



Canadian Stroke Network

Réseau Canadien contre  
les accidents cérébrovasculaires

ICES

Institute for Clinical  
Evaluative Sciences

# Registry of the Canadian Stroke Network

## Report on the 2004/05 Ontario Stroke Audit



February 2009

# **Registry of the Canadian Stroke Network**

## **Report on the 2004/05 Ontario Stroke Audit**

### **ICES Investigative Report**

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## About the Organizations Involved in this Report

### The Canadian Stroke Network (CSN)

The Canadian Stroke Network (CSN), one of Canada's Networks of Centres of Excellence ([www.nce.gc.ca](http://www.nce.gc.ca)), is a collaborative effort that brings together researchers, students, government, industry and the non-profit sector. The CSN was first funded in 1999 and is a not-for-profit corporation governed by a Board of Directors with headquarters at the University of Ottawa. The CSN puts Canada at the forefront of stroke research through its multidisciplinary research program, high-quality training for Canadian scientists and clinicians, and national and global partnerships. At present, the Network has more than 100 researchers at 32 universities across the country.

In partnership with the Heart and Stroke Foundation of Canada, the CSN formally launched the Canadian Stroke Strategy (CSS) in 2006. The strategy promotes education and awareness about stroke, the need to use effective treatments, best practices in providing coordinated care in integrated stroke programs, the importance of delivering rehabilitation at the right time and in the right intensity, and the need to support stroke patients and their families in the community. The Ontario Ministry of Health and Long-Term Care provided \$1 million in funding to the CSN to measure, monitor and evaluate stroke care in Ontario ([www.canadianstrokenetwork.ca](http://www.canadianstrokenetwork.ca)).

The Canadian Stroke Network is dedicated to decreasing the physical, social and economic consequences of stroke on the individual and on society. In pursuit of this goal, it aims to:

- promote research excellence
- train researchers and practitioners
- maximize economic benefits
- build national consensus on stroke policy
- create added value through partnerships

### ICES – Ontario's resource for informed health care decision-making

The Institute for Clinical Evaluative Sciences (ICES) is an independent, non-profit organization that produces knowledge to enhance the effectiveness of health care for Ontarians. Internationally recognized for its innovative use of population-based health information, ICES' evidence supports health policy development and guides changes to the organization and delivery of health care services.

Key to our work is our ability to link population-based health information, at the patient-level, in a way that ensures the privacy and confidentiality of personal health information. Linked databases reflecting 12 million of 30 million Canadians allow us to follow patient populations through diagnosis and treatment, and to evaluate outcomes.

ICES brings together the best and the brightest talent under one roof. Many of our scientists are not only internationally recognized leaders in their fields, but are also practicing clinicians who understand the grassroots of health care delivery, making the knowledge produced at ICES clinically-focused and useful in changing practice. Other team members have statistical training, epidemiological backgrounds, project management or communications expertise. The variety of skill sets and educational backgrounds ensures a multi-disciplinary approach to issues and creates a real-world mosaic of perspectives that is vital to shaping Ontario's future health care system.

ICES receives core funding from the Ontario Ministry of Health and Long-Term Care. In addition, our faculty and staff compete for peer-reviewed grants from federal funding agencies, such as the Canadian Institutes of Health Research, and project-specific funds are received from provincial and national organizations. These combined sources enable ICES to have a large number of projects underway, covering a broad range of topics. The knowledge that arises from these efforts is always produced independent of our funding bodies, which is critical to our success as Ontario's objective, credible source of *Evidence Guiding Health Care*.

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## Executive Summary

### Purpose

Stroke is the fourth leading cause of death and a leading cause of adult disability in Canada. In Ontario, previous studies have shown wide variations in the availability of stroke care resources in acute care institutions across the province, as well as variations in the treatment of stroke patients in organizations with similar resources. In 2000, Ontario developed a “coordinated stroke strategy” order to address these inconsistencies, and to ensure that Ontarians have equal access to high-quality stroke care. The goal of the stroke strategy was to improve both access to and quality of services across the continuum of stroke care—from primary prevention to pre-hospital/emergency care, hospital-based acute care, rehabilitation, secondary prevention and community re-engagement. The strategy, which was fully implemented by 2005, is now known as the Ontario Stroke System (OSS). The OSS includes a number of regional stroke centres and other institutions which provide specific stroke care resources throughout the province.

Within the Ontario Stroke Strategy, ongoing monitoring and evaluation are considered essential to ensure implementation of best practices and evidence-based stroke care. The Registry of the Canadian Stroke Network (RCSN) was established in 2001. Its mandate includes ongoing measurement and monitoring of the quality of stroke care delivery in Ontario. One component of the RCSN is a province-wide audit of stroke care in Ontario, which is performed every two years. This report presents data obtained from the RCSN Ontario Stroke Audit for fiscal year 2004/05, with comparisons to the previous audit performed for fiscal year 2002/03.

### Study

The 2004/05 RCSN Ontario Stroke Audit was conducted to evaluate the characteristics, management and outcomes of stroke patients in Ontario. These data were compared according to OSS region, by institutional designation within the Stroke Strategy (Regional Stroke Centre, District Stroke Centre, non-designated hospital), and by Local Health Integration Network (LHIN) of patient residence.

All Ontario acute care institutions, excluding children’s and mental health care hospitals and those with fewer than 10 stroke or transient ischemic attack (TIA) separations\* per year, were invited to participate in the RCSN Ontario Stroke Audit. All patients seen in a hospital emergency department or admitted to hospital with a “most responsible” diagnosis of stroke or TIA were eligible for inclusion in the audit. Overall, 153 acute care institutions (with 154 individual hospital sites) were eligible; all of them agreed to participate in the 2004/05 RCSN Ontario Stroke Audit.

Based on this audit, there were 23,800 hospitalizations or emergency department visits for acute stroke or TIA in Ontario in fiscal year 2004/05. The audit sample included a total of 4,913 patients (approximately 21 percent of all cases).

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\*Separation from a health care facility occurs anytime a patient (or resident) leaves because of death, discharge, sign-out against medical advice or transfer. The number of separations is the most commonly used measure of the utilization of hospital services.

### Key Messages and Recommendations for Action

- ▶ This is the second population-based Ontario Stroke Audit. These audits permit the examination of temporal trends in stroke care and outcomes across the province following implementation of the Ontario Stroke System.
- ▶ We present overall rates for key quality indicators for acute stroke care. Benchmarks have not been established for most of these indicators.
- ▶ It is recommended that patients with acute stroke or transient ischemic attack (TIA) be treated in hospital as soon as possible after symptom onset. In 2004/05, 32.5 percent of all TIA/stroke patients arrived at hospital within 2.5 hours of stroke onset. These results are similar to those obtained from the 2002/03 audit.
- ▶ Thrombolysis with recombinant tissue plasminogen activator (rtPA) has been shown to improve outcomes after ischemic stroke in appropriately selected patients. In 2004/05, thrombolysis was administered to 3.9 percent of patients with acute ischemic stroke; this finding was similar to the one derived from the 2002/03 audit. However, in the subgroup of patients presenting within 2.5 hours of stroke onset, 14.1 percent received thrombolysis in 2004/05, a significant improvement compared to the thrombolysis rate of 9.5 percent from the 2002/03 audit.
- ▶ Clinical trials have shown that being cared for in a dedicated stroke unit can reduce patients' risk of death and disability after stroke. In 2004/05, 29 out of 152 acute institutions had dedicated stroke units, and 10.9 percent were admitted directly to a stroke unit—an improvement from 2.7 percent of all stroke patients in 2002/03.
- ▶ Neuroimaging via computed tomography (CT) and/or magnetic resonance imaging (MRI) is recommended as part of an initial stroke assessment—both to confirm the diagnosis and to provide information on TIA/stroke type and location. In 2004/05, 82 percent of patients underwent neuroimaging during hospitalization—an improvement from 77 percent in 2002/03.
- ▶ In patients with ischemic stroke or TIA, carotid imaging is recommended (in appropriate cases) to determine whether carotid stenosis (narrowing of certain blood vessels in the head) is present. In 2004/05, 55 percent of patients had carotid imaging performed or scheduled—an increase from 44 percent in 2002/03.
- ▶ The proportion of stroke patients screened for dysphagia (swallowing problems) after stroke increased slightly—from 47 percent of patients in 2002/03 to 51 percent in 2004/05.
- ▶ Medical management for the secondary prevention of ischemic stroke includes the use of antithrombotic agents, warfarin for atrial fibrillation, antihypertensive therapy and lipid-lowering agents. In 2004/05, utilization rates for these interventions were as follows: 92 percent for antithrombotic agents; 74 percent for warfarin; 36 percent for antihypertensive therapy; and 44 percent for lipid-lowering agents. This represents a statistically significant increase in rates compared to 2002/03 for all interventions, except for the use of warfarin for atrial fibrillation.
- ▶ In 2004/05, 29 percent of patients were referred to a secondary prevention clinic after discharge from hospital—an increase from 14 percent of patients in 2002/03. This coincides with an increase in the number of ministry designated stroke prevention clinics from 11 in 2002/03 to 18 clinics in 2004/05.
- ▶ Across the Ontario Stroke System and the province's 14 Local Health Integration Networks (LHINs), there were variations in almost all processes of stroke care delivery, including thrombolysis, stroke unit admissions, neuroimaging, carotid imaging, dysphagia screening and medications for secondary stroke prevention.
- ▶ Rates of thrombolysis, stroke unit admissions, neuroimaging, carotid imaging and dysphagia screening were highest at regional stroke centres, followed by district stroke centres, and finally by non-designated hospitals and community hospitals.
- ▶ In 2004/05, the median inpatient length of hospital stay for stroke patients in Ontario was 6.5 days—a decrease from 7.7 days in 2002/03. After admission for stroke, 55 percent of patients were discharged home, and 15 percent were discharged to inpatient rehabilitation facilities. In the subgroup of patients with moderate to severe disability after stroke (Rankin score of 3 to 5), 35 percent were discharged to inpatient rehabilitation in 2004/05—a decrease from 42 percent in 2002/03.
- ▶ In 2004/05 the adjusted 30-day ischemic stroke case-fatality rate was 15 percent; there was no significant change in this rate from 2002/03. There were no statistically significant regional variations in stroke case fatality rates, but non-designated centres continued to have significantly higher 30-day mortality rates compared to regional stroke centres.

### Implications

In summary, compared to a similar audit done in 2002/03, the RCSN 2004/05 Ontario Stroke Audit revealed significant improvements in the use of evidence-based practices and interventions such as referral to stroke units, thrombolysis, neuroimaging, swallowing assessments, secondary prevention drug therapy and referrals to secondary prevention clinics. Although our analysis does not allow us to evaluate the reasons for the observed improvements in care, there is a temporal association between the implementation of the Ontario Stroke System and improved stroke care delivery. However, variations in care delivery among hospital types continue to exist, with lower rates of many stroke care interventions at small community hospitals compared with other hospital types.

## Background

Stroke is the fourth leading cause of death and a leading cause of adult disability in Canada.<sup>1</sup> Clinical trials have demonstrated that the optimal management of acute stroke includes: care on a dedicated stroke unit, early use of aspirin in those with ischemic stroke, and the administration of therapy aimed at thrombolysis (the process of breaking up or dissolving blood clots) to eligible patients<sup>2-4</sup> Established interventions for secondary prevention of ischemic stroke include antithrombotic agents, warfarin for those with atrial fibrillation, and carotid endarterectomy for symptomatic, high-grade carotid stenosis.<sup>5-7</sup> Such interventions require specialized institutional resources, including clinicians with expertise in stroke, organized interdisciplinary stroke care teams and units, rapid access to computed tomography (CT) or magnetic resonance imaging (MRI) scanning, and expert interpretation of neuroimaging results.

In Ontario, previous studies have shown wide variations in the availability of stroke care resources in acute care institutions across the province.<sup>8,9</sup> In order to address this, and to ensure that Ontarians have access to high-quality stroke care throughout the province, Ontario developed a “coordinated stroke strategy.” This strategy was launched by the Heart and Stroke Foundation of Ontario in 1998, and is now funded and supported by the Ontario Ministry of Health and Long-Term Care.<sup>10</sup> The strategy, which was fully implemented by 2005, is now known as the Ontario Stroke System (OSS). The Ontario Stroke System (OSS) seeks to improve both access to and quality of services across the continuum of stroke care, from primary prevention to pre-hospital and acute care to rehabilitation and community reengagement.

Within the OSS, the province is divided into regions; each has a Regional Stroke Centre or Enhanced District Stroke Centre. This is typically a large institution with specific stroke care resources (CT, MRI, cerebral angiography, neurology and neurosurgery), which is responsible for coordinating stroke care within its region (see Appendix B). Each region may also have one or more District Stroke Centres, which provide some stroke-specific resources (for example, CT scanning and a clinician with stroke expertise); the remaining hospitals are classified as community or non-designated hospitals.

With respect to emergency and acute stroke care, the Ontario Stroke System aims to coordinate and optimize stroke care through the implementation of symptom awareness campaigns, practice guidelines, care maps and collaborative arrangements among institutions. Regional transfer agreements and bypass protocols exist to permit the movement of stroke patients among these institutions, so that patients with acute stroke who would normally be seen at non-designated hospitals may be investigated and managed at larger centres with appropriate resources.

Within the OSS, ongoing monitoring and evaluation are considered essential to ensure the implementation of best practices and evidence-based stroke care. The Registry of the Canadian Stroke Network (RCSN) was established in 2001; its mandate includes the measurement and monitoring of the quality of stroke care delivery in Ontario.<sup>11</sup> The RCSN performs a province-wide audit of stroke care in Ontario every two years, a process which began in 2002/03. The purpose of the RCSN Ontario Stroke Audit data is to evaluate the characteristics, management and outcomes of stroke patients in Ontario and to make comparisons by Ontario Stroke System region, by institutional designation within the Stroke System (Regional Stroke Centre, District Stroke Centre, non-designated hospital); and by Local Health Integration Network (LHIN).

## Methods

### Participating Institutions

All Ontario acute care institutions, excluding children's and mental health care hospitals and those with fewer than 10 stroke or transient ischemic attack (TIA) separations per year, participated in the RCSN Ontario Stroke Audit. Based on the annual number of visits or admissions for stroke or TIA, institutions were categorized as low-volume (<33), medium-volume (33–99) or high-volume (>100). Institutions were also classified as Regional Stroke Centres, District Stroke Centres or non-designated hospitals, based on their designation within the Ontario Stroke System (OSS). No institutions had been classified as enhanced District Stroke Centres at the time of the 2002/03 audit, so this category was not included in the current analyses. Regional Stroke Centres included hospitals from both the community and academic hospital peer groups; however, they were treated as a distinct category because of their stroke-specific resources (see Appendix A).

### Patient Sample

All patients seen in the emergency department or admitted to hospital between April 1, 2004 and March 31, 2005 with a most responsible diagnosis of stroke or TIA were eligible for inclusion in the 2004/05 audit. Stroke/TIA separations were identified from the discharge abstract database (DAD) and the National Ambulatory Care Reporting System (NACRS) databases—maintained by the Canadian Institute for Health Information (CIHI)—using the International Classification of Diseases, Tenth Revision (ICD-10-CA) codes I60, I61, I63, I64, H34.1 and G45 (excluding G45.4). For individuals with both NACRS and DAD separations, only the DAD separation was included. For any observed discrepancies between the NACRS and DAD diagnoses, the DAD diagnosis was considered to be correct. For individuals with more than one stroke/TIA during the sampling timeframe, only the first stroke/TIA event was included. From all eligible cases, a simple random sample of 21 percent was selected, with over-sampling performed at low-volume institutions such that each institution contributed a minimum of 10 cases.

### Data Abstraction and Management

The overall research project was approved by the Research Ethics Board at Sunnybrook Health Sciences Centre in Toronto, Ontario, Canada, with additional approval by research ethics boards at participating institutions where required.

Centrally-trained neurology research nurses performed chart abstraction at the participating hospitals. Data were collected on all aspects of acute stroke management, including patient sociodemographics, the use of pre-hospital emergency medical services, and in-hospital and emergency department management, complications and outcomes.

Data were entered electronically into a custom designed Microsoft Access database on Fujitsu Lifebook® touch screen laptop computers that enhanced data validity by checking ranges and internal data consistency at the time of data entry. The program anonymized and encrypted the data before transferring them via a secure telephone line to the Institute for Clinical Evaluative Science (ICES) in Toronto. The aggregate dataset was managed and analyzed by the RCSN team at ICES. Chart validation revealed that inter-rater agreement was substantial or almost perfect ( $\kappa > 0.80$ ) for key variables including age, sex, date of stroke, use of thrombolysis and in-hospital mortality. At ICES, unique patient identification numbers were used to link the RCSN database with the Ontario Registered Persons Database to obtain information on deaths that occurred after discharge from hospital.



## Statistical Analysis

Results are presented for the entire province, for each Stroke System region, by Local Health Integration Network (LHIN), and by hospital type within the Stroke System (Regional Stroke Centre, District Stroke Centre, non-designated hospital.) Analyses by Stroke System designation are based on individual hospital sites rather than on institutions, since several institutions had multiple sites, and in some cases, one site within a multi-site institution was a Regional or District Stroke Centre, while the remaining site(s) were not.

Results were weighted based on hospital volume and the number of charts sampled, in order to account for over-sampling at low-volume institutions. The weight assigned to a record is inversely proportional to the probability of that record being selected for inclusion in the study. By using the weights in our analysis, we obtained an estimate that applied to the entire “population” of discharge records.

The characteristics, management and in-hospital outcomes of stroke patients by region and institution type were compared using Rao-Scott Chi-square tests for categorical variables. SAS V9 was used for all analyses, except median. The medians for continuous variables were analyzed using SUDAAN V10. Age- and sex-adjusted 30-day all-cause mortality rates were calculated with stratification by stroke type (ischemic vs. hemorrhagic). For analyses of mortality, the entire CIHI DAD and NACRS population was used rather than the audit sample.

## Results

Overall, 153 acute care institutions (with 154 individual hospital sites) were eligible, and all agreed to participate in the 2004/05 RCSN Ontario Stroke Audit (Appendix B). Of these, 34 sites (22 percent) were low-volume; 49 sites (32 percent) were medium-volume; and 71 sites (46 percent) were high-volume (see Exhibit 1). Within the Ontario Stroke Strategy, 128 sites (83 percent) were non-designated hospitals; 17 sites (11 percent) were designated as District Stroke Centres (DSCs); and nine sites (six percent) were designated as Regional Stroke Centres (RSCs). Non-designated hospitals accounted for 64 percent of all stroke visits during the study period; DSCs accounted for 20 percent of all visits; and RSCs accounted for 16 percent of all visits (see Exhibit 4).

### Baseline Characteristics (Exhibits 3–5)

According to the Ontario 2004/05 Stroke Audit, there were 23,800 hospitalizations or emergency department visits for acute stroke or transient ischemic attack (TIA) during the study period. The initial audit sample included 5,032 charts. Of these, 119 charts were excluded because they were missing or because it was determined after review that the diagnosis of stroke or TIA was incorrect. The total sample size was 4,913 stroke events (representing 21 percent of the total stroke population). Overall, 51 percent of patients were women; the mean age at stroke presentation was 73 years (see Exhibit 3). There were significant differences in stroke presentation among regions and among different types of hospitals (see Exhibits 3–5).

The final diagnoses were as follows: ischemic stroke (46 percent); TIA (in 34 percent); intracerebral hemorrhage [ICH] (seven percent); and subarachnoid hemorrhage [SAH] (three percent). Approximately 10 percent of patients were categorized as “unable to determine” compared to six percent who fell into this category in the 2002/03 audit (see Exhibit 4). Patients at non-designated hospitals were significantly more likely to have an undetermined stroke type (12 percent vs. 9.7 percent of those treated at DSCs and 2.6 percent of those seen in RSCs); this was partly due to lower neuroimaging rates at non-designated hospitals. Overall, the presence of established stroke risk factors was high: 62 percent of patients had hypertension; 24 percent had a history of diabetes; 30 percent had hyperlipidemia; 14 percent were current smokers; and 14 percent had atrial fibrillation. These findings were similar to those seen in 2002/03.

## **Pre-hospital and Emergency Care (Exhibits 6–8)**

In 2004/05, 32.5 percent of Ontario stroke patients presented to hospital within 2.5 hours of stroke onset; 55 percent were transported to health care facilities by ambulance; and 65 percent of those who went to hospital were admitted. These results were similar to those seen in 2002/03. There were significant regional variations in the proportion of patients presenting within 2.5 hours of stroke onset and in the proportion of patients admitted to hospital.

## **Thrombolysis (Exhibits 9–14)**

Thrombolysis was administered to 3.9 percent of patients with ischemic stroke in 2004/05, with no significant change compared to 2002/03. However, among patients with ischemic stroke who presented within 2.5 hours of symptom onset, 14.1 percent received intravenous (IV) tissue plasminogen activator (tPA)—a significant increase compared to 9.5 percent of similar patients in 2002/03. Rates of thrombolysis were higher at Regional Stroke Centres (RSCs) compared to other types of hospitals (see Exhibit 10). There were wide regional variations in thrombolysis administration rates.

For patients receiving intravenous thrombolysis, the provincial median “door-to-needle” time in 2004/05 was 84 minutes, similar to the rate observed in the 2002/03 audit. Only one Stroke System region (the Southeast region) achieved the benchmark thrombolysis delivery time of 60 minutes (see Exhibit 12). Median door-to-needle times were significantly shorter for patients treated at RSCs compared to those for patients seen at other types of hospitals (see Exhibit 13).

## **Emergency and In-hospital Management (Exhibits 15–29)**

In 2004/05, 82 percent of patients underwent neuroimaging before they were discharged—an increase from the rate of 77 percent observed in 2002/03. Neuroimaging was performed within 24 hours of arrival in the emergency department in 69 percent of patients—an increase from 47 percent of patients in 2002/03.

Forty-nine percent of stroke/TIA patients had carotid imaging performed in hospital or scheduled to be done as an outpatient procedure—an increase from 39 percent of patients in 2002/03. Carotid imaging rates were higher at Regional Stroke Centres (RSCs) compared to other types of hospitals (see Exhibit 20). There were significant variations in carotid imaging rates by Ontario Stroke System (OSS) and by Local Health Integration Networks or LHINs (see Exhibits 18 and 20). Eleven percent of patients were admitted to an acute stroke unit—a significant increase compared to 2.7 percent of patients in 2002/03. Rates of stroke unit admission were significantly higher at RSCs compared to other hospital types, and there were significant variations in stroke unit admission rates across OSS regions and LHINs. Dysphagia screening was performed in 51 percent of stroke patients—an increase from 47 percent of patients in 2002/03.

In 2004/05, 92 percent of patients with ischemic stroke or TIA were prescribed antithrombotic agents at discharge; 44 percent were prescribed lipid-lowering medications; 36 percent were prescribed angiotensin-converting enzyme (ACE) inhibitors; and 74 percent of those with atrial fibrillation were prescribed warfarin. There were significant increases in the rates of prescription of all of these secondary prevention drug therapies, with exception of warfarin in patients with atrial fibrillation. Rates of prescribing were similar across hospital types; however, differences were observed across both OSS and LHINs (see Exhibits 21–23).



