greater volume of intravenous tPA-treated patients per year[6,8,19] are more likely to treat within 60 minutes. Previous studies reported that hospitals that treat larger proportions of Black patients have better tPA administration rates for Blacks.[20–22] In our study, the race/ethnic disparity in DTNT ≤45 during off hours persisted even after adjustment for proportion of minority treated, stroke center certification, and other hospital characteristics, which support our conclusion that admission factors likely account for delayed treatment in Blacks.

Multiple hospital-based initiatives have been implemented to improve processes of care and shorten time to treatment. Target: Stroke, a national quality improvement program, emphasizes 11 key best practice strategies to improve DTNT, including hospital prenotification by EMS, rapid triage and stroke team notification, and rapid acquisition and interpretation of computed tomography (CT) scans.[8,23] Door-to-CT time is an understudied hospital process of care that directly affects DTNT. Currently, the Registry does not contain data on time of generation or interpretation of CT results or data on which physician (emergency department physician or neurologist) interpreted the CT scan; however, these factors are important determinants of DTNT and should be examined in future studies.

The FL-PR CReSD has delivered 2 tools to hospitals in the Registry to improve acute stroke care—the hospital-specific Disparities Dashboards and the interactive Door-to-Needle educational module. The Disparities Dashboards allow hospitals to benchmark their adherence to GWTG-S metrics, DTNT, and door-to-CT time and compare their performance to other hospitals in the region and state. The Door-to-Needle module is an interactive, web-based tool designed for emergency medical personnel, stroke neurologists, and emergency department physicians which emphasizes evidence-based best practices to shorten DTNT. The effect of the Dashboards and the Door-to-Needle module on DTNT has not yet been evaluated; therefore, DTNT improvements cannot be directly attributed to these interventions. Improvements in stroke care from 2010 to 2015 observed in our study are likely because of participation in the GWTG-S quality improvement program by increasing adherence to stroke performance measures as previously reported.[24]

There was substantial regional variation in DTNT, which may be partly because of regional variation in stroke mortality rates, concentration of neurologists, and hospital characteristics. In Florida, counties with the highest age-adjusted stroke morality rates and the lowest concentration of neurologists are located in North Florida and the Panhandle region.[25] In contrast, the highest concentrations of primary stroke centers, comprehensive stroke centers, academic institutions, and neurologists are in the southern and central regions of Florida. Also, large hospitals (bed size ≥450) that have participated in GWTG-S ≥6 years are predominantly in southern and central Florida compared with the North and Panhandle.[26] Hospital size and time in the GWTG-S were not significant predictors of DTNT ≤60 or DTNT ≤45 in our study, but it has been shown that time in GWTG-S is associated with greater achievement of GWTG-S predefined stroke performance measures, particularly in larger, teaching hospitals.[24] These factors do not fully explain low achievement of DTNT ≤60 and DTNT ≤45 in West Central Florida. Future analysis of the hospital Disparities Dashboard data will clarify causes of regional disparities in DTNT.

The FL-PR Stroke Registry is an ongoing, growing registry, which supports the study of delivery of evidence-based best practices, identification of disparities, and development of future interventions to reduce disparities in acute stroke care. Data are systematically collected in the harmonized GWTG-S data entry system. In our future studies, we plan to evaluate the effect of the Disparities Dashboards and Door-to-Needle module interventions on adherence to stroke care measures in a clinical trial design. Current results will inform the development of broader hospital and community-based educational interventions to address disparities in stroke care.