## Length of Stay, Discharge Status and Destination, and 30-day Mortality (Exhibits 30–47)

For patients with stroke or TIA who were admitted to Ontario hospitals in 2004/05, the median length of stay was 6.5 days, a decrease of almost one day compared to 2002/03 (see Exhibits 30–32). At discharge, 53 percent had a Rankin score\* <2 (indicating minimal disability); this proportion was similar to that seen in 2002/03. Overall, 55 percent of patients were discharged home, 10 percent went to a nursing home or long-term care facility, and 15.5 percent were discharged to an inpatient rehabilitation facility. These findings were similar to those seen in 2002/03. However, in the subgroup of patients with moderate to severe disability (Rankin score of 3 to 5), 35 percent were discharged to inpatient rehabilitation in 2004/05—a decrease from 42 percent of similar patients in 2002/03. In addition, persistent differences were noted in discharge destination rates by institutional designation within the Ontario Stroke System (i.e., Regional Stroke Centre, District Stroke Centre, non-designated hospital) and across OSS regions and LHINs (see Exhibits 33–35).

The proportion of patients referred to secondary stroke prevention clinics after discharge was 29.1 percent, a significant increase from 14.1 percent in 2002/03. Referral rates were higher at Regional Stroke Centres compared to other hospital types. There were variations in secondary prevention clinic referral rates across OSS regions and LHINs (see Exhibits 39–41).

## Discussion

This is the second population-based audit of stroke care in Ontario, with a focus on recognized quality of care indicators.<sup>12,13</sup> Compared to the 2002/03 audit, the 2004/05 audit found significant improvements in multiple elements of stroke care delivery, including thrombolysis, stroke unit admissions, neuroimaging rates, carotid imaging rates, medications for secondary stroke prevention and referrals to secondary prevention clinics. These widespread improvements illustrate the impact of a coordinated stroke system which has matured and extends beyond the province's regional stroke centres.

However, despite the observed improvements in stroke care delivery between 2002/03 and 2004/05, rates of use of some interventions remain low, and regional variations persist. For example, during the latest study period, substantially higher rates of thrombolysis, neuroimaging and other interventions took place in Regional Stroke Centres compared to other types of hospitals; these rates also differed for patients treated in certain regions of the province. These findings are consistent with studies from a variety of jurisdictions which have identified gaps and regional variations in stroke care delivery; for example, one Canadian study found lower utilization of neuroimaging in rural institutions.<sup>9, 14–17</sup>

The 2004/05 finding that rates of thrombolysis use across much of the province remain low—particularly in smaller treatment centres—may relate to a lack of timely neuroimaging or interpretation of test results in these centres. These low rates may also be explained by the limited number of physicians with stroke care expertise in certain facilities and geographic areas. In addition, the costs of acute thrombolytics are not funded directly as part of the Ontario Stroke System (OSS) and must be assumed by each academic hospital. Bypass protocols and cooperative arrangements have been established across OSS regions to allow potentially eligible patients to be taken or transferred to sites with the capacity to administer thrombolysis. Many of these protocols/arrangements have been implemented since the first audit was undertaken in 2002/03, and this may have led to improved rates of thrombolysis administration. The use of telemedicine may also have contributed to the improved performance in thrombolysis administration observed among the non-designated hospitals.

\* The Rankin Scale, a handicap index frequently used in stroke outcome research, rates the effects of stroke as follows:

A score of...

0= no symptoms at all;

1= no significant disability despite symptoms, able to carry out all usual activities;

2= slight disability, unable to carry out all previous activities, but can care for self without assistance;

3= moderate disability requires some help, but able to walk without assistance;

4= moderately severe disability, unable to walk without assistance and unable to care for self without assistance;

5= severe disability requiring constant nursing care and attention.

Addressing other observed gaps in care may require more targeted interventions. For example, the relatively low use of warfarin for patients with atrial fibrillation suggests the need for local quality improvement interventions such as provider feedback, academic detailing and education. Stroke symptom and public awareness campaigns may be important strategies for decreasing pre-hospital delays and increasing the proportion of patients eligible for thrombolysis. For instance, evaluation of a public awareness campaign by the Heart and Stroke Foundation of Ontario found that 72 percent of people surveyed in August 2005 were able to identify at least two signs and symptoms of stroke. Many were aware of the need to treat this as a medical emergency—a marked increase from the 2003 polling results where only 52 percent of those surveyed were aware of at least two signs and symptoms of stroke (Heart and Stroke Foundation of Ontario, 2005, unpublished data).

One of the challenges involved in increasing public awareness of stroke is Ontario's multicultural, multilingual population. The public service announcements and TV advertisements by the Heart and Stroke Foundation have all been broadcast in English. As well, in 2005, in an effort to improve timely arrival by ambulance to emergency departments, the OSS and Emergency Medical Services (EMS) within the OSS regions developed and implemented the acute stroke protocol. This protocol involves redirecting appropriate stroke patients to designated stroke centres. We await the next audit to see if the refocused television ad campaign and the new EMS acute stroke protocol result in more timely arrival of patients with suspected stroke to hospital emergency departments in Ontario.

In addition to variations in the delivery of care to Ontarians with stroke, we observed significant regional and inter-institutional variations in stroke outcomes. Compared to those seen at other centres, patients at Regional Stroke Centres (RSCs) had longer lengths of stay, were more likely to be discharged to inpatient rehabilitation facilities, and were more likely to have measurable disability at the time of discharge (as measured by a modified Rankin score of 3 or greater). This likely reflects the higher proportion of patients seen at RSCs presenting with severe stroke (including intracerebral and subarachnoid hemorrhage); research shows that initial stroke severity is the most important predictor of functional outcome. As stroke care becomes more concentrated in RSCs, it will be important to monitor provincial stroke mortality rates to see if these decline over time. We do not have information on other important stroke outcomes, such as long-term functional status and quality of life.

The latest audit found that, among patients with moderate to severe disability after stroke, the proportion of those discharged from hospital to inpatient rehabilitation facilities had declined—from 42 percent in 2002/03 to 35 percent in 2004/05. The reasons for this decrease are not known, but deserve further study, to ensure that all patients who might benefit from inpatient stroke rehabilitation have access to this intervention.

The Ontario Stroke System (OSS) was developed to ensure that all Ontarians have access to optimal stroke care. This 2004/05 audit was undertaken two years after most regions had fully developed or implemented a strategy, so the results should be viewed as “close to capacity” for the full potential effectiveness of the OSS. It is reassuring to note the significant improvements in the quality of stroke care delivery across the province compared to 2002/03. Future audits should provide valuable information about the effectiveness and quality of stroke care within a well-established provincial system.

## Exhibits and Findings

### Exhibit 1a Characteristics of participating hospitals, by Ontario Stroke System (OSS) region, April 1, 2004 to March 31, 2005

Ontario Stroke System (OSS) Regions →		Ontario institutions	[1] Southwest	[2] Central South	[3] West GTA	[4] Toronto West	[5] South East Toronto	[6] North and East GTA	[7] Central East	[8] Southeast	[9] Champlain	[10] Northeast	[11] Northwest
<b>Number of hospitals</b>		<b>154</b>	<b>34</b>	<b>24</b>	<b>7</b>	<b>6</b>	<b>4</b>	<b>4</b>	<b>19</b>	<b>9</b>	<b>18</b>	<b>21</b>	<b>8</b>
<b>Designation within the Stroke System (n)</b>	Non-designated	<b>128</b>	28	20	6	5	3	3	16	7	16	17	7
	District Stroke Centre	<b>17</b>	5	3	0	0	0	0	3	1	1	4	0
	Regional Stroke Centre	<b>9</b>	1	1	1	1	1	1	0	1	1	0	1
<b>Annual stroke patient volume (n)***</b>	Low (<33 patients)	<b>34</b>	9	2	0	0	0	0	0	1	6	11	5
	Medium (33–99 patients)	<b>49</b>	13	8	1	0	0	0	7	4	7	7	2
	High (≥100 patients)	<b>71</b>	12	14	6	6	4	4	12	4	5	3	1
<b>Location (n)***</b>	Urban	<b>90</b>	15	19	7	6	4	4	14	5	8	6	2
	Rural	<b>64</b>	19	5	0	0	0	0	5	4	10	15	6
<b>Ontario hospital peer group (n)***</b>	Large Community	<b>102</b>	28	15	7	3	3	3	16	7	9	8	3
	Small Community	<b>36</b>	3	4	0	0	0	0	3	1	7	13	5
	Academic	<b>16</b>	3	5	0	3	1	1	0	1	2	0	0
<b>Stroke unit on site (n)*</b>		<b>31</b>	5	3	4	3	1	3	4	1	2	4	1

**Annual stroke patient volume:**  
Indicates the annual number of hospital separations (inpatient and emergency) for stroke or transient ischemic attack.

**Non-designated:**  
Acute care hospital that does not fit the definition of District or Regional Stroke Centre.

**District Stroke Centre:** Facilities with written stroke protocols for emergency services, emergency department and acute care including: transport and triage protocols; ability to offer thrombolytic therapy to suitable ischemic stroke patients; timely computed tomography (CT) scanning and expert interpretation; clinicians with stroke expertise; and, linkages to rehabilitation and secondary prevention.

**Regional Stroke Centre:**  
All the requirements of a District Stroke Centre, plus neurosurgical facilities and interventional radiology.

**Stroke unit:**  
Specialized, geographically-located hospital unit with dedicated stroke team and stroke resources.

#### Ontario hospital peer group:

**Small community hospitals:** Facilities that generally provide less than 3,500 weighted cases per year, have a referral population of less than 20,000 people, and are the only hospital in their community, as defined by the Joint Policy and Planning Committee.

**Academic hospitals:** University-affiliated facility; member of the Council of Academic Hospitals of Ontario.

**Large community hospitals:** All other hospitals.

Significance levels used [p=p-value]: \*p<0.05; \*\*p<0.01; \*\*\*p<0.001 for comparisons across OSS regions in 2004/05.

#### Findings

- There were regional variations in hospital characteristics, including patient volume, location (urban vs. rural), peer group and stroke unit availability.

**Exhibit 1b Characteristics of participating hospitals, by Ontario Stroke System (OSS) designation, April 1, 2004 to March 31, 2005**

Ontario Stroke System (OSS) Designations →		Ontario	Non-designated Hospital	District Stroke Centre	Regional Stroke Centre
<b>Number of hospitals</b>		<b>154</b>	<b>128</b>	<b>17</b>	<b>9</b>
<b>Annual stroke patient volume (n)***</b>	Low (<33 patients)	<b>34</b>	34	0	0
	Medium (33–99 patients)	<b>49</b>	48	1	0
	High (≥100 patients)	<b>71</b>	46	16	9
<b>Location (n)***</b>	Urban	<b>90</b>	64	17	9
	Rural	<b>64</b>	64	0	0
<b>Ontario hospital peer group (n)***</b>	Large Community	<b>102</b>	83	17	2
	Small Community	<b>36</b>	36	0	0
	Academic	<b>16</b>	9	0	7
<b>Stroke unit on site (n)***</b>		<b>31</b>	10	12	9

**Annual stroke patient volume:** Indicates the annual number of hospital separations (inpatient and emergency) for stroke or transient ischemic attack.

**Non-designated:** Acute care hospital that does not fit the definition of District or Regional Stroke Centre.

**District Stroke Centre:** Facilities with written stroke protocols for emergency services, emergency department and acute care including: transport and triage protocols; ability to offer thrombolytic therapy to suitable ischemic stroke patients; timely computed tomography (CT) scanning and expert interpretation; clinicians with stroke expertise; and, linkages to rehabilitation and secondary prevention.

**Regional Stroke Centre:** All the requirements of a District Stroke Centre, plus neurosurgical facilities and interventional radiology.

**Stroke unit:** Specialized, geographically-located hospital unit with dedicated stroke team and stroke resources.

**Ontario hospital peer group:**

**Small community hospitals:** Facilities that generally provide less than 3,500 weighted cases per year, have a referral population of less than 20,000 people, and are the only hospital in their community, as defined by the Joint Policy and Planning Committee.

**Academic hospitals:** University-affiliated facility; member of the Council of Academic Hospitals of Ontario.

**Large community hospitals:** All other hospitals.

Significance levels used [p=p-value]: \*p<0.05; \*\*p<0.01; \*\*\*p<0.001 for comparisons across OSS designations in 2004/05.

**Findings**

- Regional stroke centres were all high-volume urban facilities with stroke units on-site; seven out of nine were also academic institutions. Non-designated hospitals were more likely than other hospital types to be low-volume in terms of stroke patients, to be located in rural areas, and to be small community hospitals.
- Only 10 of 128 non-designated hospitals had stroke units on-site.

**Exhibit 2 Characteristics of participating hospitals, by Ontario Local Health Integration Network (LHIN),  
April 1, 2004 to March 31, 2005**

LHINs →		Ontario	1 Erie St. Clair	2 South West	3 Waterloo Wellington	4 Hamilton Niagara Haldimand Brant	5 Central West	6 Mississauga Halton	7 Toronto Central	8 Central	9 Central East	10 South East	11 Champlain	12 North Simcoe Muskoka	13 North East	14 North West
<b>Number of hospitals</b>		<b>154</b>	<b>7</b>	<b>27</b>	<b>7</b>	<b>17</b>	<b>3</b>	<b>4</b>	<b>7</b>	<b>8</b>	<b>12</b>	<b>10</b>	<b>17</b>	<b>6</b>	<b>21</b>	<b>8</b>
<b>Designation within the Stroke System (n)</b>	Non-designated	<b>128</b>	4	24	6	14	3	3	4	7	11	8	15	5	17	7
	District Stroke Centre	<b>17</b>	3	2	1	2	0	0	0	1	1	1	1	1	4	0
	Regional Stroke Centre	<b>9</b>	0	1	0	1	0	1	3	0	0	1	1	0	0	1
<b>Annual stroke patient volume (n)**</b>	Low (<33 patients)	<b>34</b>	0	9	1	1	0	0	0	0	0	1	6	0	11	5
	Medium (33–99 patients)	<b>49</b>	2	11	2	6	0	1	0	2	3	5	6	2	7	2
	High (≥100 patients)	<b>71</b>	5	7	4	10	3	3	7	6	9	4	5	4	3	1
<b>Location (n)***</b>	Urban	<b>90</b>	6	9	4	15	3	4	7	8	9	5	8	4	6	2
	Rural	<b>64</b>	1	18	3	2	0	0	0	0	3	5	9	2	15	6
<b>Ontario hospital peer group (n)***</b>	Large Community	<b>102</b>	7	21	5	10	3	4	2	7	10	8	8	6	8	3
	Small Community	<b>36</b>	0	3	2	2	0	0	0	1	2	1	7	0	13	5
	Academic	<b>16</b>	0	3	0	5	0	0	5	0	0	1	2	0	0	0
<b>Stroke unit on site (n)*</b>		<b>31</b>	2	3	1	2	2	2	5	3	2	1	2	1	4	1

**Annual stroke patient volume:** Indicates the annual number of hospital separations (inpatient and emergency) for stroke or transient ischemic attack.

**Non-designated:** Acute care hospital that does not fit the definition of District or Regional Stroke Centre.

**District Stroke Centre:** Facilities with written stroke protocols for emergency services, emergency department and acute care including: transport and triage protocols; ability to offer thrombolytic therapy to suitable ischemic stroke patients; timely computed tomography (CT) scanning and expert interpretation; clinicians with stroke expertise; and, linkages to rehabilitation and secondary prevention.

**Regional Stroke Centre:** All the requirements of a District Stroke Centre, plus neurosurgical facilities and interventional radiology.

**Stroke unit:** Specialized, geographically-located hospital unit with dedicated stroke team and stroke resources.

**Ontario hospital peer group:**

**Small community hospitals:** Facilities that generally provide less than 3,500 weighted cases per year, have a referral population of less than 20,000 people, and are the only hospital in their community, as defined by the Joint Policy and Planning Committee.

**Academic hospitals:** University-affiliated facility; member of the Council of Academic Hospitals of Ontario.

**Large community hospitals:** All other hospitals.

Significance levels used [p=p-value]: \*p<0.05; \*\*p<0.01; \*\*\*p<0.001 for comparisons across LHINs in 2004/05.

**Findings**

- There were significant variations in patient demographics and stroke risk factors across OSS regions.

**Exhibit 3 Patient demographics and presentation, by Ontario Stroke System (OSS) region, April 1, 2004 to March 31, 2005**

Patients with stroke or transient ischemic attack seen in the emergency department or admitted to hospital													
Ontario Stroke System (OSS) Regions ➔		Ontario	[1] Southwest	[2] Central South	[3] West GTA	[4] Toronto West	[5] South East Toronto	[6] North and East GTA	[7] Central East	[8] Southeast	[9] Champlain	[10] Northeast	[11] Northwest
<b>Number (provincial total)</b>		<b>23,800</b>	<b>3,560</b>	<b>4,279</b>	<b>2,491</b>	<b>1,760</b>	<b>1,250</b>	<b>1,848</b>	<b>3,438</b>	<b>1,062</b>	<b>2,214</b>	<b>1,382</b>	<b>516</b>
<b>Number (audit sample)</b>		<b>4,913</b>	<b>872</b>	<b>814</b>	<b>420</b>	<b>292</b>	<b>215</b>	<b>308</b>	<b>619</b>	<b>234</b>	<b>542</b>	<b>437</b>	<b>160</b>
<b>Female sex (%)</b>		<b>51.2</b>	51.6	52.4	46.4	51.1	54.2	54.2	49.9	50.4	53.6	49.2	46.9
<b>Mean age (years)**</b>		<b>73.0</b>	72.8	72.8	71.8	71.3	72.1	73.7	74.2	73.9	74.4	73.3	68.7
<b>Persons living alone (%)**</b>		<b>19.7</b>	18.7	20.5	14.7	19.1	22.8	16.2	19.5	24.7	19.2	26.2	25.2
<b>Rural residence (%)***</b>		<b>16.4</b>	27.9	10.8	3.4	0.7	1.8	0.6	20.2	41.4	24.2	34.9	32.6
<b>Stroke Type (%)***</b>	Intracerebral hemorrhage	<b>7.1</b>	4.6	7.4	7.9	10.3	7.4	10.4	8.5	5.2	4.0	5.6	4.3
	Ischemic stroke	<b>46.0</b>	42.9	45.2	50.9	51.5	49.0	51.0	43.3	51.8	39.9	44.4	45.2
	Subarachnoid hemorrhage	<b>3.3</b>	3.2	3.1	4.3	4.8	3.4	4.9	2.5	3.3	2.9	0.9	2.3
	Transient ischemic attack	<b>33.8</b>	31.6	35.4	31.6	26.2	31.4	28.2	35.8	30.8	40.3	39.9	46.9
	Undetermined stroke type	<b>9.8</b>	17.6	9.0	5.3	7.2	8.8	5.5	9.9	8.9	12.9	9.2	1.4
<b>Medical History (%)</b>	Independent prior to admission***	<b>74.7</b>	79.2	73.8	74.5	68.8	71.9	68.2	75.2	77.2	80.0	69.4	85.7
	Prior stroke/TIA	<b>34.1</b>	36.4	34.0	31.6	27.9	32.6	31.5	34.8	35.9	37.7	36.3	35.5
	Diabetes**	<b>23.7</b>	24.3	25.3	26.5	24.0	27.3	19.5	18.9	28.9	20.4	27.0	24.8
	Hypertension	<b>61.6</b>	65.5	59.3	62.9	57.6	60.0	64.0	60.2	61.4	63.7	61.4	56.6
	Current smoker***	<b>14.1</b>	16.1	13.4	12.4	12.0	17.3	4.9	15.3	15.3	13.3	19.0	26.6
	Hyperlipidemia*	<b>30.2</b>	31.2	31.3	34.2	30.5	35.7	30.8	27.6	28.0	28.5	23.4	23.6
	Atrial fibrillation**	<b>13.9</b>	11.3	13.6	11.6	11.3	12.6	19.2	15.1	15.9	15.4	12.7	22.1
	Myocardial infarction*	<b>13.5</b>	13.5	11.6	12.3	11.5	18.1	14.9	12.7	16.1	12.9	19.7	10.5

Significance levels used [p=p-value]: \*p<0.05; \*\*p<0.01; \*\*\*p<0.001 for comparisons across OSS regions in 2004/05.

**Findings**

- There were significant variations in patient demographics and stroke risk factors across OSS regions.

**Exhibit 4 Patient demographics and presentation, by Ontario Stroke System (OSS) designation, April 1, 2004 to March 31, 2005**

Patients with stroke or transient ischemic attack seen in the emergency department or admitted to hospital		Ontario	Non-designated Hospital	District Stroke Centre	Regional Stroke Centre
Ontario Stroke System (OSS) Designations ➔					
<b>Number (provincial total)</b>		<b>23,800</b>	<b>14,598</b>	<b>4,720</b>	<b>4,482</b>
<b>Number (audit sample)</b>		<b>4,913</b>	<b>3,141</b>	<b>985</b>	<b>787</b>
Female sex (%)		51.2	51.6	51.7	49.1
Mean age (years)***		73.0	73.7	73.4	70.1
Person living alone (%)		19.7	19.8	21.0	17.6
Rural residence (%)***		16.4	20.6	12.6	6.7
Stroke Type (%)***	Intracerebral hemorrhage	7.1	5.4	7.9	11.5
	Ischemic stroke	46.0	44.4	47.4	50.1
	Subarachnoid hemorrhage	3.3	1.7	1.5	10.4
	Transient ischemic attack	33.8	36.5	33.5	25.4
	Undetermined stroke type	9.8	12.1	9.7	2.6
Medical History (%)	Independent prior to admission	74.7	75.0	75.4	73.1
	Prior stroke/TIA	34.1	34.0	36.7	31.5
	Diabetes	23.7	23.8	25.0	22.0
	Hypertension	61.6	62.1	62.7	58.8
	Current smoker**	14.1	12.7	15.9	16.8
	Hyperlipidemia*	30.2	31.3	26.3	30.5
	Atrial fibrillation	13.9	14.3	13.6	12.9
	Myocardial infarction	13.5	13.3	14.5	13.0

**Non-designated:**  
Acute care hospital that does not fit the definition of District or Regional Stroke Centre.

**District Stroke Centre:** Facilities with written stroke protocols for emergency services, emergency department and acute care including: transport and triage protocols; ability to offer thrombolytic therapy to suitable ischemic stroke patients; timely computed tomography (CT) scanning and expert interpretation; clinicians with stroke expertise; and, linkages to rehabilitation and secondary prevention.

**Regional Stroke Centre:**  
All the requirements of a District Stroke Centre, plus neurosurgical facilities and interventional radiology.

Significance levels used [p=p-value]: \*p<0.05; \*\*p<0.01; \*\*\*p<0.001 for comparisons across OSS designations in 2004/05.

**Findings**

- Compared to other hospitals, regional stroke centres saw a higher proportion of patients with hemorrhagic strokes.
- Compared to other hospital types, non-designated hospitals saw a higher proportion of patients with an undetermined stroke type, likely related to lower rates of neuroimaging.