Some limitations of the study should be noted. We were unable to assess the impact of many key best practice strategies for DTNT improvement (eg, premixing of tPA, time to the generation of CT scan results) and sociocultural factors (eg, whether patient lives alone) that are not included in our data collection. Also, we were unable to determine whether ER physicians or neurologists were the initial treating physicians because the registry does not contain these data. Our future interventions aim to extend data collection methods to include implementation of best practice strategies, use of the Disparities Dashboards and Door-to-Needle educational module, information on initial treating physicians, and sociocultural factors as these factors may explain some of the observed disparities in DTNT. Furthermore, the longitudinal effects of sex and race/ethnic differences in DTNT on long-term stroke outcomes, including mortality, disability, and quality of life, should be studied. Our goal for the second phase of the FL-PR Stroke Registry is to improve transition of care after discharge from acute stroke hospitalizations and reduce disparities in transition of stroke care. We also plan to develop, deliver, and disseminate educational interventions that will affect postdischarge systems of care and long-term stroke outcomes in our Registry.

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Disparities and Trends in Door-to-Needle Time: The FL-PR CReSD Study (Florida-Puerto Rico Collaboration to Reduce Stroke Disparities)

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SUPPLEMENTAL MATERIAL

Disparities and Trends in Door to Needle Time: Florida Puerto Rico Collaboration to Reduce Stroke Disparities Study

Supplemental Tables (4)

Supplemental Figures (6)

Supplemental Table I. Characteristics of IV tPA-treated Acute Ischemic Stroke Cases with Door-to-Needle time ≤45 minutes and Door-to-needle >45 minutes in the FL-PR Stroke Registry, 2010-2015

	DTNT ≤ 45 min (n=1117, 18%)	DTNT > 45 min (n=5064; 82%)	*P* Value
Age (y), mean ± SD	70.6 ± 14.3	70.7 ± 14.5	0.75
Women, n (%)	478 (43)	2500 (49)	<0.0001
Race/ethnicity, n (%)			<0.0001
White	669 (60)	3281 (65)	
Black	125 (11)	737 (14)	
FL Hispanic	255 (23)	644 (13)	
PR Hispanic	68 (6)	402 (8)	
Region, n (%)			<0.0001
South FL	581 (52)	1934 (38)	
West Central FL	132 (12)	1054 (21)	
East Central FL	147 (13)	839 (17)	
North FL & Panhandle	189 (17)	835 (16)	
Puerto Rico	68 (6)	402 (8)	
Insurance Status, n (%)			<0.0001
Medicare	278 (25)	1576 (31)	
Private	347 (31)	1939 (38)	
Medicaid/Uninsured	100 (9)	544 (11)	
Unknown	392 (35)	1005 (20)	
Vascular risk factor, n (%)			
Hypertension	590 (53)	3352 (66)	<.0001
Diabetes mellitus	198 (18)	1199 (24)	<.0001
Medical history, n (%)			
AF	233 (21)	1128 (22)	0.30
CAD/Previous MI	190 (17)	1177 (23)	<.0001
Previous stroke/TIA	152 (14)	1079 (21)	<.0001
NIHSS, n (%)			0.0002
≤5	219 (20)	1096 (22)	
6-15	494 (44)	2164 (43)	
≥16	368 (33)	1492 (29)	
Missing	36 (3)	312 (6)	
Arrival Mode, n (%)			<0.0001
EMS	945 (85)	3935 (78)	
Not by EMS	79 (7)	652 (13)	
Missing/Unknown	93 (8)	477 (9)	
Ambulation Status*, n (%)			<0.0001
Independent	258 (23)	1377 (27)	
With Assistance	336 (30)	1803 (36)	
Missing/ND	523 (47)	1884 (37)	
Hospital size, n (%)			<0.0001
Small (<250 beds)	138 (12)	759 (15)	

Mid (≥250-450 beds) Large (>450 beds)	372 (33) 607 (55)	1417 (28) 2888 (57)	
Years in GWTG-S, mean±SD	8.1 + 2.3	8.5+ 2.4	<0.0001

AF indicates atrial fibrillation; CAD, coronary artery disease; DTNT, door-to- needle time; EMS, emergency medical services; FL, Florida; GWTG-S, Get With The Guidelines-Stroke; IV, intravenous; MI, myocardial infarction; NIHSS, National Institute of Health Stroke Scale; PR, Puerto Rico; TIA, transient ischemic attack; and tPA, tissue-type plasminogen activator.
*Ambulation before stroke.