**Exhibit 5 Patient demographics and presentation, by Ontario Local Health Integration Network (LHIN), April 1, 2004 to March 31, 2005**

Patients with stroke or transient ischemic attack seen in the emergency department or admitted to hospital																
LHINs →		Ontario	1 Erie St. Clair	2 South West	3 Waterloo Wellington	4 Hamilton Niagara Haldimand Brant	5 Central West	6 Mississauga Halton	7 Toronto Central	8 Central	9 Central East	10 South East	11 Champlain	12 North Simcoe Muskoka	13 North East	14 North West
<b>Number (provincial total)</b>		23,800	1,625	1,910	1,306	2,994	982	1,567	1,939	2,505	2,804	1,112	2,130	978	1,433	515
<b>Number (audit sample)</b>		4,913	294	558	265	564	164	268	328	424	493	242	520	187	447	159
<b>Female sex (%)</b>		51.2	53.0	50.6	55.3	50.5	50.2	48.6	51.4	52.4	50.8	51.1	53.6	48.9	48.4	47.8
<b>Mean age (years)*</b>		73.0	72.5	72.8	72.2	72.9	70.6	71.9	73.1	73.5	73.6	73.6	74.6	73.5	73.0	69.0
<b>Persons living alone (%)**</b>		19.7	16.8	21.2	14.9	22.6	14.7	14.9	22.4	15.9	18.9	25.1	18.5	21.8	25.7	26.2
<b>Rural residence (%)***</b>		16.4	11.4	43.1	17.4	7.8	3.1	0.4	0.9	0.7	11.1	43.8	22.6	40.3	36.9	31.8
<b>Stroke Type (%)***</b>	Intracerebral hemorrhage	7.1	4.7	4.9	8.7	6.8	7.9	8.1	9.7	12.3	6.3	4.9	4.2	6.3	5.8	4.3
	Ischemic stroke	46	43.1	42.2	40.4	47.2	50.5	50.4	53.1	46.9	47	53	39.1	43.3	43.5	46
	Subarachnoid hemorrhage	3.3	1.5	4.3	2.3	3.3	6.7	4.5	3.7	3.6	2.4	3.2	3.2	4.7	1.2	2.3
	Transient ischemic attack	33.8	27.1	35.9	41.3	33	29.8	31.7	25.9	31.5	33.6	31.3	40.3	35.7	40.3	45.8
	Undetermined stroke type	9.8	23.6	12.8	7.3	9.7	5.0	5.4	7.5	5.8	10.7	7.6	13.2	10.0	9.2	1.6
<b>Medical History (%)</b>	Independent prior to admission***	74.7	81.4	78.4	73.5	73.7	63.6	80.3	67.0	68.7	77.0	79.2	78.7	75.5	70.1	85.6
	Prior stroke/TIA	34.1	35.1	36.6	31.4	34.9	31.9	28.9	33.8	27.7	35.6	35.3	38.0	36.8	37.1	35.3
	Diabetes*	23.7	25.8	23.5	24.0	25.1	28.7	22.5	24.4	21.4	22.6	27.0	20.5	16.0	28.0	25.6
	Hypertension	61.6	69.7	61.4	58.7	59.3	70.0	57.1	62.5	60.4	62.3	61.4	63.5	57.4	60.4	56.5
	Current smoker**	14.1	16.6	16.4	15.9	12.8	14.9	12.9	14.1	7.3	12.4	16.3	12.4	18.5	18.9	25.6
	Hyperlipidemia***	30.2	32.4	29.7	27.1	33.4	29.9	34.0	36.7	26.0	33.4	27.5	28.7	22.2	24.5	23.3
	Atrial fibrillation**	13.9	10.0	11.8	11.6	14.3	11.7	13.8	11.4	17.0	15.5	16.3	14.8	11.8	13.5	22.1
	Myocardial infarction	13.5	15.6	11.6	8.3	12.9	13.7	11.2	14.3	12.5	15.3	17.4	12.6	12.7	18.9	10.5

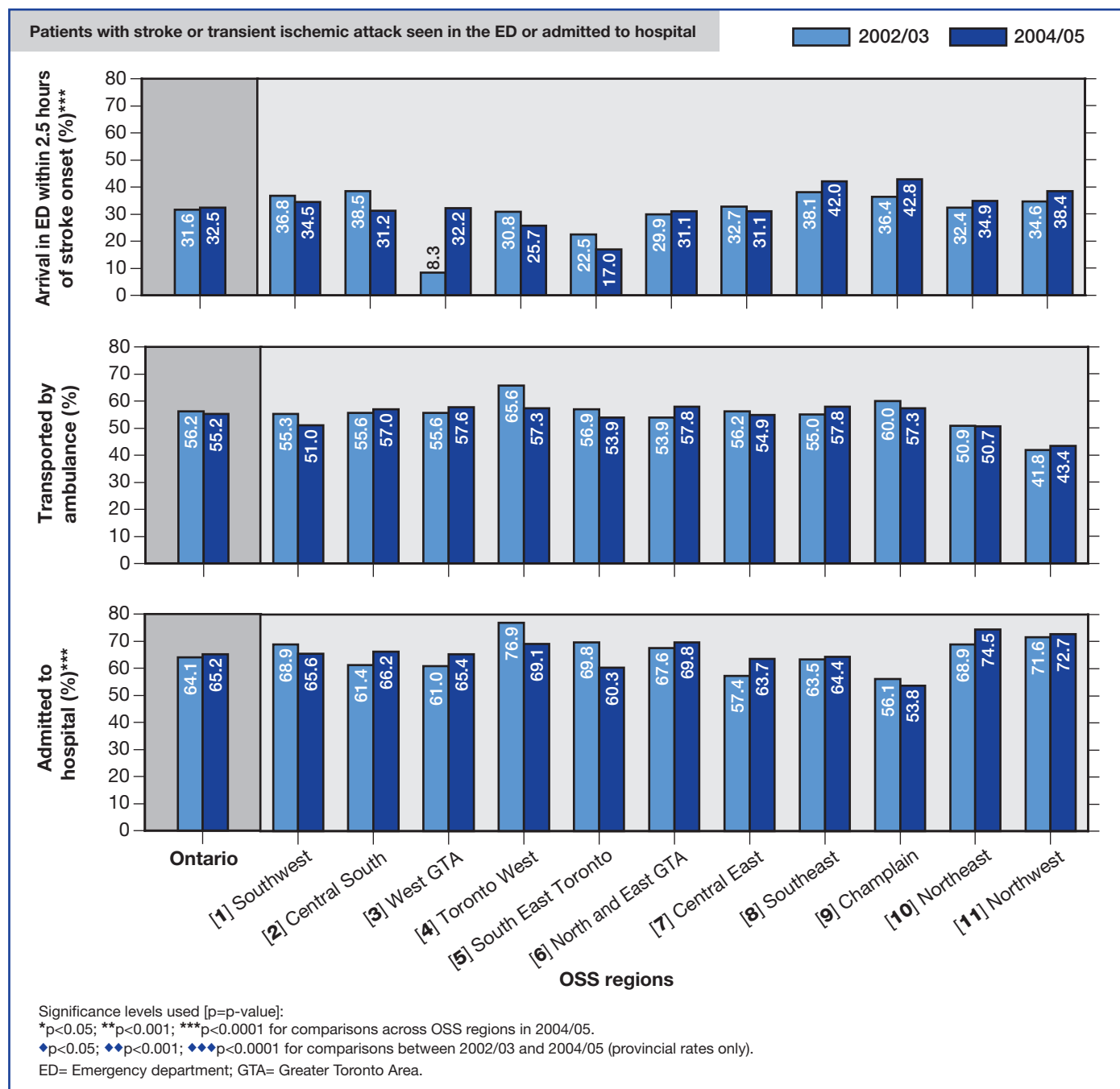
Significance levels used [p=p-value]: \*p<0.05; \*\*p<0.01; \*\*\*p<0.001 for comparisons across LHINs in 2004/05.

**Findings**

- There were significant variations in patient demographics and stroke risk factors across Local Health Integration Networks (LHINs).



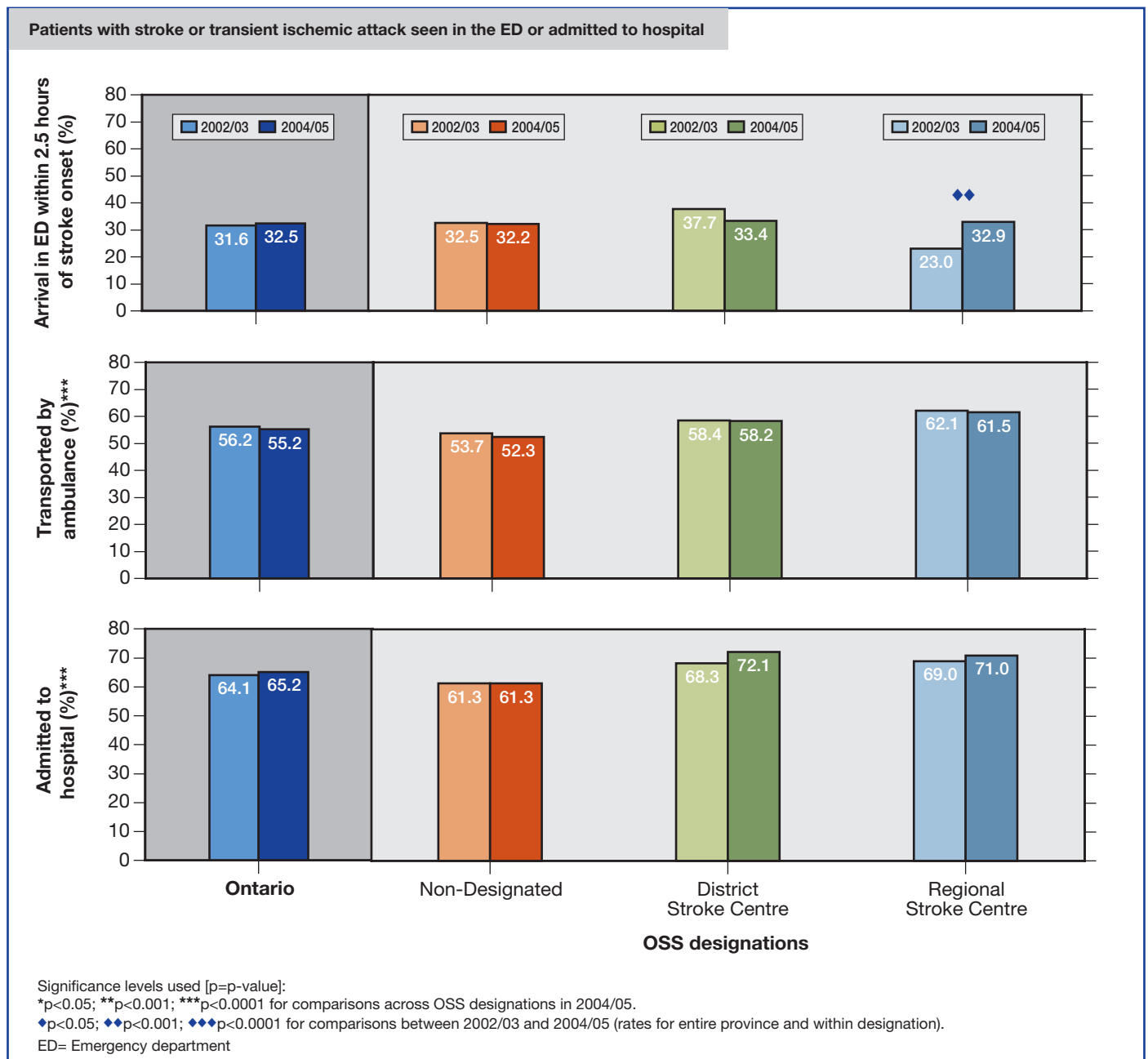
**Exhibit 6 Pre-hospital and emergency stroke care by Ontario Stroke System (OSS) region, 2002/03 and 2004/05**



**Findings**

- Overall, in 2004/05, 32.5 percent of patients arrived at hospital within 2.5 hours of stroke onset, with no significant change compared to 2002/03. There were variations in the proportion of patients arriving within 2.5 hours of stroke onset across OSS regions, with a range of 17.0 percent (South East Toronto) to 42.8 percent (Champlain).
- In 2004/05, 55.2 percent of patients were transported to hospital by ambulance, with no significant change compared to 2002/03, and no significant regional variation.
- Overall, 65.2 percent of patients were admitted to hospital in 2004/05, with no significant change compared to 2002/03. There were variations in admission rates by OSS region, with a low of 53.8 percent in Champlain and a high of 74.5 percent in the Northeast region.

**Exhibit 7 Pre-hospital and emergency stroke care by Ontario Stroke System (OSS) designation, 2002/03 and 2004/05**



**Non-designated:**  
Acute care hospital that does not fit the definition of District or Regional Stroke Centre.

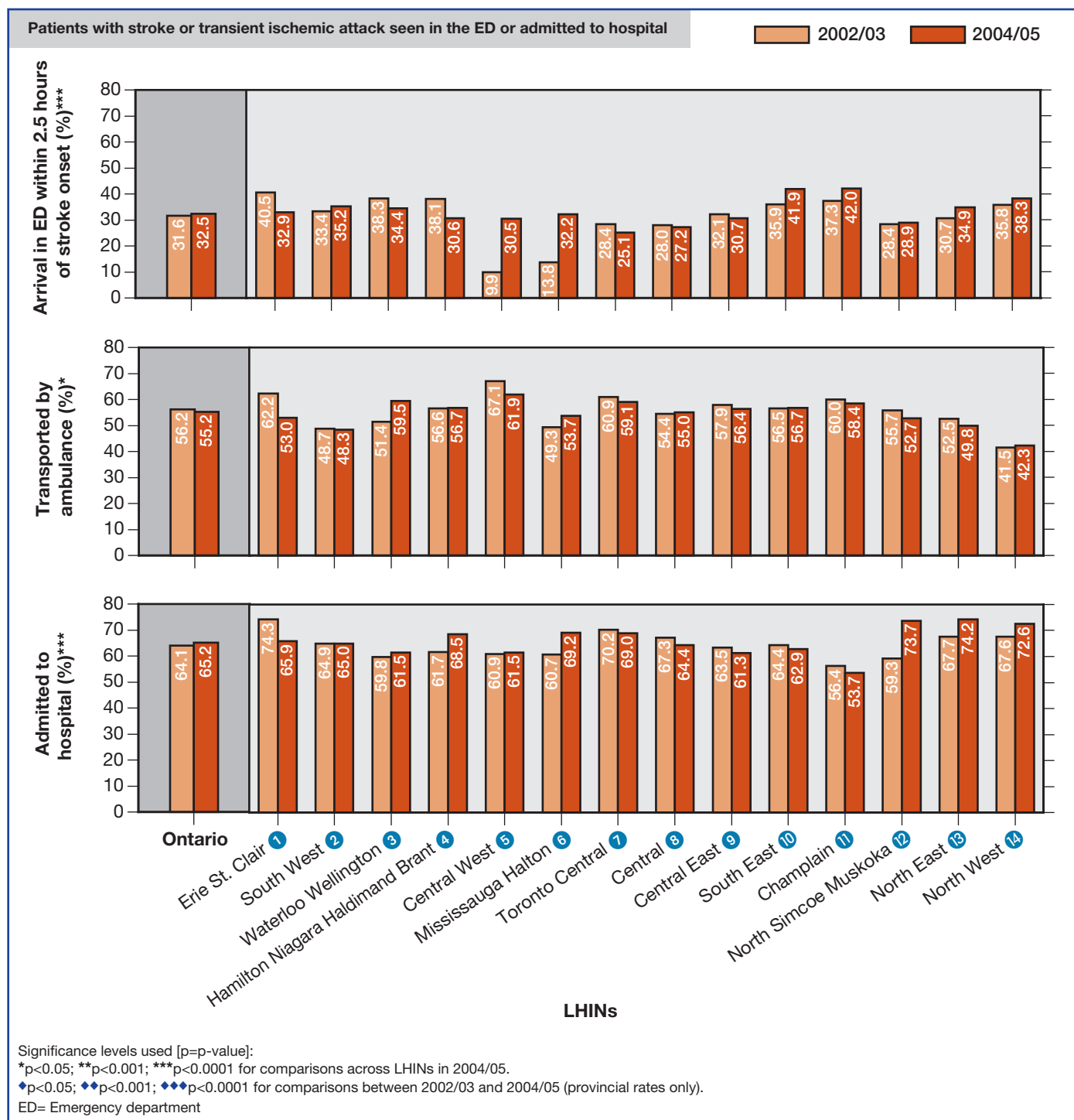
**District Stroke Centre:** Facilities with written stroke protocols for emergency services, emergency department and acute care including: transport and triage protocols; ability to offer thrombolytic therapy to suitable ischemic stroke patients; timely computed tomography (CT) scanning and expert interpretation; clinicians with stroke expertise; and, linkages to rehabilitation and secondary prevention.

**Regional Stroke Centre:**  
All the requirements of a District Stroke Centre, plus neurosurgical facilities and interventional radiology.

**Findings**

- Although there was no increase in the proportion of patients arriving in the emergency department within 2.5 hours of stroke onset across the entire province, at regional stroke centres rates increased from 23.0 percent in 2002/03 to 32.9 percent in 2004/05.
- Patients seen at regional stroke centres were more likely than those seen at other hospital types to be transported by ambulance and to be admitted to hospital.

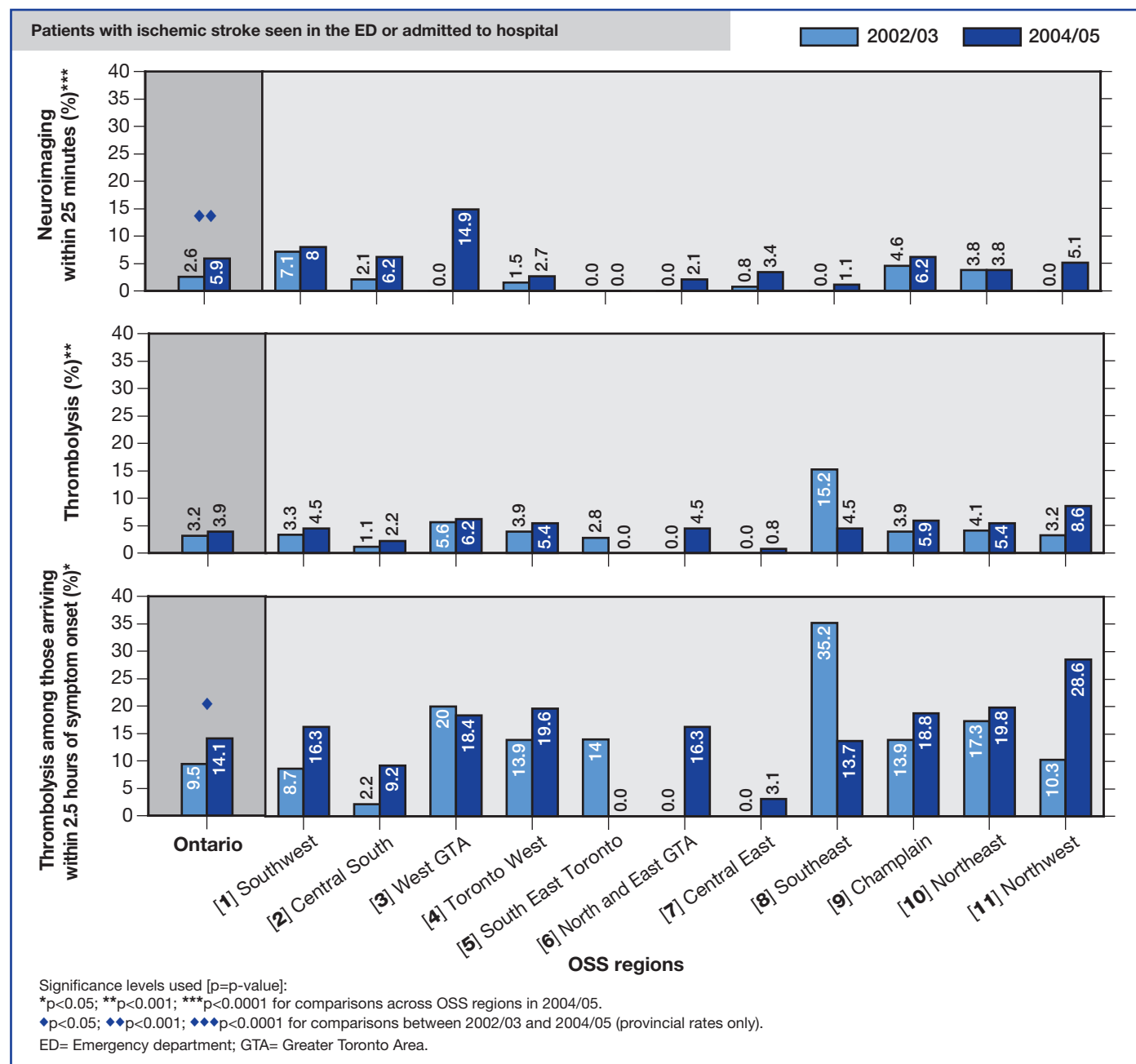
**Exhibit 8 Pre-hospital and emergency stroke care by Ontario Local Health Integration Network (LHIN), 2002/03 and 2004/05**



**Findings**

- There were variations by Local Health Integration Network (LHIN) in the proportion of patients presenting to the emergency department within 2.5 hours of stroke onset, with a low of 25.1 percent in the Toronto Central LHIN and highs of 42.0 percent (Champlain LHIN) and 41.9 percent (South East LHIN).
- There were also variations by LHIN in the proportion of patients transported by ambulance and admitted to hospital.

**Exhibit 9 Proportion (%) of patients with ischemic stroke receiving neuroimaging and thrombolysis, by Ontario Stroke System (OSS) region, 2002/03 and 2004/05†**

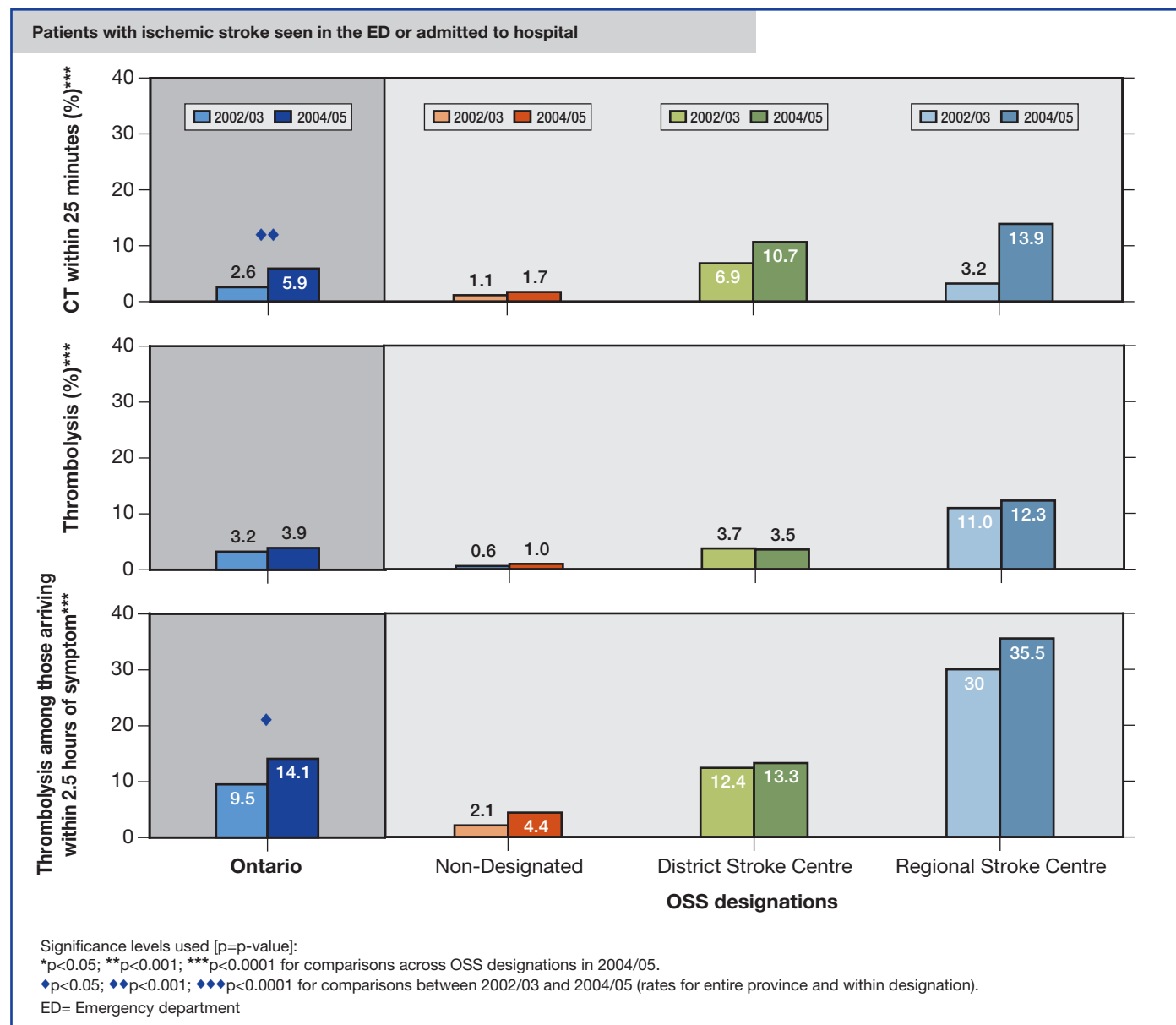


†Although some regions appear to have administered no thrombolysis during the study time frame, other data sources confirm that thrombolysis may have been given in up to 1% of all ischemic stroke patient cases and up to 2% of all ischemic stroke patient cases arriving within 2.5 hours, but these were not captured in the audit sample.

**Findings**

- The overall rate of neuroimaging within 25 minutes of arrival was 5.9 percent in 2004/05—an increase from 2.6 percent in 2002/03. There were significant regional variations in these rates.
- The overall rate of thrombolysis administration in patients with ischemic stroke in 2004/05 was 3.9 percent, with no significant change compared to 2002/03. There was variation in thrombolysis administration rates by OSS region, with a high of 8.6 percent in the Northwest region.
- In the subgroup of patients with ischemic stroke presenting to hospital within 2.5 hours of stroke onset, the provincial thrombolysis administration rate in 2004/05 was 14.1 percent, an increase from 9.5 percent in 2002/03. There were regional variations in thrombolysis admission rates, with a high of 28.6 percent in the Northwest OSS region.

**Exhibit 10 Proportion (%) of patients with ischemic stroke receiving neuroimaging and thrombolysis, by Ontario Stroke System (OSS) designation, 2002/03 and 2004/05†**



**Non-designated:**  
Acute care hospital that does not fit the definition of District or Regional Stroke Centre.

**District Stroke Centre:** Facilities with written stroke protocols for emergency services, emergency department and acute care including: transport and triage protocols; ability to offer thrombolytic therapy to suitable ischemic stroke patients; timely computed tomography (CT) scanning and expert interpretation; clinicians with stroke expertise; and, linkages to rehabilitation and secondary prevention.

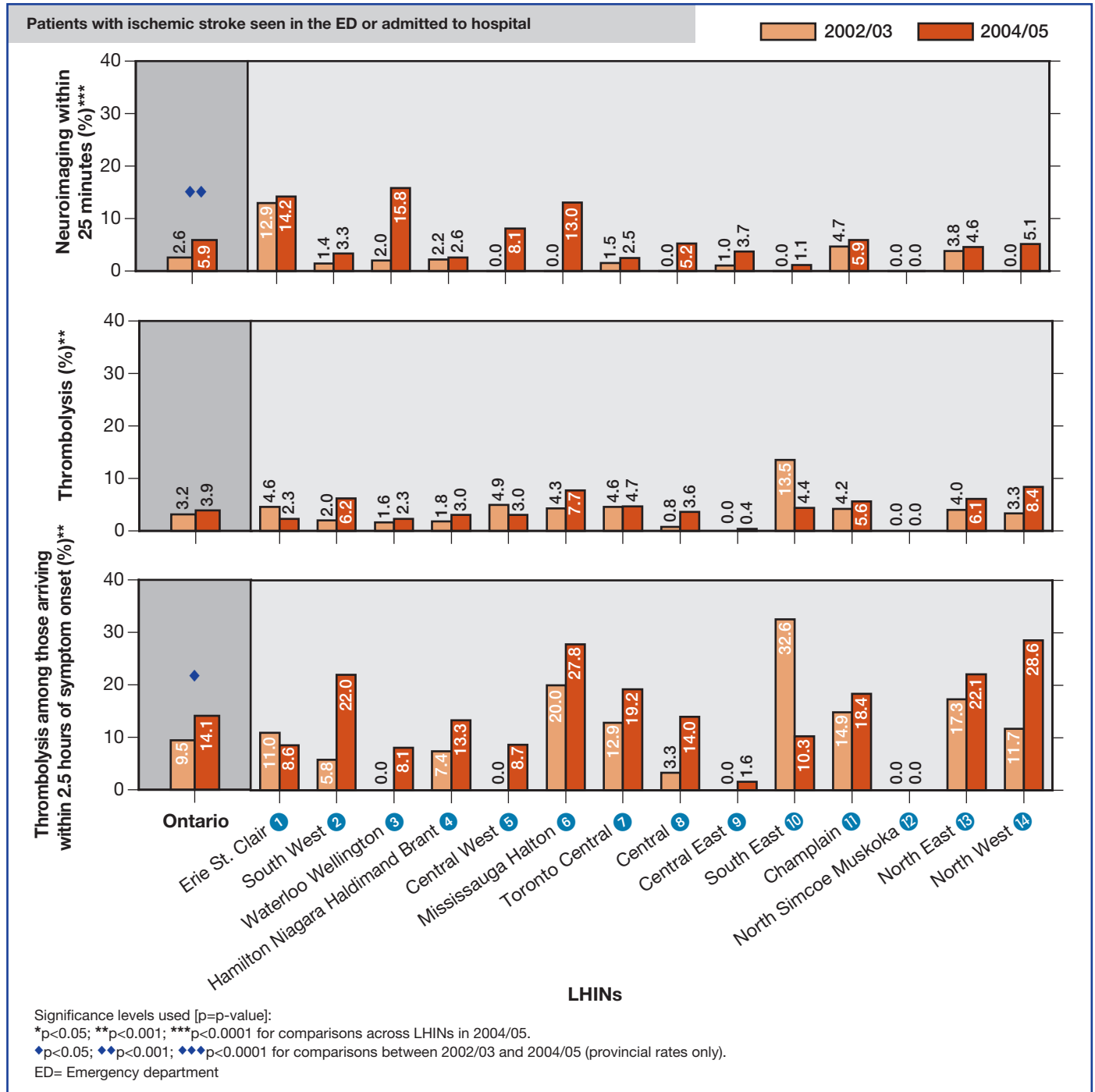
**Regional Stroke Centre:**  
All the requirements of a District Stroke Centre, plus neurosurgical facilities and interventional radiology.

†Although some regions appear to have administered no thrombolysis during the study time frame, other data sources confirm that thrombolysis may have been given in up to 1% of all ischemic stroke patient cases and up to 2% of all ischemic stroke patient cases arriving within 2.5 hours, but that these were not captured in the audit sample.

**Findings**

- Between 2002/03 and 2004/05, there were significant increases in thrombolysis administration and neuroimaging rates (within 25 minutes of hospital arrival) at regional and non-designated hospitals.
- Rates of thrombolysis administration and neuroimaging were highest at regional stroke centres and lowest at non-designated hospitals.

**Exhibit 11 Proportion (%) of patients with ischemic stroke receiving neuroimaging and thrombolysis, by Ontario Local Health Integration Network (LHIN), 2002/03 and 2004/05†**

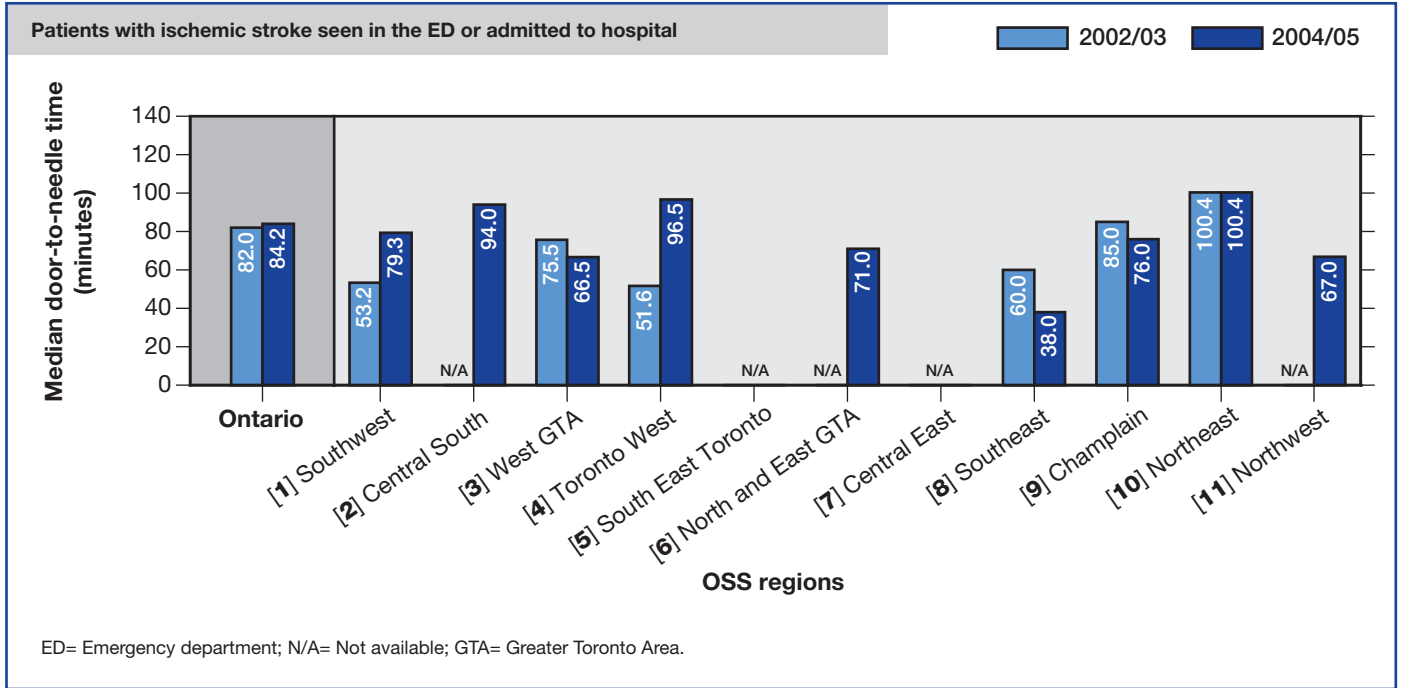


†Although some regions appear to have administered no thrombolysis during the study time frame, other data sources confirm that thrombolysis may have been given in up to 1% of all ischemic stroke patient cases and up to 2% of all ischemic stroke patient cases arriving within 2.5 hours, but that these were not captured in the audit sample.

**Findings**

- There were variations by Local Health Integration Network (LHIN) in the rates of thrombolysis administration and in neuroimaging within 25 minutes of hospital arrival.
- The highest rates of thrombolysis administration were seen in the North West LHIN, which also had the greatest increase in thrombolysis delivery between 2002/03 and 2004/05.

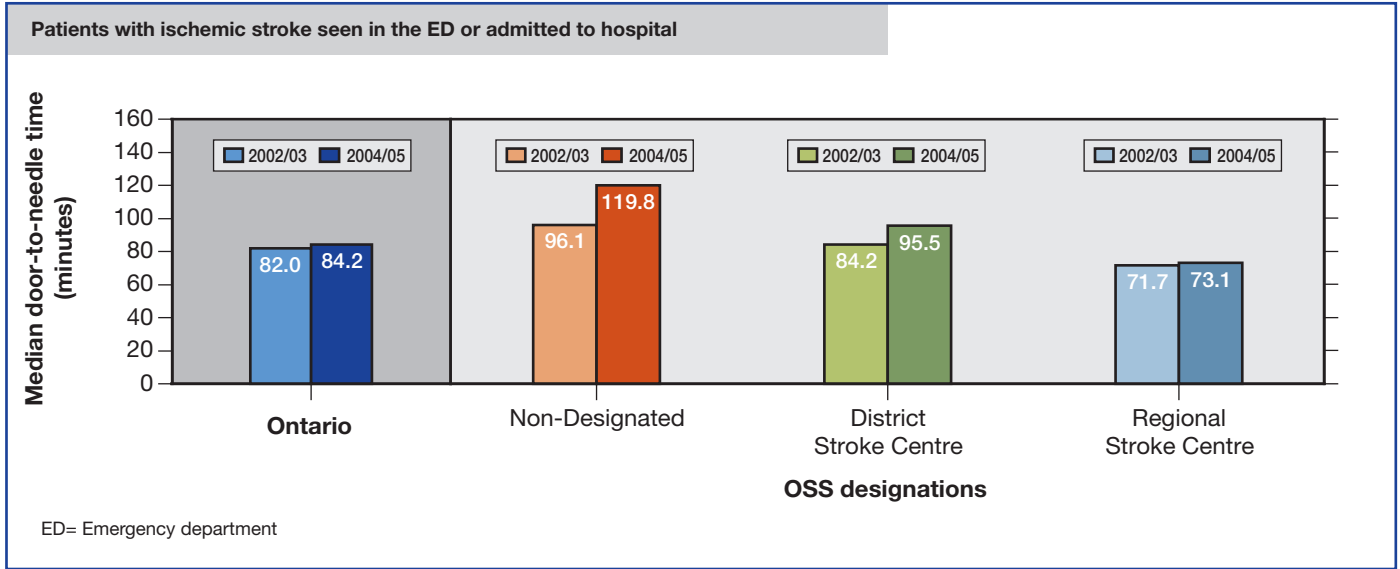
**Exhibit 12 Median door-to-needle time among patients receiving intravenous thrombolysis, by Ontario Stroke System (OSS) region, 2002/03 and 2004/05**



**Findings**

- Among patients receiving intravenous thrombolysis in 2004/05, the median door-to-needle time was 84.2 minutes, with no significant change compared to 2002/03.
- The benchmark for door-to-needle time is 60 minutes. This was achieved in only one OSS region (Southeast), which also saw a significant improvement in door-to-needle time in 2004/05 compared to 2002/03.
- Due to small sample sizes, the available data were not sufficient to report on this indicator for some OSS regions.

**Exhibit 13 Median door-to-needle time among patients receiving intravenous thrombolysis, by Ontario Stroke System (OSS) designation, 2002/03 and 2004/05**



**Non-designated:**  
Acute care hospital that does not fit the definition of District or Regional Stroke Centre.

**District Stroke Centre:** Facilities with written stroke protocols for emergency services, emergency department and acute care including: transport and triage protocols; ability to offer thrombolytic therapy to suitable ischemic stroke patients; timely computed tomography (CT) scanning and expert interpretation; clinicians with stroke expertise; and, linkages to rehabilitation and secondary prevention.

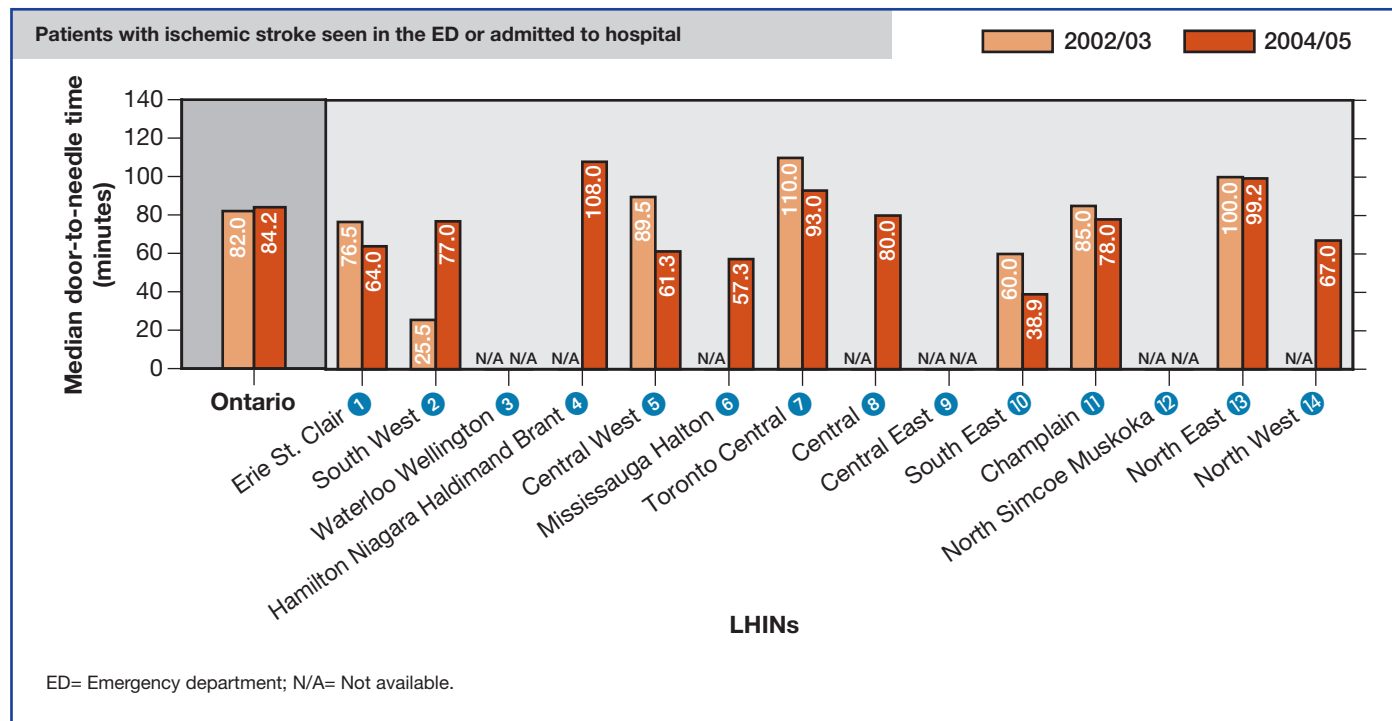
**Regional Stroke Centre:**  
All the requirements of a District Stroke Centre, plus neurosurgical facilities and interventional radiology.

**Findings**

- Among patients receiving intravenous thrombolysis in 2004/05, the median door-to-needle times were 73.1, 95.5 and 119.8 minutes at regional stroke centres, district stroke centres and non-designated hospitals, respectively. These were all above the benchmark of 60 minutes.



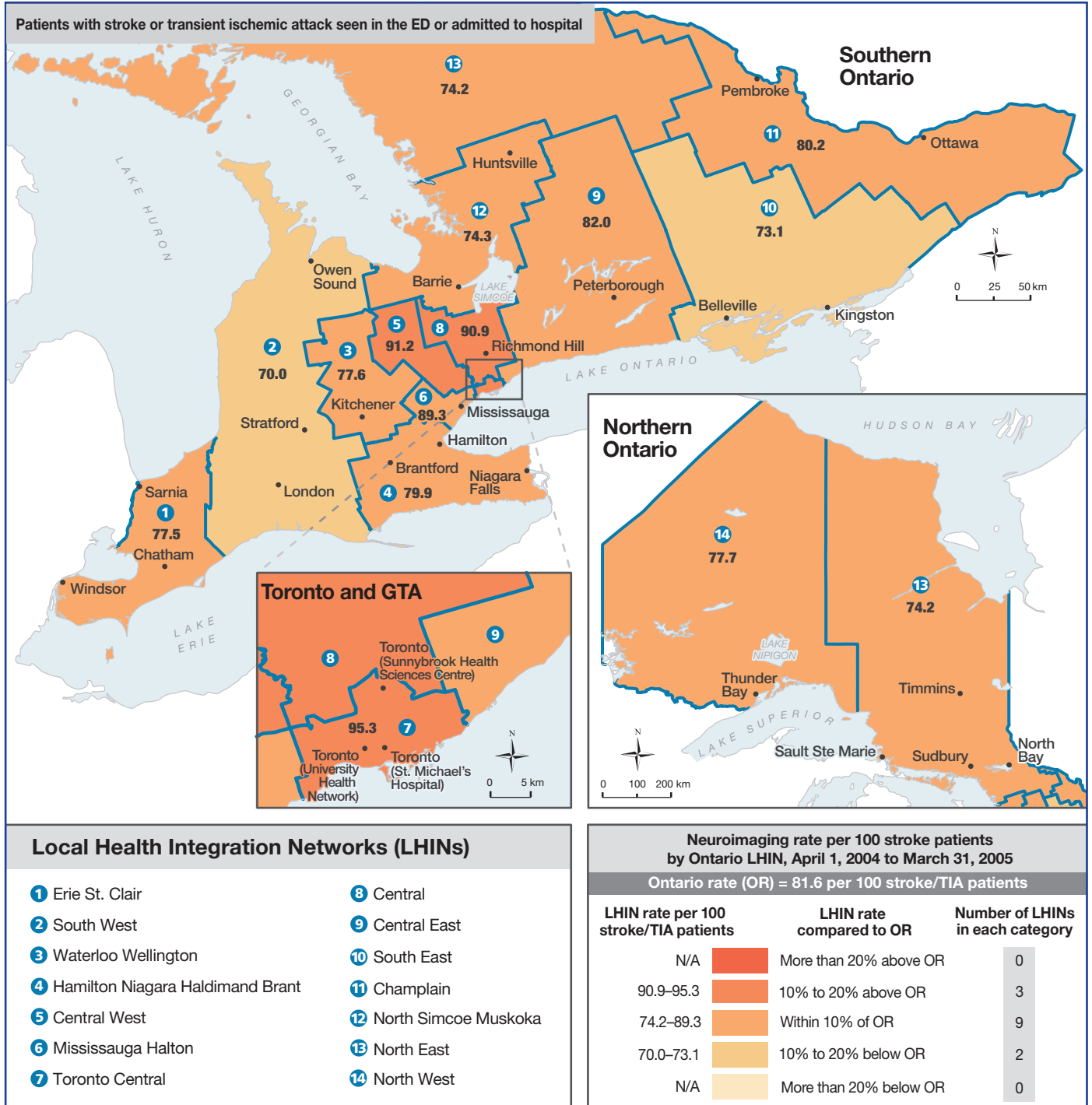
**Exhibit 14 Median door-to-needle time among patients receiving intravenous thrombolysis, by Ontario Local Health Integration Network (LHIN), 2002/03 and 2004/05**



**Findings**

- There were variations in median door-to-needle time by Local Health Integration Network (LHIN), although due to small sample sizes, data on this indicator were not available for some regions.
- In 2004/05, the Mississauga Halton and South East LHINs had a median door-to-needle time below the benchmark of 60 minutes.
- Five LHINs had a decrease in the median door-to-needle time in 2004/05 compared to 2002/03.