Supplemental Table II. Factors Associated with Door-to-needle time≤60 minutes and Door-to-Needle time≤45 minutes

Factors	DTNT≤60 vs. DTNT>60*	DTNT≤45 vs. DTNT>45*
Age		
65-79 (vs. 18-64)	1.15 (1.01-1.31)	1.11 (0.93-1.34)
≥80 (vs. 18-64)	1.11 (0.94-1.30)	1.03 (0.84-1.28)
NIHSS		
6-15 (vs. ≤5)	1.19 (1.07-1.33)	1.20 (1.01–1.43)
≥16 (vs. ≤5)	1.19 (1.02-1.38)	1.32 (1.13–1.54)
Prior CAD/MI		
No (vs. Yes)	1.18 (1.03-1.34)	1.24 (1.04-1.47)
Prior stroke/TIA		
No (vs. Yes)	1.22 (1.09-1.46)	1.24 (1.02-1.52)
EMS arrival		
No (vs. Yes)	0.62 (0.52-0.75)	0.54 (0.45-0.65)
Stroke Center Certification		
Primary (vs. Comprehensive)	0.49 (0.35-0.69)	0.38 (0.23-0.62)

*Fully adjusted model includes age, race/ethnicity, sex, insurance status, smoking status, hypertension, diabetes mellitus, CAD/prior MI, prior stroke /TIA, dyslipidemia, atrial fibrillation, peripheral vascular disease, EMS prenotification, ambulation status prior to stroke, NIHSS, arrival mode, number of beds, stroke center certification, years in GWTG-S, and proportion minority treated.

Supplemental Table III. DTNT≤60 in the FL-PR Stroke Registry by Sex, Race/ethnicity, and Region (2010-2015)

	2010	**2011**	**2012**	**2013**	**2014**	**2015**
Women	18.9	24.9	33.7	45.6	52.1	52.9
Men	22.6	29.1	38.9	48.1	55.4	61.2
FL White	19.0	24.5	36	43.5	51.8	57.4
FL Black	16.0	27.1	29.2	44.3	47.6	57.0
FL Hispanic	32.5	35.2	43.7	61.7	67.8	64.6
PR Hispanic	34.3	40	39.1	44.2	49.1	48.6
East Central	12.2	20.5	37.5	50.8	44.6	55.4
North & Panhandle	24.9	35.2	42	46.2	49	49.4
West Central	13.8	12.4	22.4	31.4	37.7	45.2
South	22.7	30.3	39.4	52.9	67.1	69.0
Puerto Rico	34.3	40.0	39.1	44.2	49.1	48.6

Supplemental Table IV. DTNT≤45 in the FL-PR Stroke Registry by Sex, Race/ethnicity, and Region (2010-2015)

	2010	**2011**	**2012**	**2013**	**2014**	**2015**
Women	5.3	6.6	9.4	19	25.2	24
Men	6.1	9.7	17.0	24.3	25.1	31.7
FL White	5.6	7.2	13.8	18.9	24.4	28.9
FL Black	4.7	1.9	9.0	23.3	15.3	29.0
FL Hispanic	5.0	14.3	15.9	32.9	40.2	38.0
PR Hispanic	11.4	20.0	12.6	16.3	14.9	10
East Central	6.1	2.3	14.4	19.0	15.6	25.0
North & Panhandle	7.7	14.3	19.6	26.6	20.6	24.7
West Central	3.4	3.1	7.1	14.4	15.5	20.2
South	4.8	7.5	13.0	25.5	36.5	39.5
Puerto Rico	11.4	20.0	12.6	16.3	14.9	10.0