**Exhibit 15 Neuroimaging rate<sup>†</sup> per 100 stroke patients, by Ontario Local Health Integration Network (LHIN), April 1, 2004 to March 31, 2005**

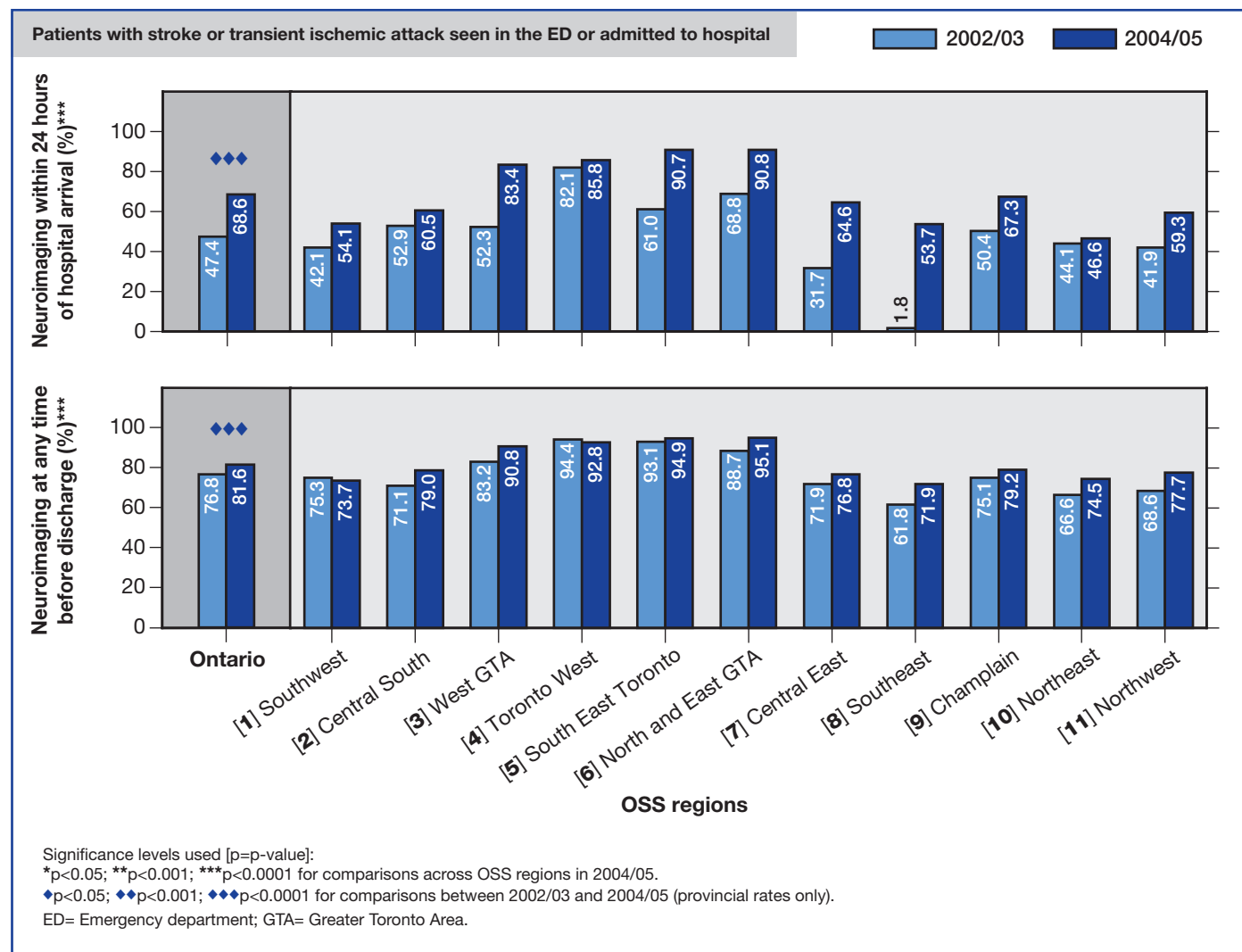


<sup>†</sup> Neuroimaging includes computed tomography (CT) and magnetic resonance imaging (MRI) of the brain performed at any time during hospitalization. ED= Emergency department; GTA= Greater Toronto Area.

**Findings**

- There were significant regional variations in rates of neuroimaging among stroke patients during the study period.

**Exhibit 16 Proportion (%) of stroke patients who underwent neuroimaging<sup>†</sup> by Ontario Stroke System (OSS) region, 2002/03 and 2004/05**

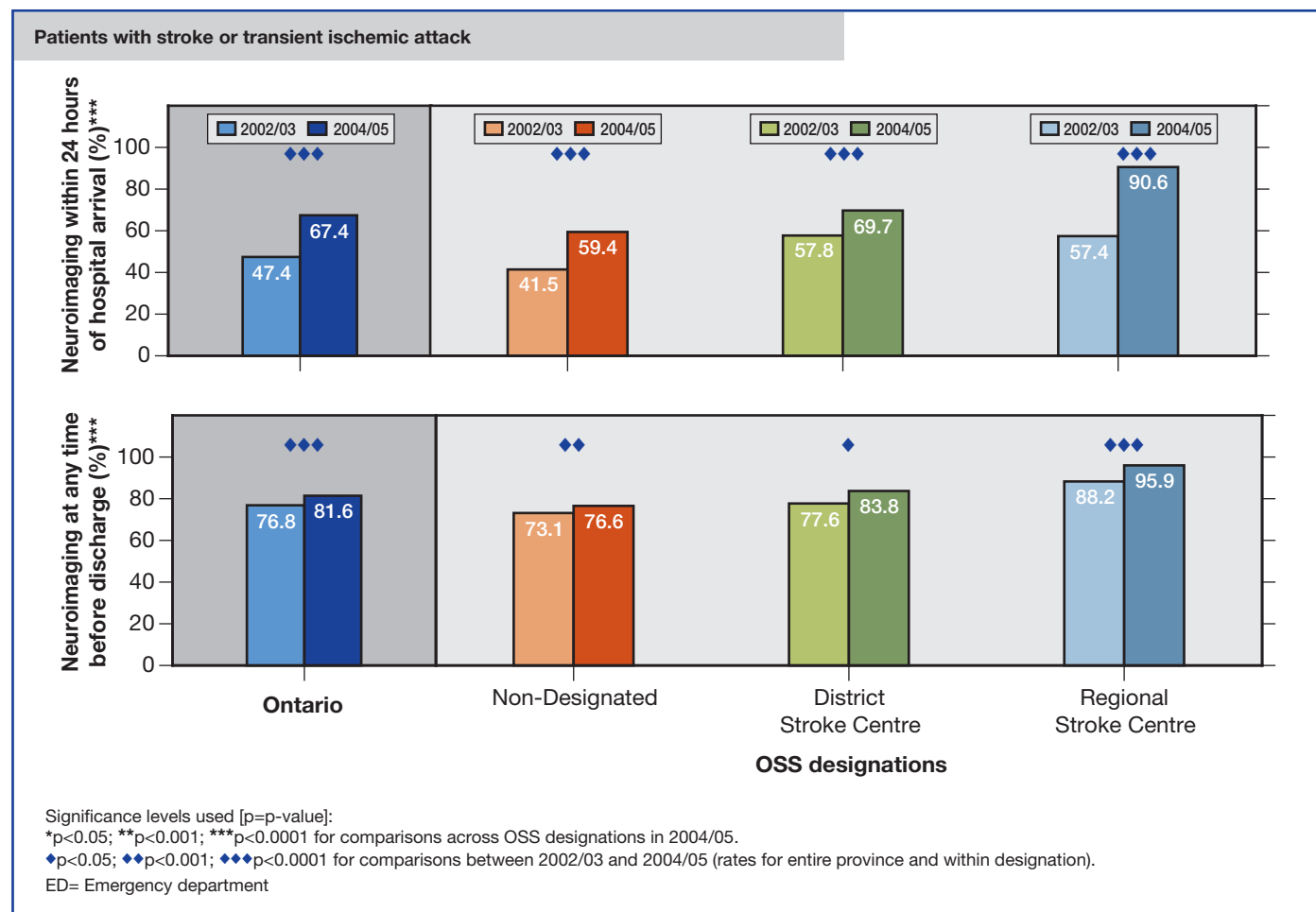


<sup>†</sup>Neuroimaging includes computed tomography (CT) and magnetic resonance imaging (MRI) of the brain.

**Findings**

- In 2004/05, 68.6 percent of patients underwent neuroimaging within 24 hours of hospital arrival and 81.6 percent underwent neuroimaging prior to discharge from hospital, a significant improvement compared to 47.4 percent and 76.8 percent, respectively, in 2002/03 (p<0.0001).
- There were variations in neuroimaging rates by OSS region; however, these were less pronounced in 2004/05 compared to 2002/03.

**Exhibit 17 Proportion (%) of stroke patients undergoing neuroimaging,<sup>‡</sup> by Ontario Stroke System (OSS) designation, 2002/03 and 2004/05**



**Non-designated:**  
Acute care hospital that does not fit the definition of District or Regional Stroke Centre.

**District Stroke Centre:** Facilities with written stroke protocols for emergency services, emergency department and acute care including: transport and triage protocols; ability to offer thrombolytic therapy to suitable ischemic stroke patients; timely computed tomography (CT) scanning and expert interpretation; clinicians with stroke expertise; and, linkages to rehabilitation and secondary prevention.

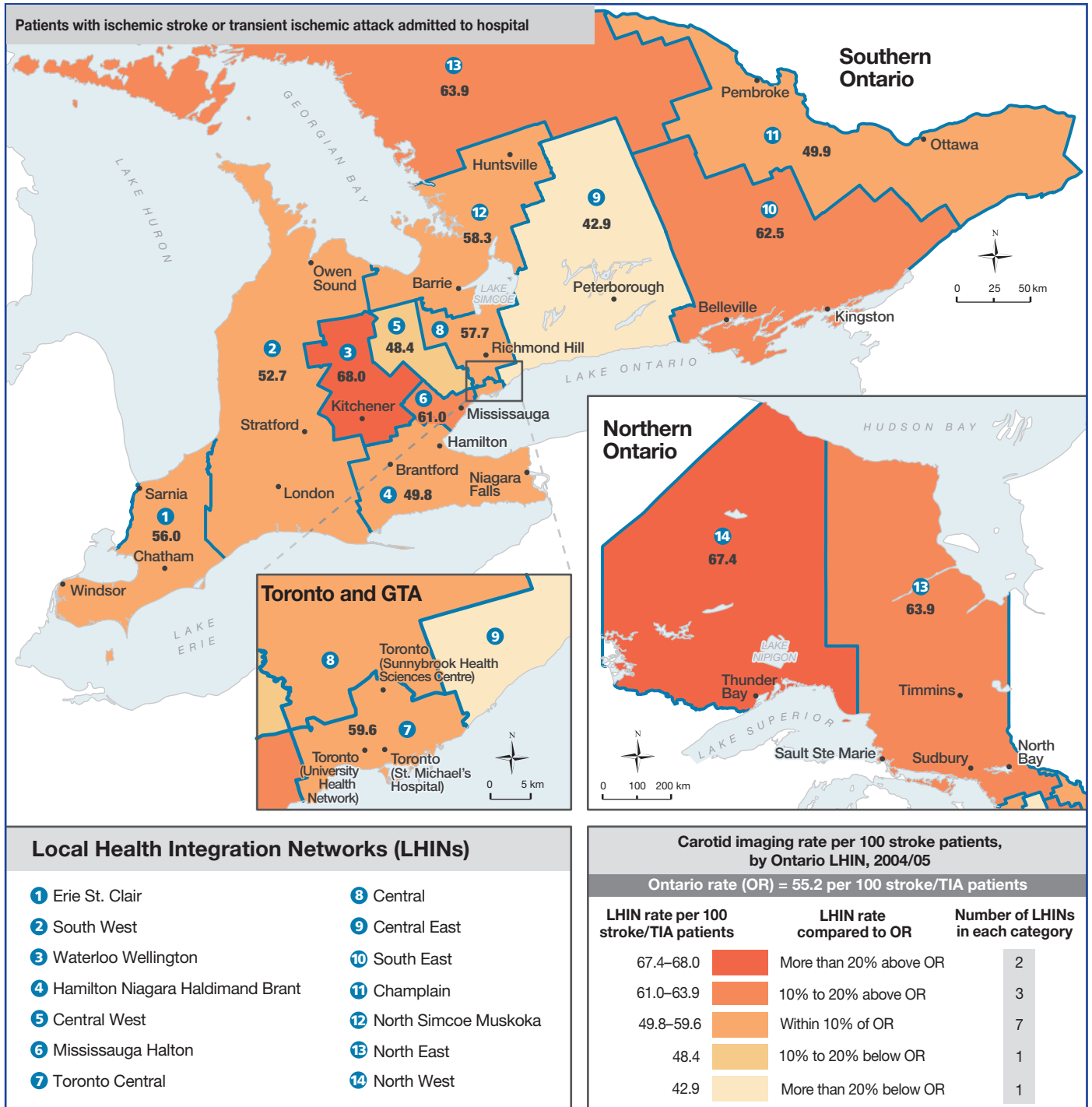
**Regional Stroke Centre:**  
All the requirements of a District Stroke Centre, plus neurosurgical facilities and interventional radiology.

<sup>‡</sup>Neuroimaging includes computed tomography (CT) and magnetic resonance imaging (MRI) of the brain.

**Findings**

- Neuroimaging rates were markedly higher at regional stroke centres compared to other types of hospitals, with imaging rates prior to discharge of 95.9 percent, 83.8 percent and 76.6 percent at regional stroke centres, district stroke centres and non-designated hospitals, respectively.
- There were statistically significant improvements in neuroimaging rates at all types of hospital between 2002/03 and 2004/05.

**Exhibit 18 Carotid imaging rate per 100 stroke patients by Ontario Local Health Integration Network (LHIN), 2004/05**

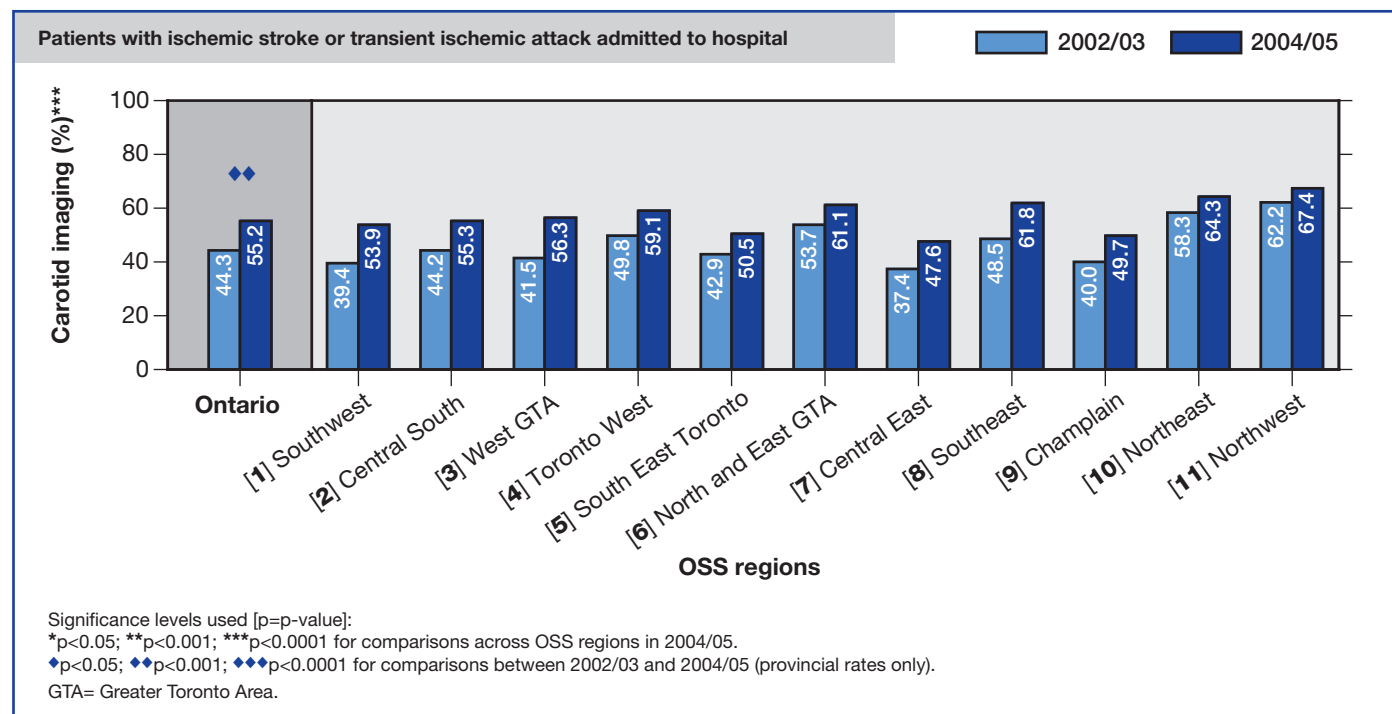


GTA= Greater Toronto Area.

**Findings**

- There were significant regional variations in rates of carotid imaging among patients with ischemic stroke and transient ischemic attack.

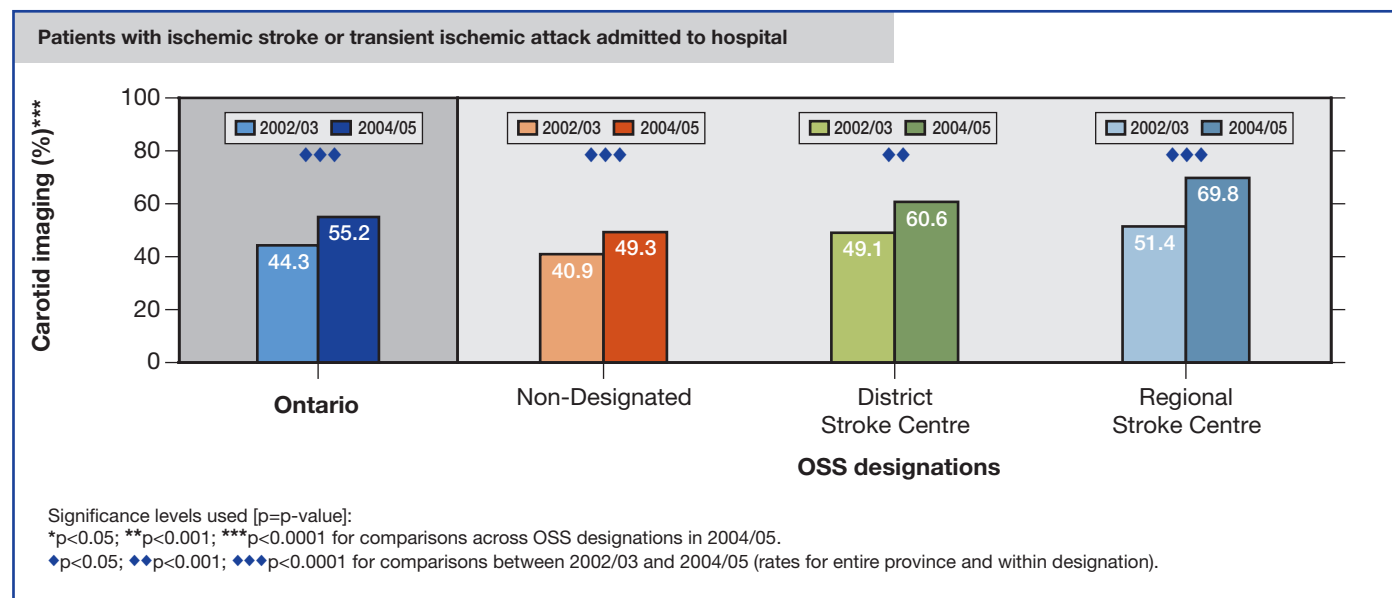
**Exhibit 19 Proportion (%) of stroke patients who received carotid imaging, by Ontario Stroke System (OSS) region, 2002/03 and 2004/05**



**Findings**

- Overall in 2004/05, 55.2 percent of patients with stroke or transient ischemic attack (TIA) had carotid imaging done in hospital or scheduled to be done following hospital discharge—a significant improvement compared to 44.3 percent of patients in 2002/03. Increased imaging rates were seen in all OSS regions.
- There were significant variations in carotid imaging rates across OSS regions (p<0.0001).

**Exhibit 20 Proportion (%) of stroke patients who received carotid imaging, by Ontario Stroke System (OSS) designation, 2002/03 and 2004/05**



**Non-designated:**  
Acute care hospital that does not fit the definition of District or Regional Stroke Centre.

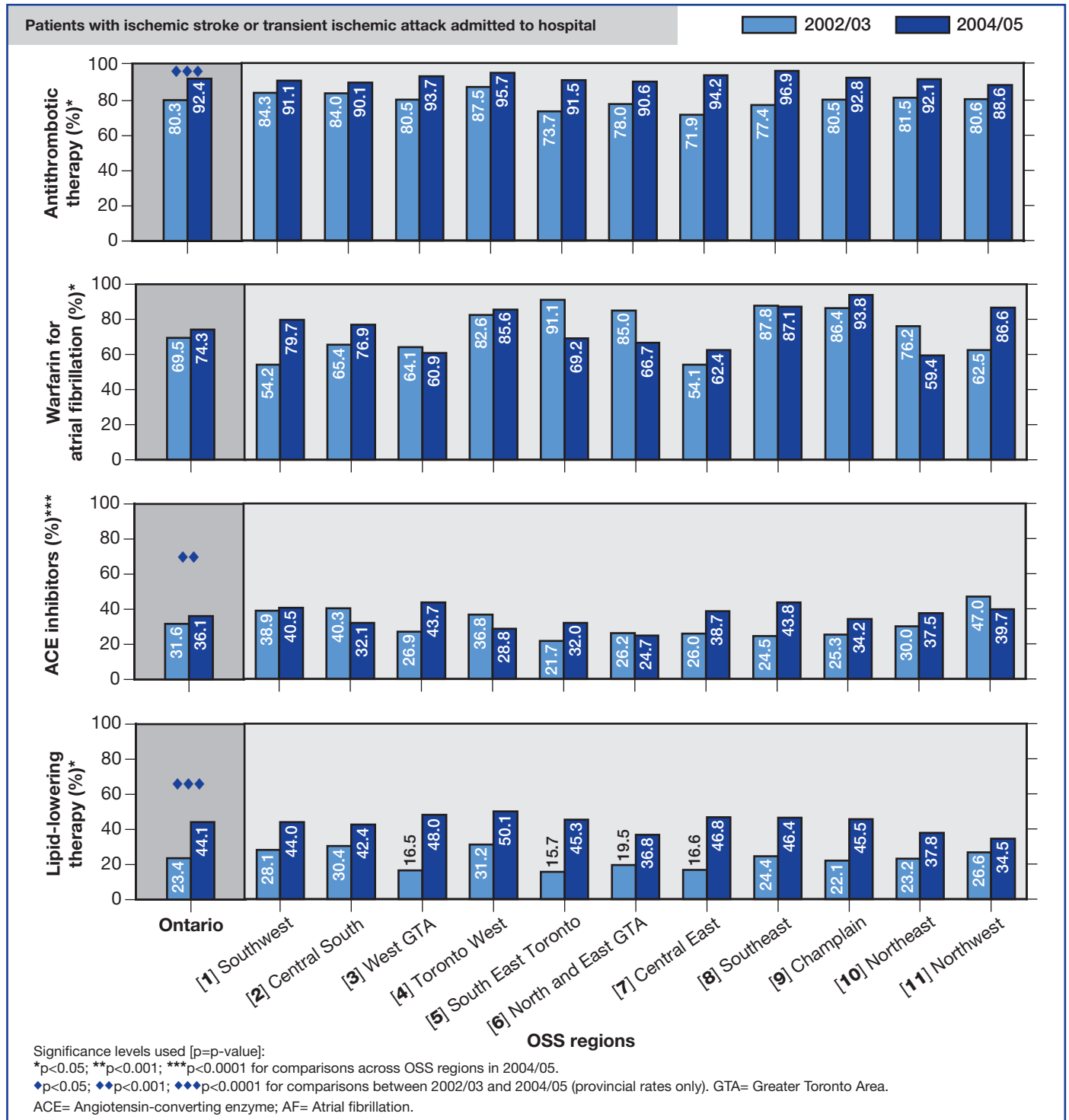
**District Stroke Centre:** Facilities with written stroke protocols for emergency services, emergency department and acute care including: transport and triage protocols; ability to offer thrombolytic therapy to suitable ischemic stroke patients; timely computed tomography (CT) scanning and expert interpretation; clinicians with stroke expertise; and, linkages to rehabilitation and secondary prevention.

**Regional Stroke Centre:** All the requirements of a District Stroke Centre, plus neurosurgical facilities and interventional radiology.

**Findings**

- Carotid imaging rates were higher at regional stroke centres compared to other types of hospitals, with rates of 69.8 percent, 60.6 percent and 49.3 percent at regional stroke centres, district stroke centres and non-designated hospitals, respectively.
- There were significant improvements in carotid imaging rates at all types of hospital between 2002/03 and 2004/05 (p<0.001).

**Exhibit 21 Proportion (%) of stroke patients who received drug therapy at discharge, by Ontario Stroke System (OSS) region, 2002/03 and 2004/05†**



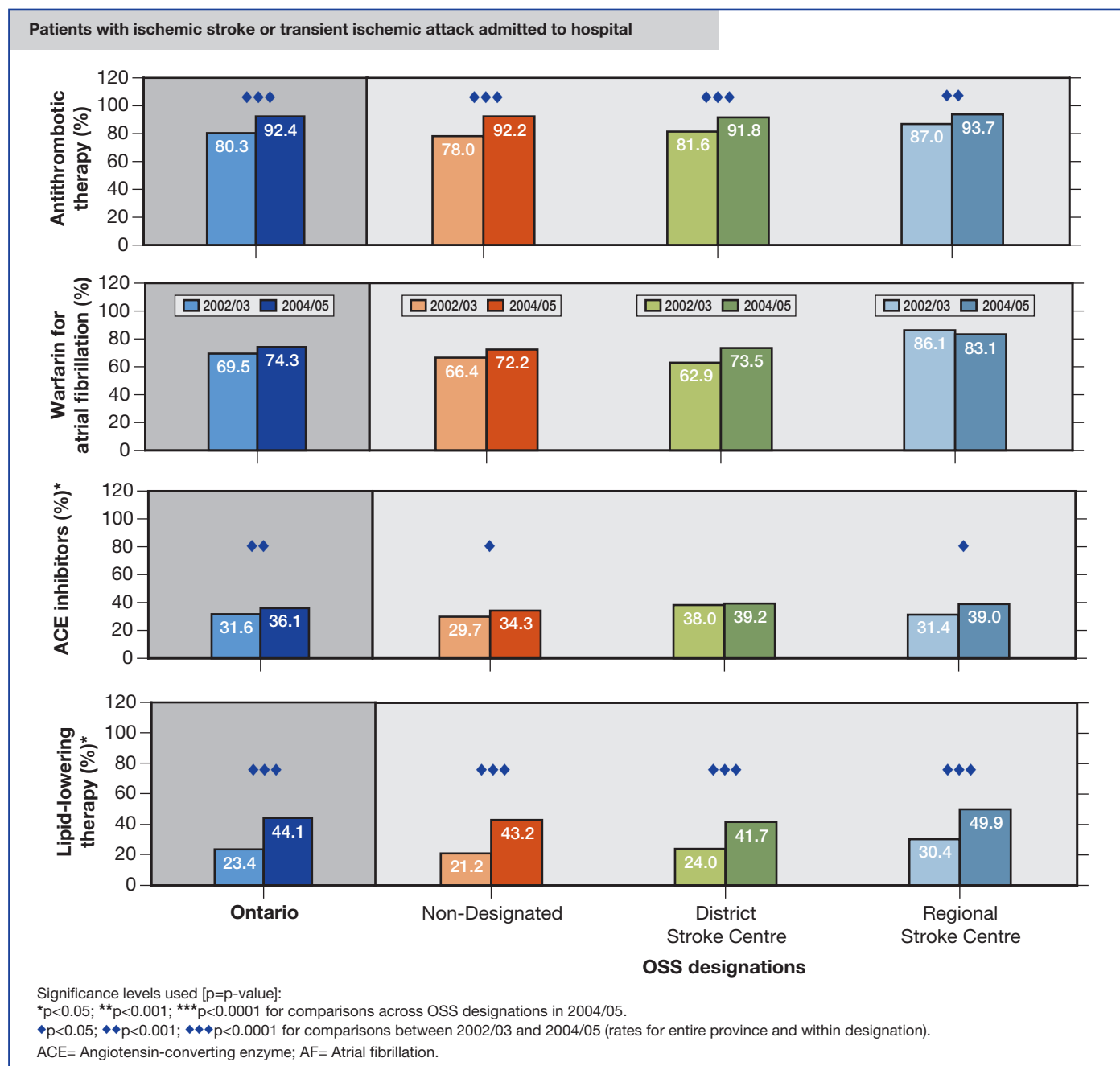
**Findings**

- In 2004/05, 92.4 percent of patients with ischemic stroke or transient ischemic attack (TIA) were discharged on antithrombotic therapy; 74.3 percent on warfarin (in the subgroup with atrial fibrillation); 36.1 percent on ACE inhibitors; and 44.1 percent on lipid-lowering therapy.
- In most regions, there were significant increases in prescribing rates of antithrombotic therapy, ACE inhibitors and lipid-lowering therapy between 2002/03 and 2004/05. There were variations in prescribing rates by OSS region.

†Antithrombotic therapy includes aspirin, combination aspirin and dipyridamole, clopidogrel and warfarin.



**Exhibit 22 Proportion (%) of stroke patients who received drug therapy at discharge, by Ontario Stroke System (OSS) designation, 2002/03 and 2004/05**



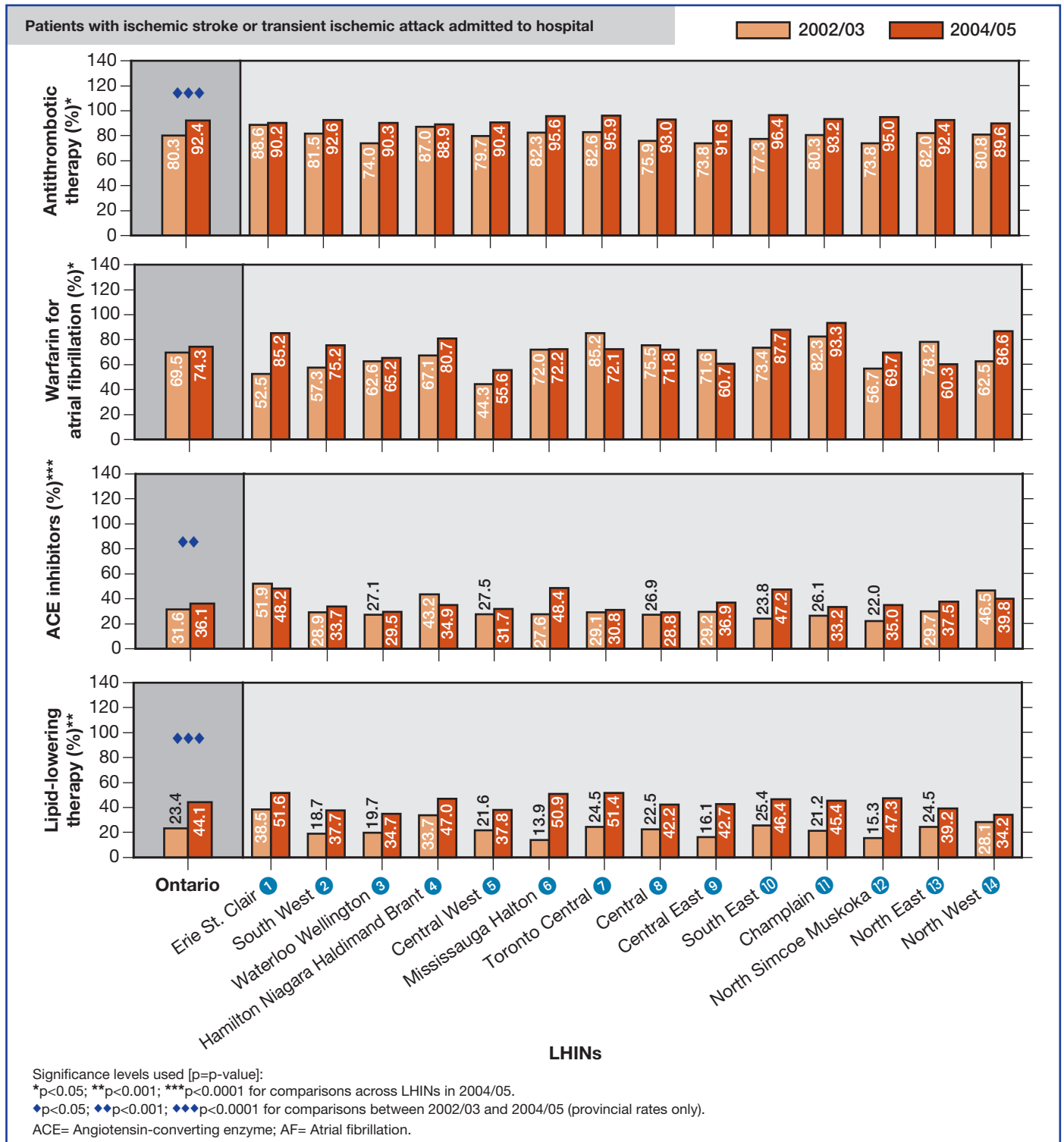
**Non-designated:**  
Acute care hospital that does not fit the definition of District or Regional Stroke Centre.

**District Stroke Centre:** Facilities with written stroke protocols for emergency services, emergency department and acute care including: transport and triage protocols; ability to offer thrombolytic therapy to suitable ischemic stroke patients; timely computed tomography (CT) scanning and expert interpretation; clinicians with stroke expertise; and, linkages to rehabilitation and secondary prevention.

**Regional Stroke Centre:**  
All the requirements of a District Stroke Centre, plus neurosurgical facilities and interventional radiology.

- Findings**
- In 2004/05, there were variations in rates of prescribing of ACE inhibitors and lipid-lowering therapy after discharge across facility types (p<0.05), but no significant variations in prescribing of antithrombotic agents or warfarin for atrial fibrillation.
  - There were increases in rates of prescribing antithrombotic therapy, ACE inhibitors and lipid-lowering medications for secondary stroke prevention between 2002/03 and 2004/05 across the entire province and in all facility types.

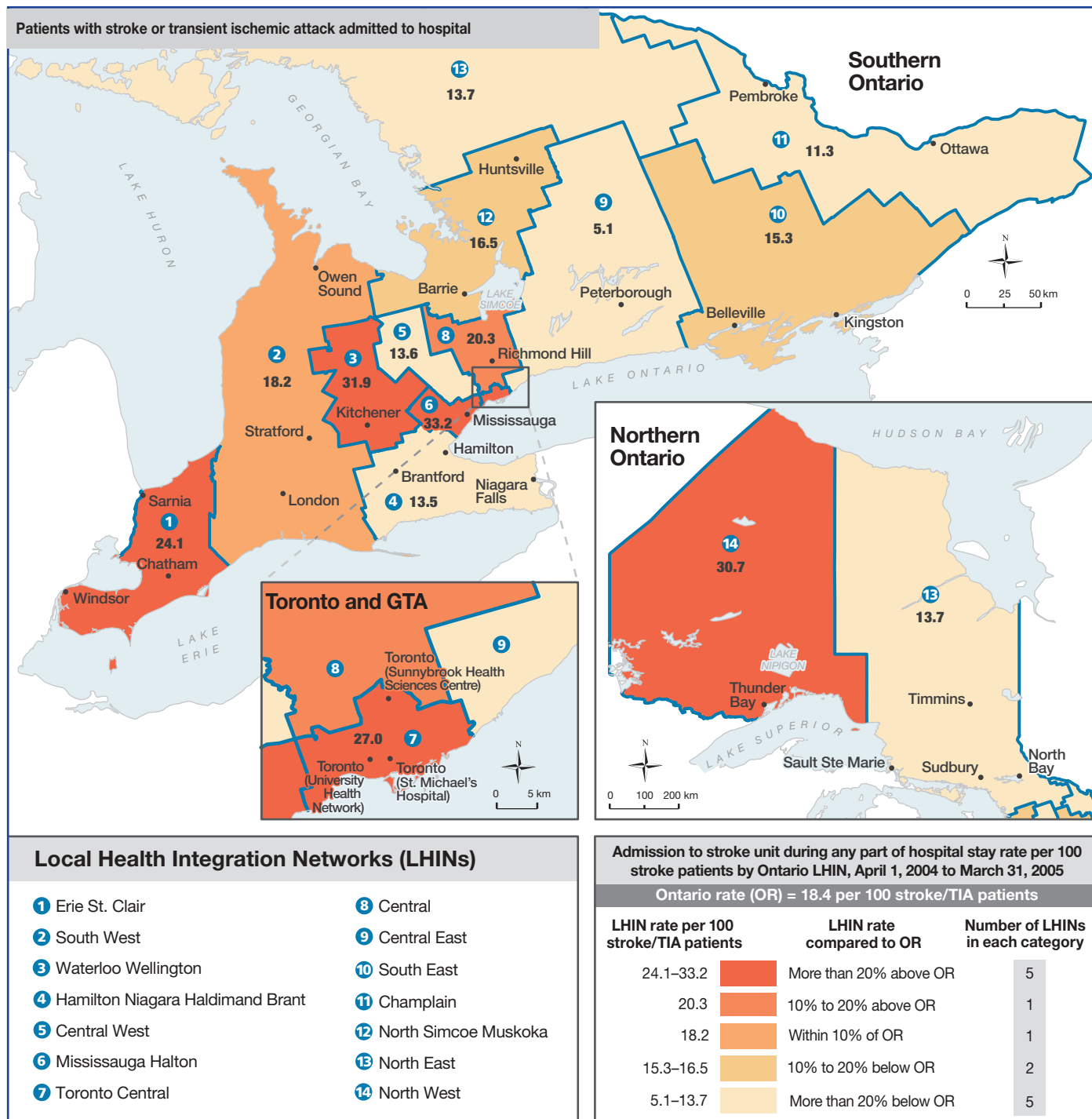
**Exhibit 23 Proportion (%) of stroke patients who received drug therapy at discharge, by Ontario Local Health Integration Network (LHIN), 2002/03 and 2004/05†**



**Findings**

- In 2004/05, there were regional variations in prescribing rates for ACE inhibitors and lipid-lowering therapy after discharge for secondary stroke prevention.
- There were increases in prescribing rates for secondary stroke prevention medications across almost all Local Health Integration Networks (LHINs) in Ontario (compared to rates in 2002/03).

**Exhibit 24 Admission to stroke unit during any part of hospital stay† (rate per 100 stroke patients), by Ontario Local Health Integration Network (LHIN), April 1, 2004 to March 31, 2005**



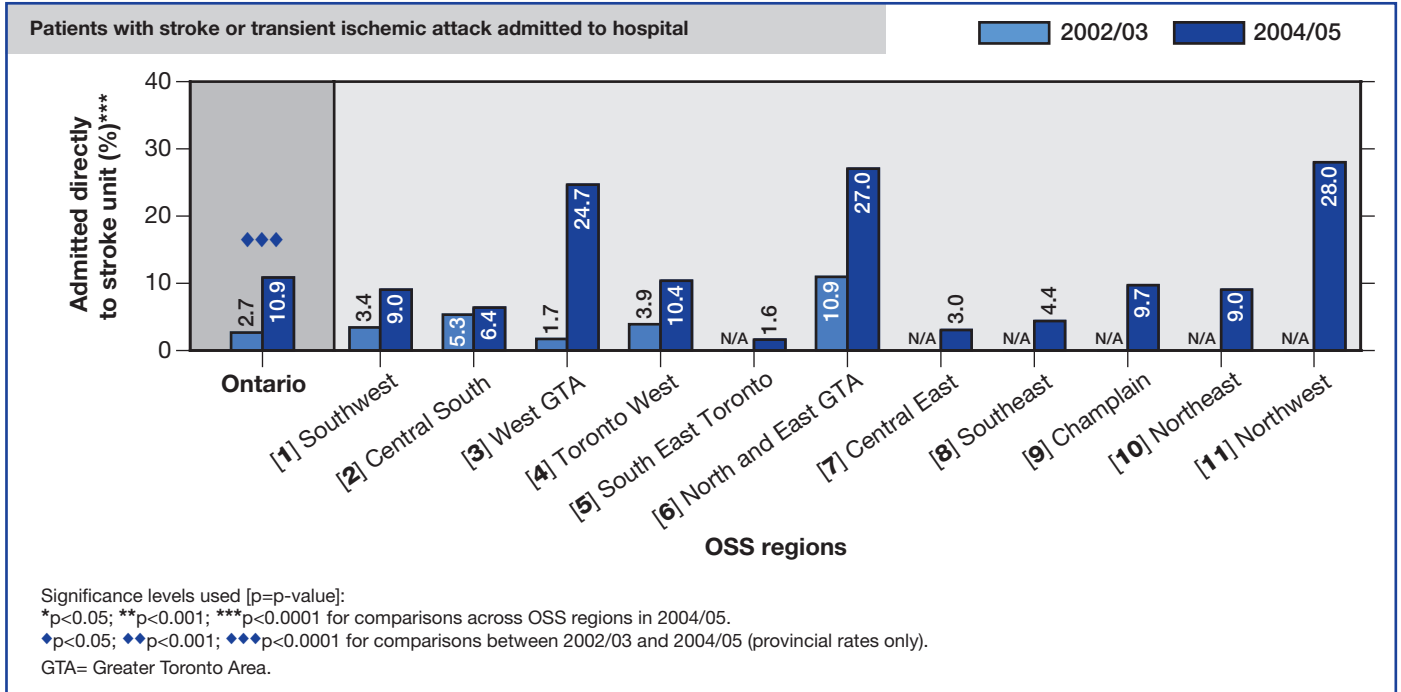
GTA= Greater Toronto Area.

† This indicator measures care on a stroke unit occurring at any time during hospital admission. This differs from the “stroke unit” indicator measured in the 2002/03 audit, when only the initial admission to a stroke unit was captured, rather than stroke unit care at any point in time.

**Findings**

- There were significant regional variations in rates of admission to acute stroke units.

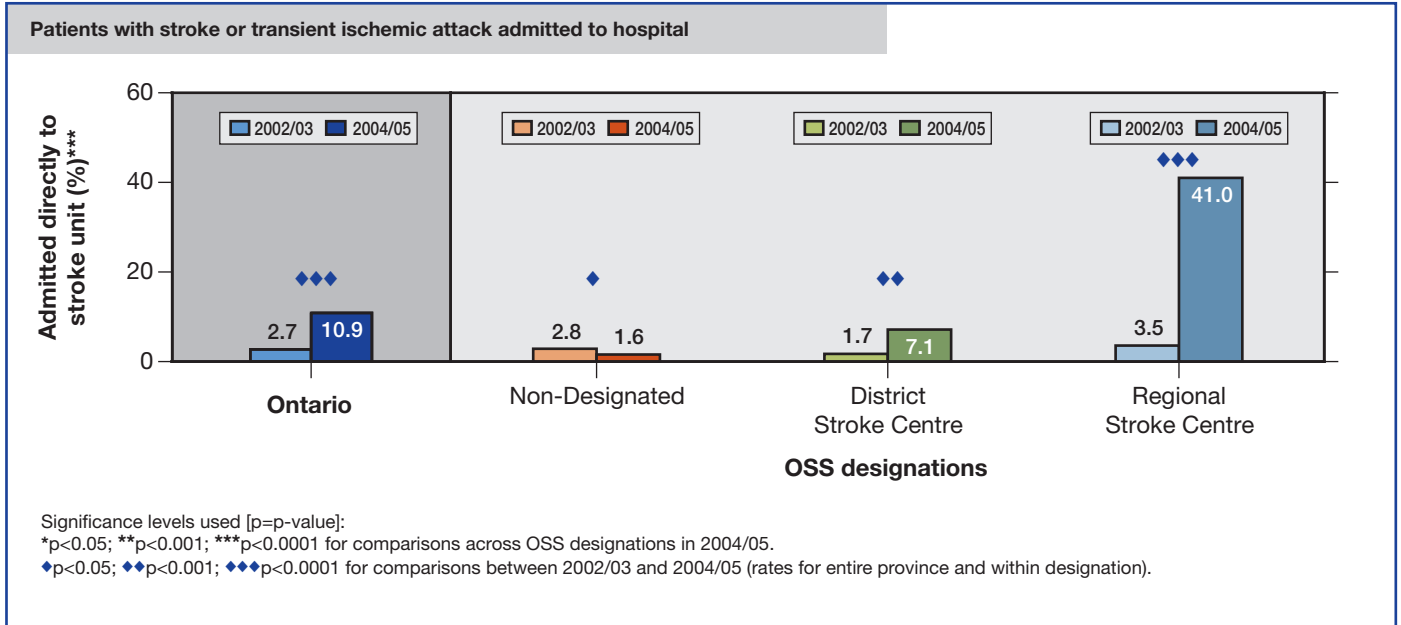
**Exhibit 25 Proportion (%) of stroke patients admitted directly to a stroke unit, by Ontario Stroke System (OSS) region, 2002/03 and 2004/05**



**Findings**

- In 2004/05, 10.9 percent of patients were admitted directly to a stroke unit—a significant increase from 2.7 percent in 2002/03 (p<0.0001).
- In 2004/05, there were significant variations in stroke unit admission rates by OSS region, from a low of 1.6 percent in South East Toronto region to a high of 28.0 percent in the Northwest region (p<0.0001).