DTNT Improvements from 2010-2015

The proportion of cases receiving DTNT≤60 increased from 21% in 2010 to 57% in 2015. Similarly, DTNT≤45 increased from 6% in 2010 to 28% in 2015. Improvements in DTNT≤60 and DTNT≤45 were lower in women compared to men (34% vs. 39% and 19% vs. 26%). Regionally, improvement in DTNT≤60 was greatest in South Florida (46% increase), followed by East Central Florida (43% increase), West Central Florida (31% increase), the North and Panhandle (24% increase) and Puerto Rico (15% increase). DTNT≤45 improved most in South Florida (35% increase), followed by East Central Florida (19%), West Central Florida and the North and Panhandle region (17% increase in both), with a slight decrease in Puerto Rico (1% decrease).

The greatest improvement in DTNT≤60 was among Blacks (41% increase), followed by Whites (38% increase), FL Hispanics (32% increase), and PR Hispanics (15% increase). Achievement of DTNT≤45 increased most in FL Hispanics (33% increase), then Blacks (24% increase), Whites (23%), but slightly decreased in PR Hispanics (1% decrease). In 2015, FL Hispanics had the highest proportion of DTNT≤60 (65%), followed by White (57%), Black (57%), and PR Hispanics (49%). FL Hispanics also had the highest proportion of DTNT≤45 (38%), followed by Blacks (29%) and Whites (29%), then PR Hispanics (10%).

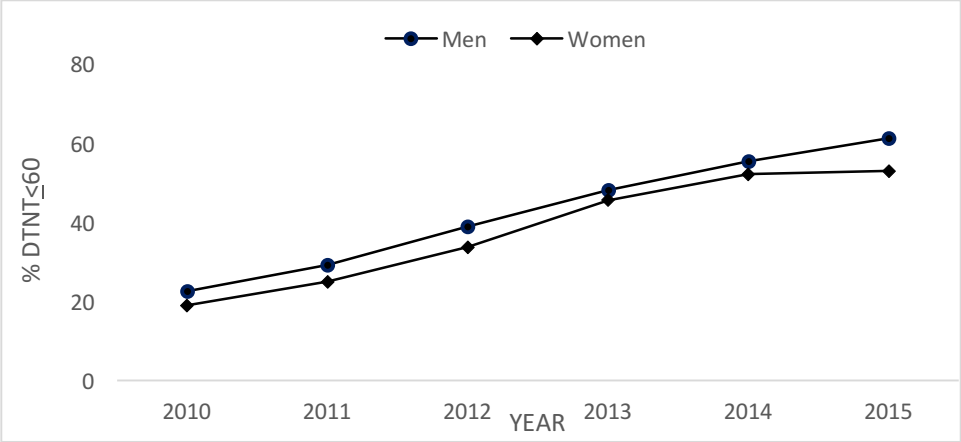

Figure I. Temporal Trends in DTNT≤60 in the FL-PR Stroke Registry by Sex, 2010-2015