**Exhibit 26 Proportion (%) of stroke patients admitted directly to a stroke unit, by Ontario Stroke System (OSS) designation, 2002/03 and 2004/05**



**Non-designated:**  
Acute care hospital that does not fit the definition of District or Regional Stroke Centre.

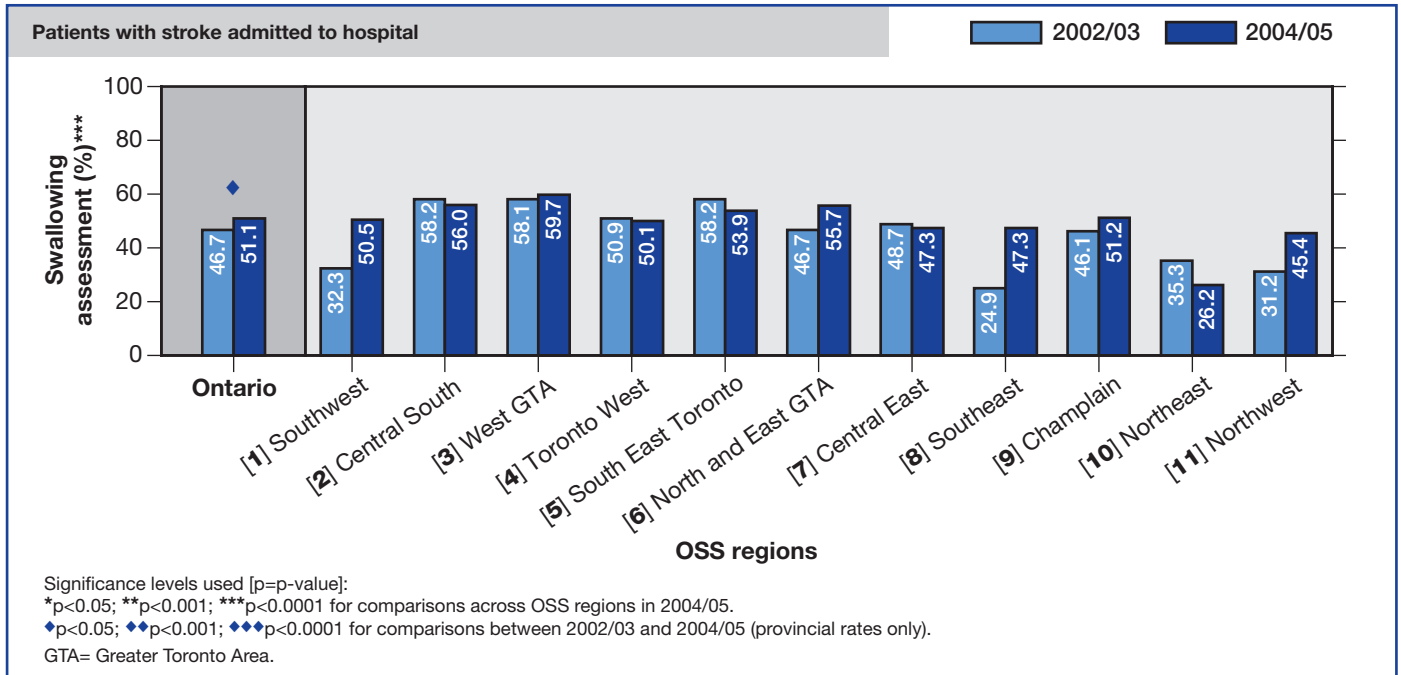
**District Stroke Centre:** Facilities with written stroke protocols for emergency services, emergency department and acute care including: transport and triage protocols; ability to offer thrombolytic therapy to suitable ischemic stroke patients; timely computed tomography (CT) scanning and expert interpretation; clinicians with stroke expertise; and, linkages to rehabilitation and secondary prevention.

**Regional Stroke Centre:** All the requirements of a District Stroke Centre, plus neurosurgical facilities and interventional radiology.

**Findings**

- Stroke unit admission rates increased dramatically at regional stroke centres—from 3.5 percent in 2002/03 to 41.0 percent in 2004/05 (p<0.0001); rates also increased at district stroke centres from 1.7 percent in 2002/03 to 7.1 percent in 2004/05 (p<0.001).
- Stroke unit admission rates at non-designated hospitals remained very low (1.6 percent) in 2004/05.

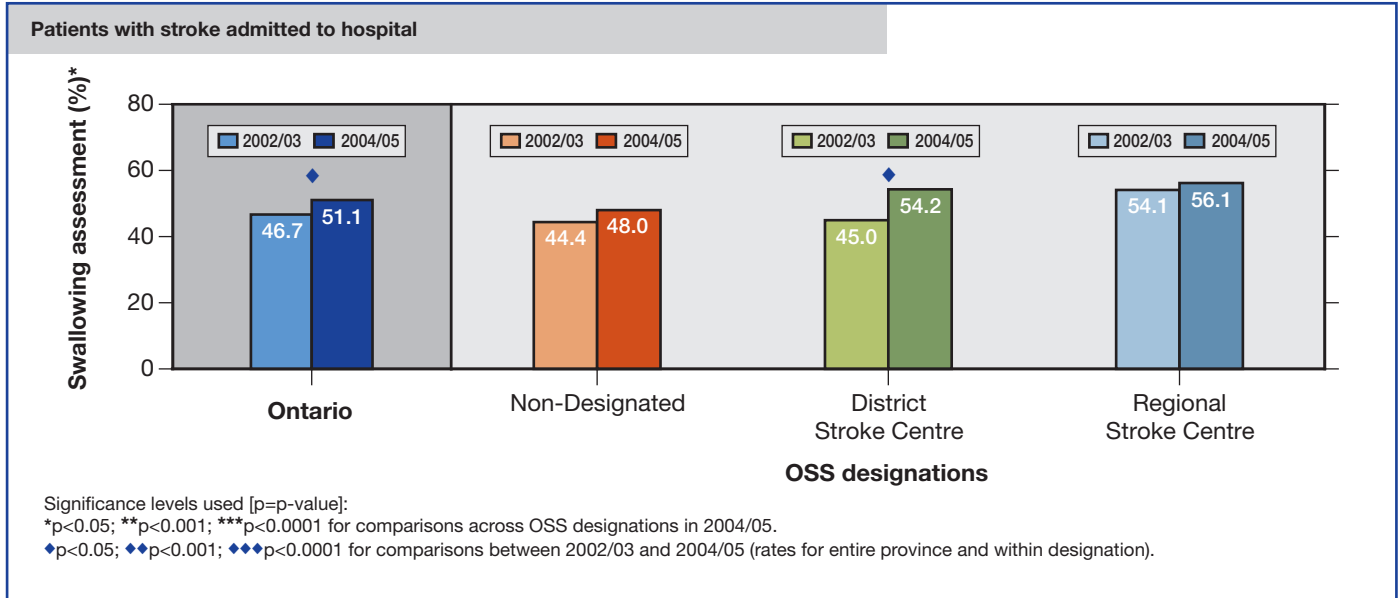
**Exhibit 27 Proportion (%) of stroke patients who underwent dysphagia screening, by Ontario Stroke System (OSS) region, 2002/03 and 2004/05**



**Findings**

- In 2004/05, 51.1 percent of patients admitted with stroke or transient ischemic attack (TIA) underwent screening for dysphagia (swallowing disorder)—an increase from 46.7 percent in 2002/03 (p<0.01).
- In 2004/05, there were variations in dysphagia screening rates across OSS regions, ranging from 26.2 percent to 59.7 percent.

**Exhibit 28 Proportion (%) of stroke patients who underwent dysphagia screening, by Ontario Stroke System (OSS) designation, 2002/03 and 2004/05**



**Non-designated:**  
Acute care hospital that does not fit the definition of District or Regional Stroke Centre.

**District Stroke Centre:** Facilities with written stroke protocols for emergency services, emergency department and acute care including: transport and triage protocols; ability to offer thrombolytic therapy to suitable ischemic stroke patients; timely computed tomography (CT) scanning and expert interpretation; clinicians with stroke expertise; and, linkages to rehabilitation and secondary prevention.

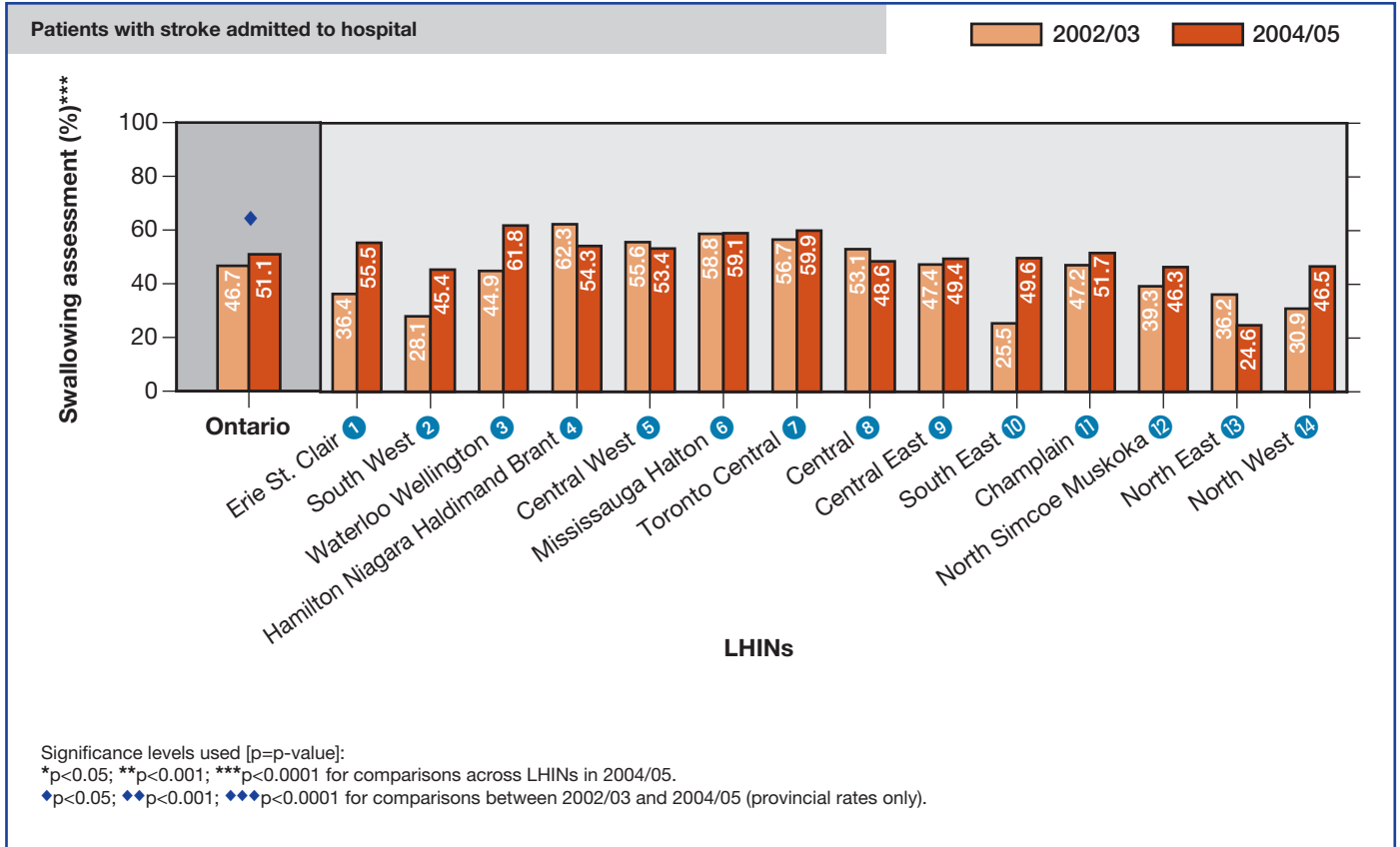
**Regional Stroke Centre:**  
All the requirements of a District Stroke Centre, plus neurosurgical facilities and interventional radiology.

**Findings**

- In 2004/05, dysphagia screening rates were highest at regional stroke centres (56.1 percent of patients), followed by district stroke centres (54.2 percent) and non-designated hospitals (48.0 percent).
- There were increases in rates of dysphagia screening between 2002/03 and 2004/05 at all hospital types.



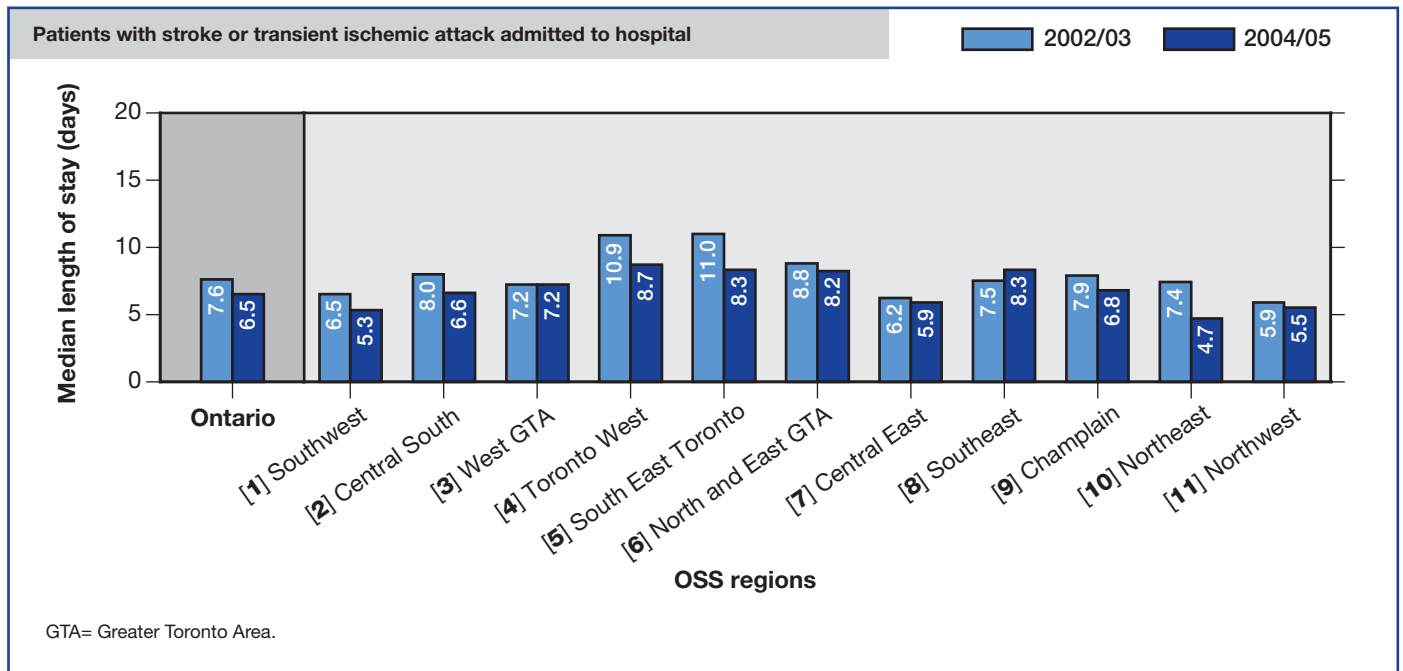
**Exhibit 29 Proportion (%) of stroke patients who underwent dysphagia screening, by Ontario Local Health Integration Network (LHIN), 2002/03 and 2004/05**



**Findings**

- In 2004/05, there were variations in dysphagia screening rates across Local Health Integration Networks (LHINs), ranging from 24.6 percent to 61.8 percent (p<0.0001).

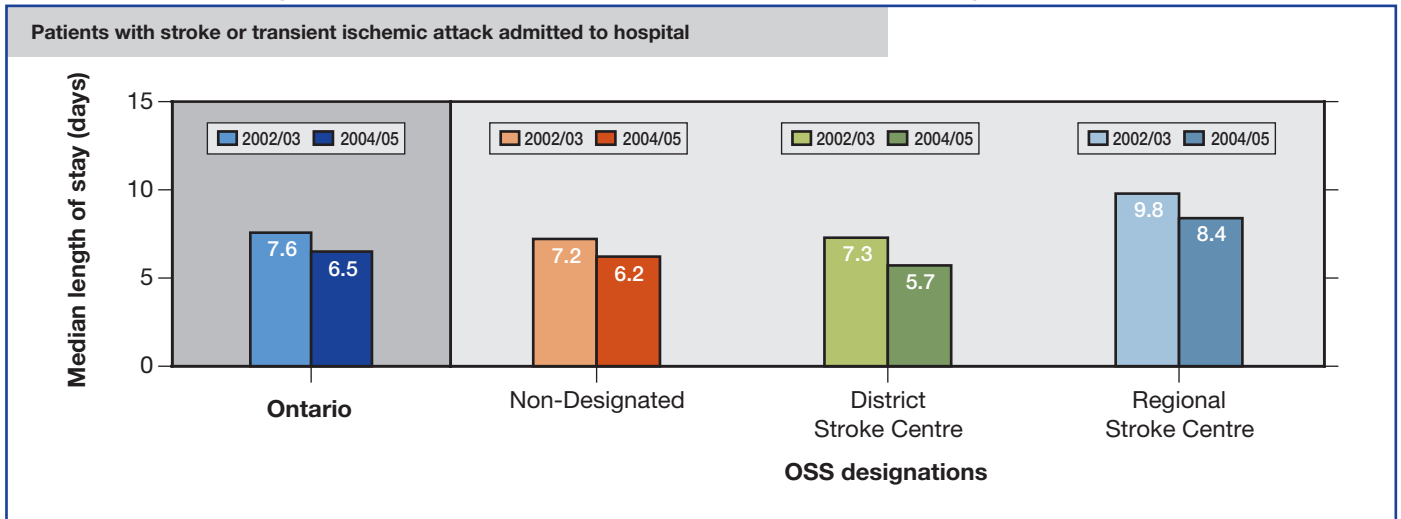
**Exhibit 30 Median length of hospital stay by Ontario Stroke System (OSS) region, 2002/03 and 2004/05**



**Findings**

- In 2004/05, the median length of hospital stay for patients with stroke or transient ischemic attack was 6.5 days—a decrease from 7.6 days in 2002/03.
- There were variations in the median length of stay by OSS region.

**Exhibit 31 Median length of hospital stay by Ontario Stroke System (OSS) designation, 2002/03 and 2004/05**



**Non-designated:**  
Acute care hospital that does not fit the definition of District or Regional Stroke Centre.

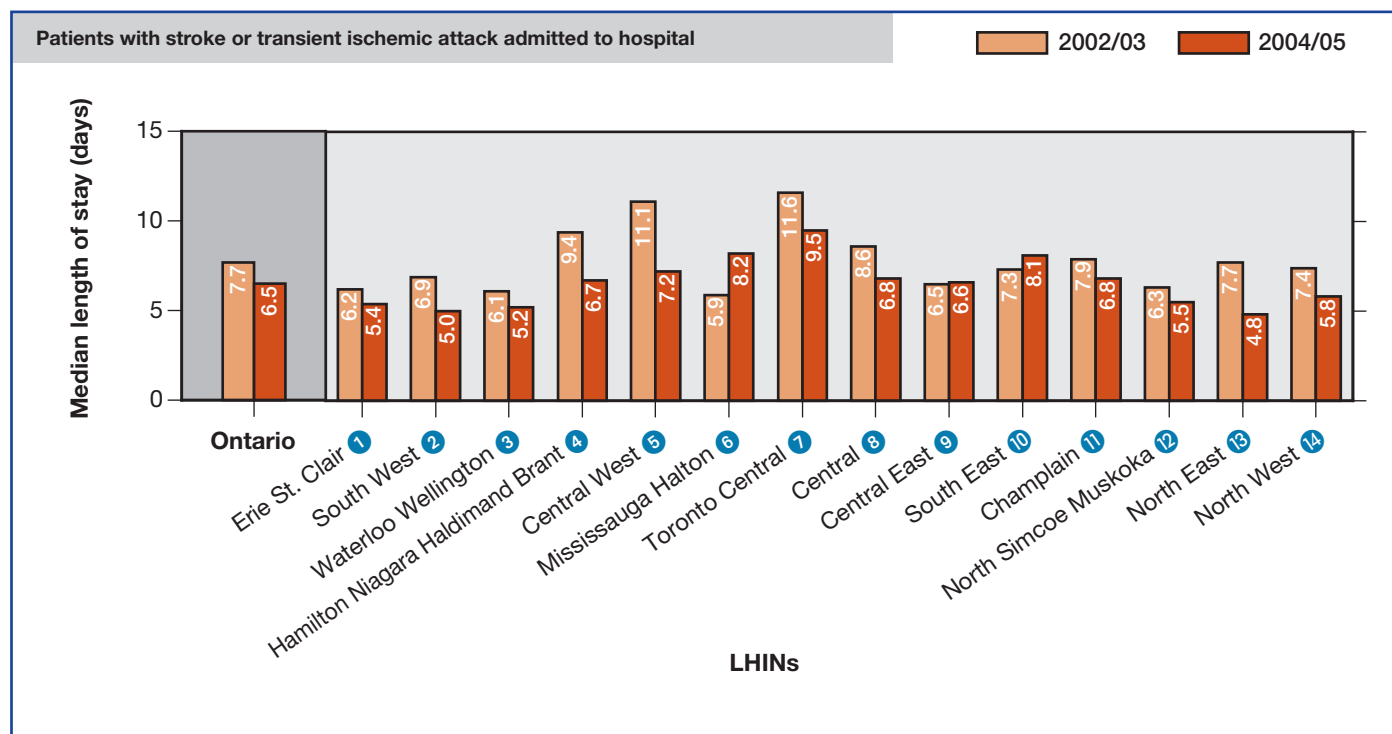
**District Stroke Centre:** Facilities with written stroke protocols for emergency services, emergency department and acute care including: transport and triage protocols; ability to offer thrombolytic therapy to suitable ischemic stroke patients; timely computed tomography (CT) scanning and expert interpretation; clinicians with stroke expertise; and, linkages to rehabilitation and secondary prevention.

**Regional Stroke Centre:**  
All the requirements of a District Stroke Centre, plus neurosurgical facilities and interventional radiology.

**Findings**

- In both 2002/03 and 2004/05, the median length of hospital stay for patients with stroke or transient ischemic attack was greater at regional stroke centres compared with other types of hospitals.
- The median length of stay decreased between 2002/03 and 2004/05 at regional stroke centres, district stroke centres and non-designated hospitals.