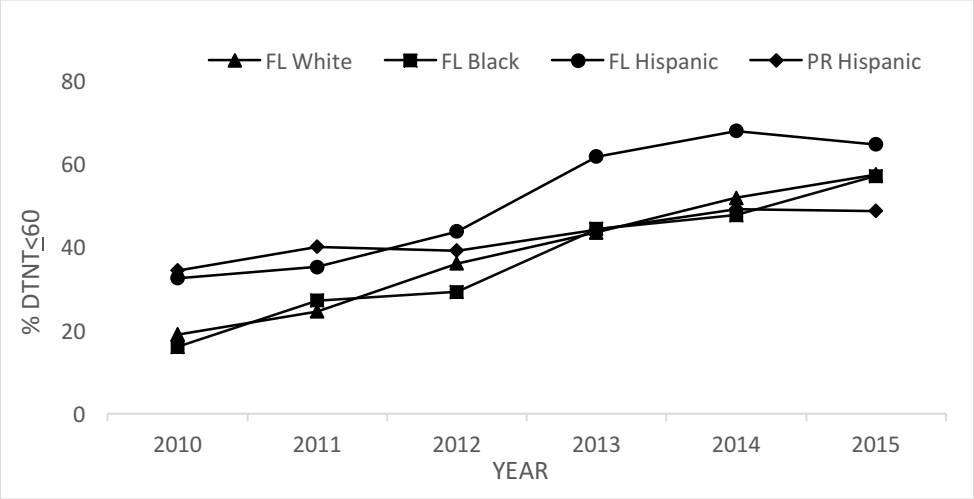

Figure II. Temporal Trends in DTNT≤60 in the FL-PR Stroke Registry by Race/ethnicity, 2010-2015

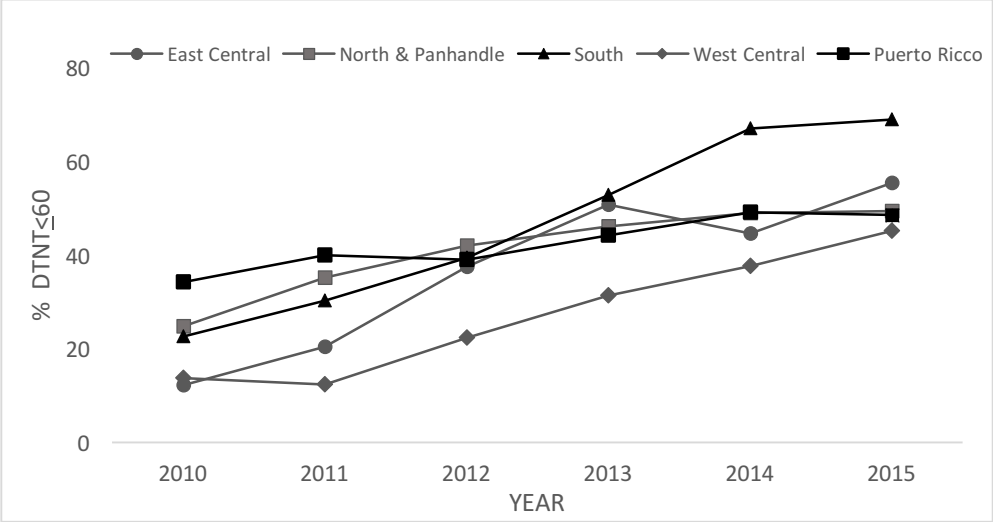

Figure III. Temporal Trends in DTNT≤60 in the FL-PR Stroke Registry by Region, 2010-2015

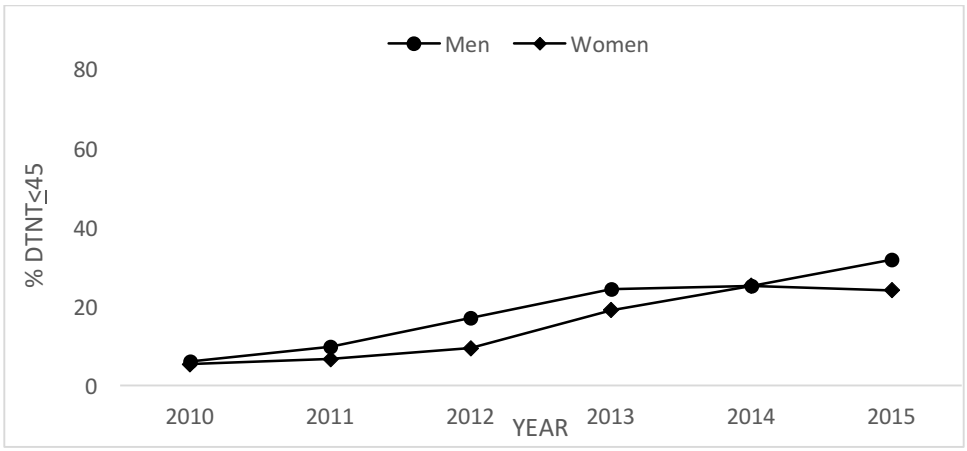

Figure IV. Temporal Trends in DTNT≤45 in the FL-PR Stroke Registry by Sex, 2010-2015

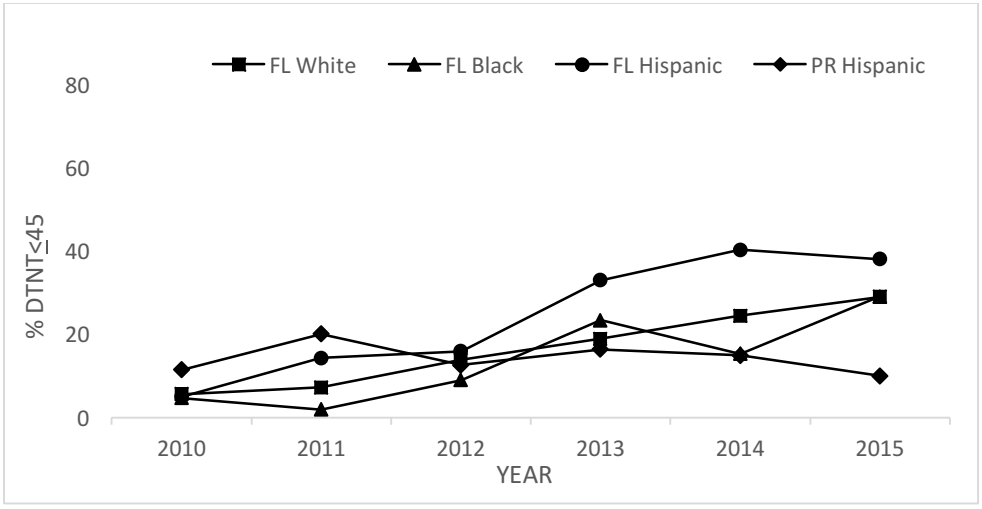

Figure V. Temporal Trends in DTNT≤45 in the FL-PR Stroke Registry by Race/ethnicity, 2010-2015

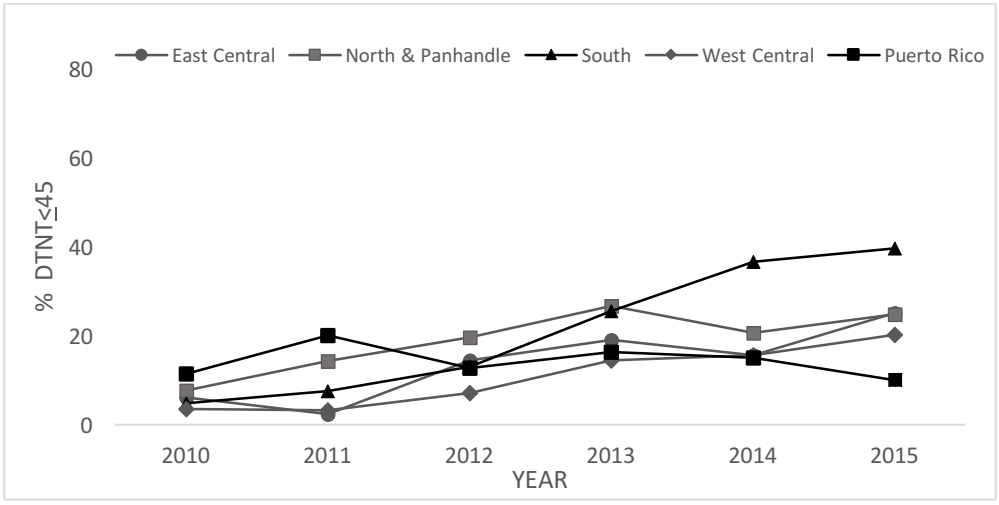

Figure VI. Temporal Trends in DTNT≤45 in the FL-PR Stroke Registry by Region, 2010-2015