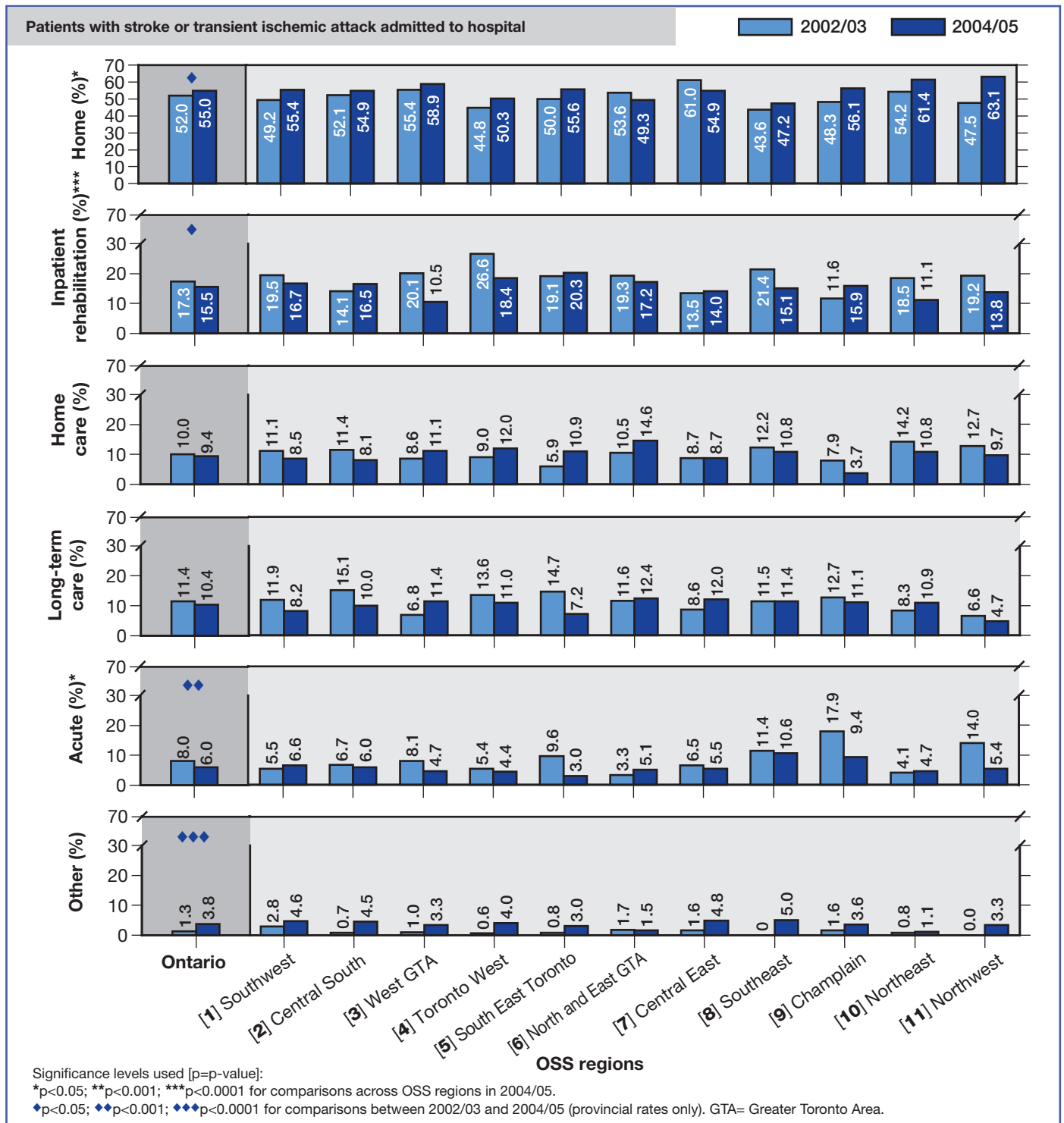
**Exhibit 32 Median length of hospital stay by Ontario Local Health Integration Network (LHIN), 2002/03 and 2004/05**



**Findings**

- There were variations in median length of hospital stay for patients with stroke or transient ischemic attack across Local Health Integration Networks (LHINs).
- Median length of stay decreased between 2002/03 and 2004/05 in almost all LHINs.

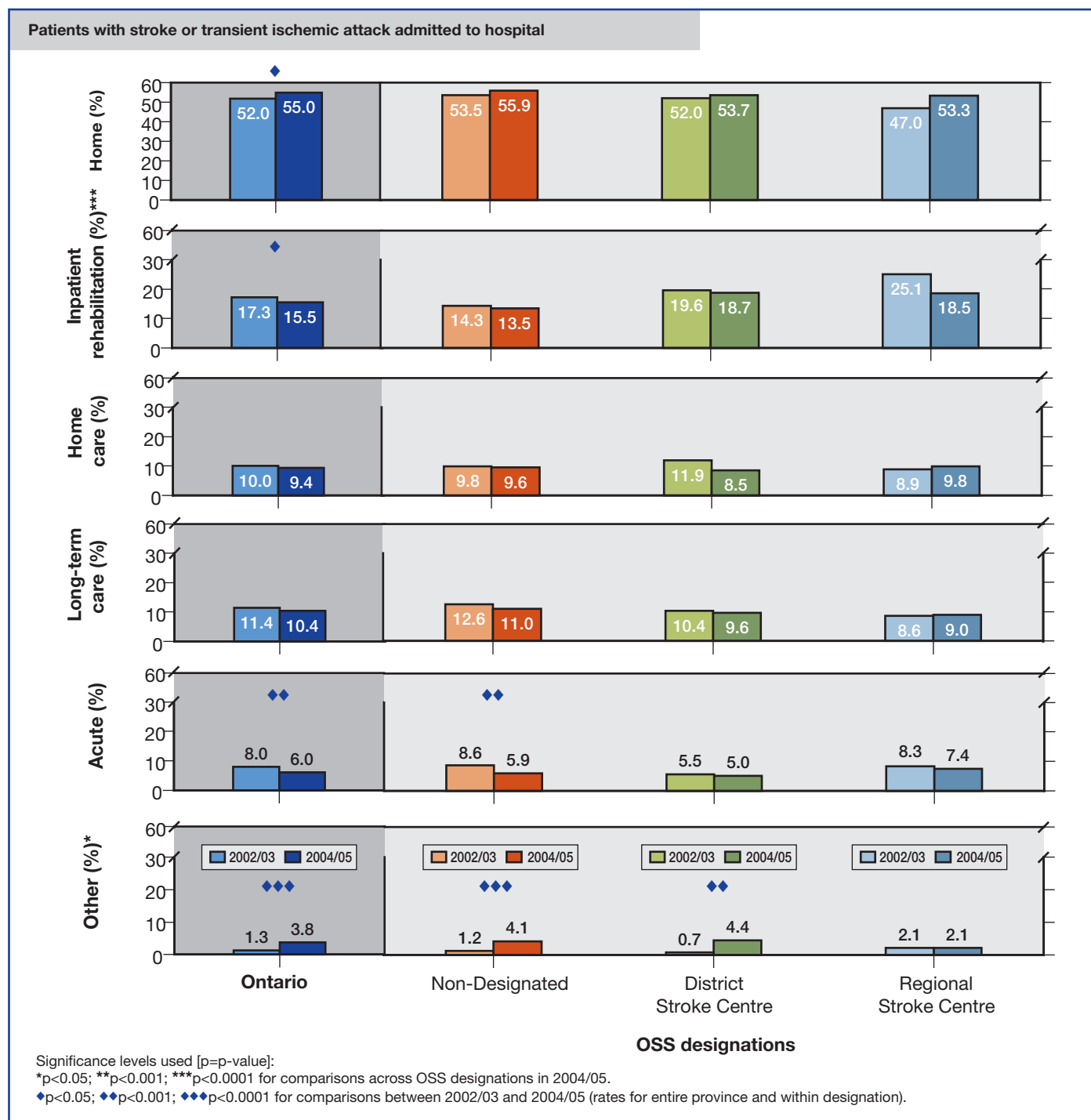
Exhibit 33 Discharge destination by Ontario Stroke System (OSS) region, 2002/03 and 2004/05



Findings

- In 2004/05, 55.0 percent of patients admitted with stroke or transient ischemic attack (TIA) were discharged home, a slight increase from 52.0 percent in 2002/03.
- In 2004/05, 15.5 percent of patients admitted with stroke or TIA were discharged to inpatient rehabilitation—a decrease from 17.3 percent in 2002/03.
- There were variations by OSS region in the proportion of patients discharged to home, inpatient rehabilitation and acute care.

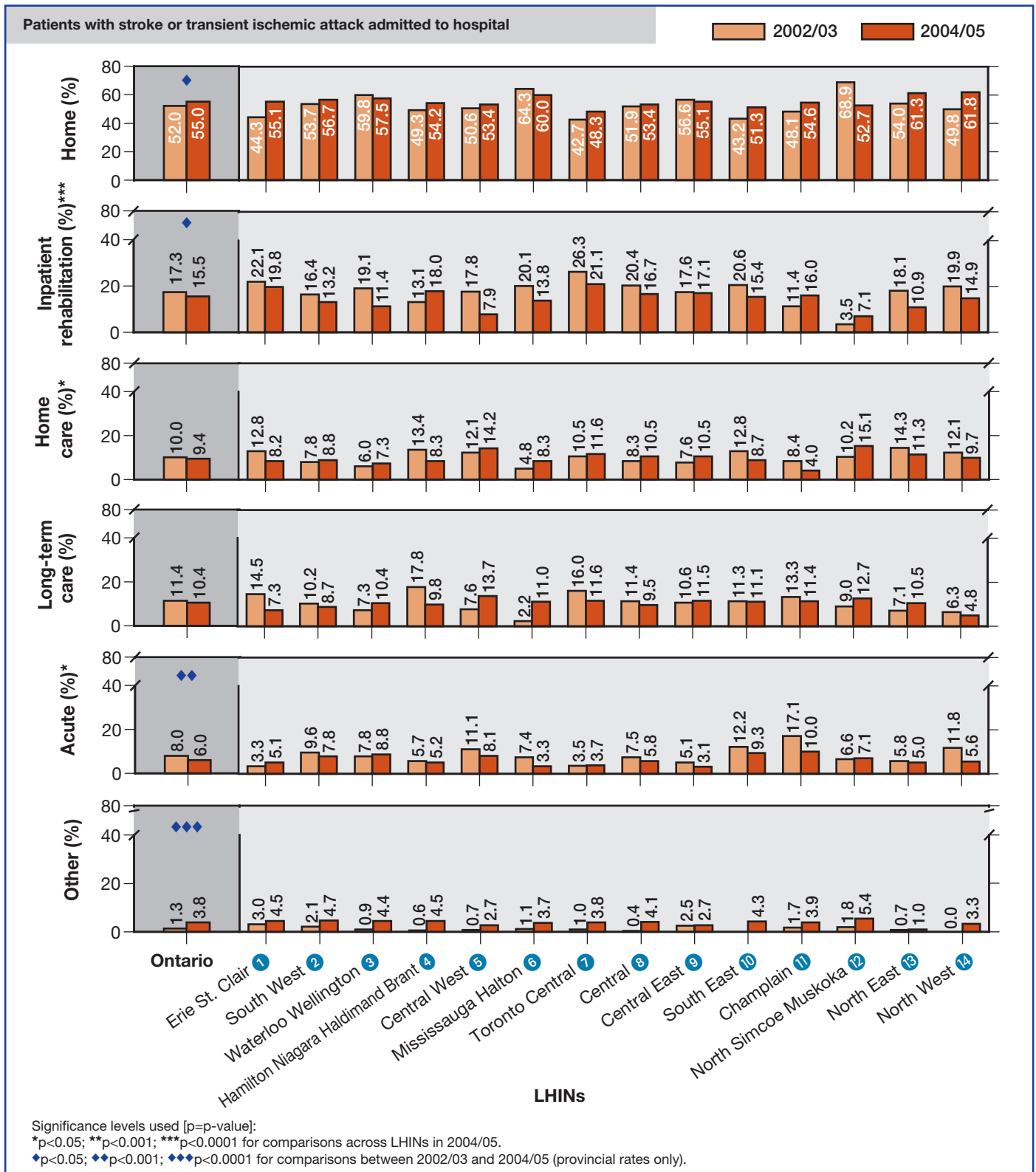
Exhibit 34 Discharge destination by Ontario Stroke System (OSS) designation, 2002/03 and 2004/05



**Findings**

- Compared to patients with stroke or transient ischemic attack seen at non-designated hospitals, those seen at regional and district stroke centres were more likely to be transferred to inpatient rehabilitation.
- At regional stroke centres, there was a decrease in the proportion of stroke patients discharged to inpatient rehabilitation—from 25.1 percent in 2002/03 to 18.5 percent in 2004/05.

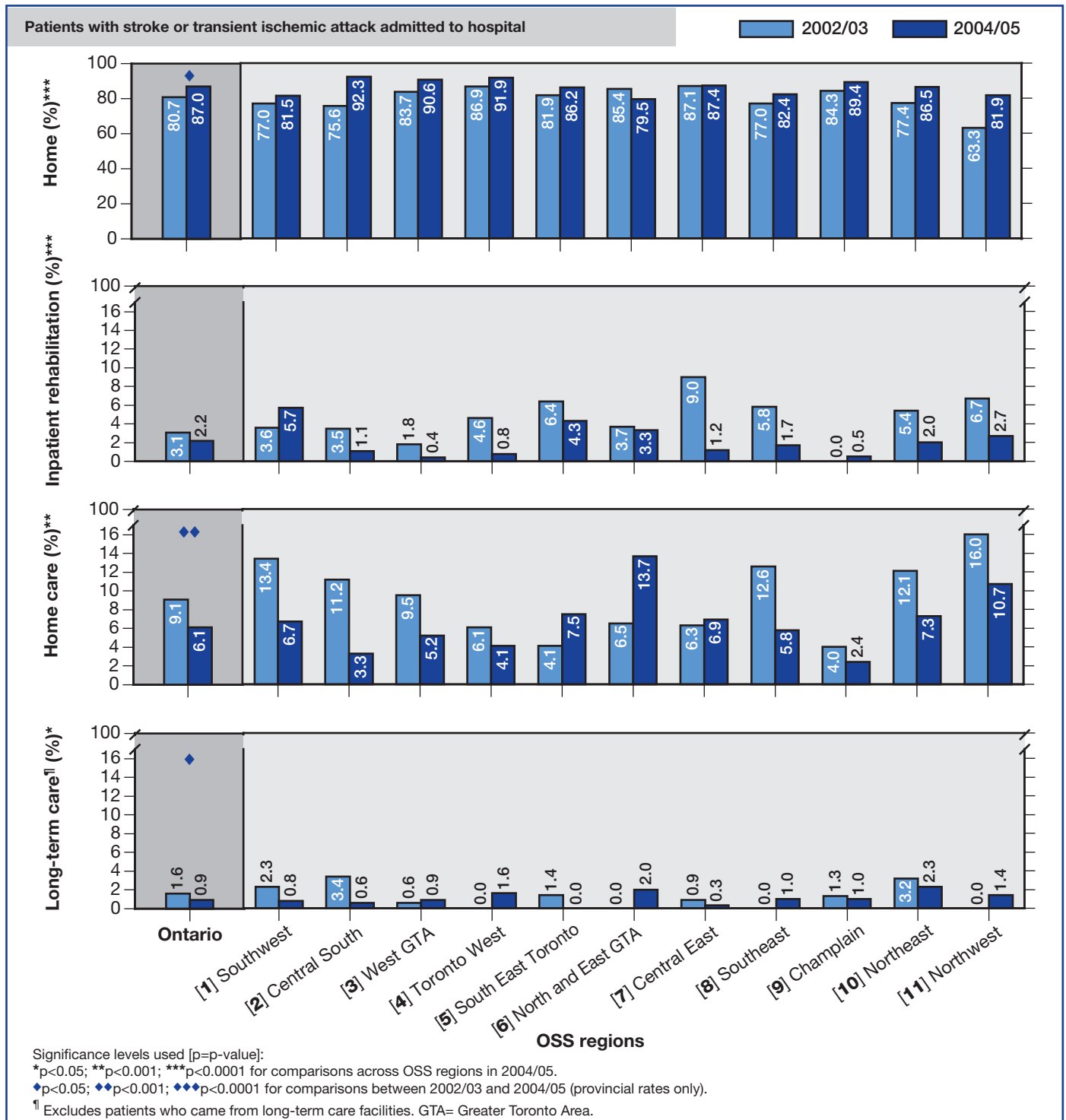
Exhibit 35 Discharge destination by Ontario Local Health Integration Network (LHIN), 2002/03 and 2004/05



Findings

- There were variations across Local Health Integration Networks (LHINs) in discharge destination after hospitalization for stroke or transient ischemic attack.

**Exhibit 36a Discharge destination of patients with Rankin score 0–2, by Ontario Stroke System (OSS) region, 2002/03 and 2004/05**

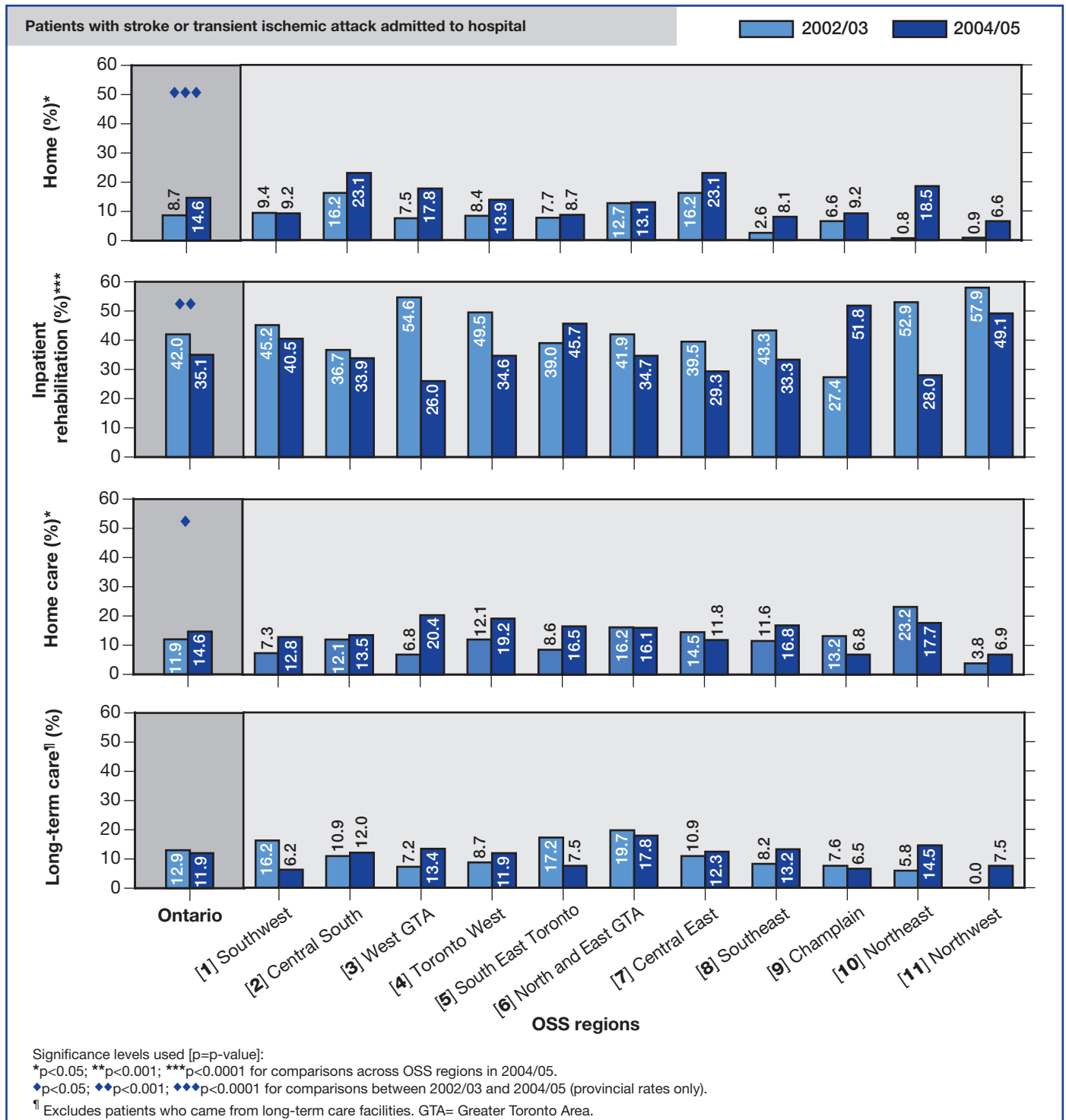


**Findings**

- Among stroke patients with no or minimal disability at discharge (Rankin score 0–2), the majority (87.0 percent) were discharged home in 2004/05, an increase from 80.7 percent in 2002/03. There were significant variations in discharge destination across OSS regions.



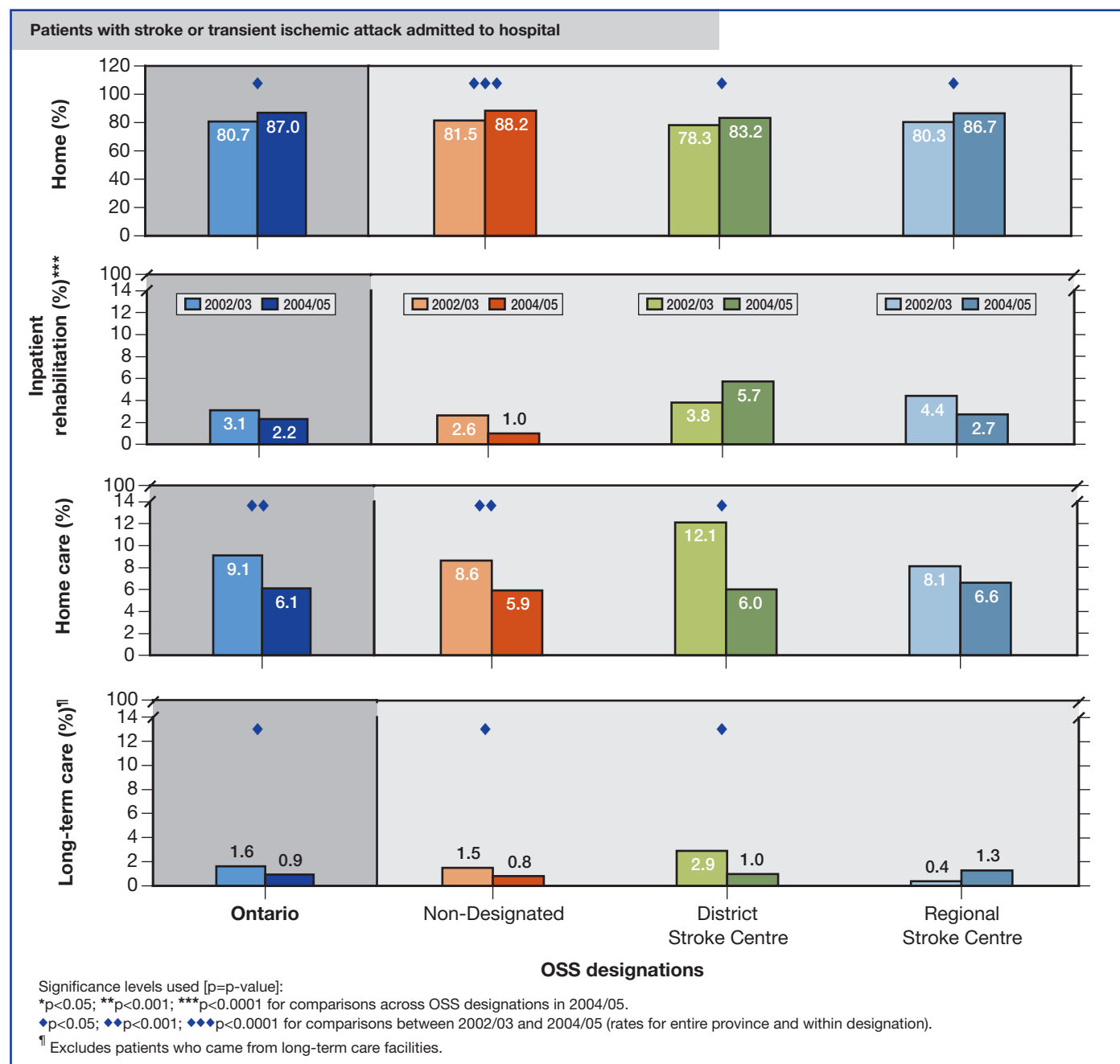
**Exhibit 36b Discharge destination of patients with Rankin score 3–5, by Ontario Stroke System (OSS) region, 2002/03 and 2004/05**



**Findings**

- Among stroke patients with moderate to severe disability at discharge (Rankin score 3–5), the majority (35.1 percent) were discharged to inpatient rehabilitation in 2004/05. This was a significant decrease compared to 42.0 percent in 2002/03. There were significant variations in discharge destinations across OSS regions.

**Exhibit 37a Discharge destination of patients with Rankin score 0–2, by Ontario Stroke System (OSS) designation, 2002/03 and 2004/05**



**Non-designated:**  
Acute care hospital that does not fit the definition of District or Regional Stroke Centre.

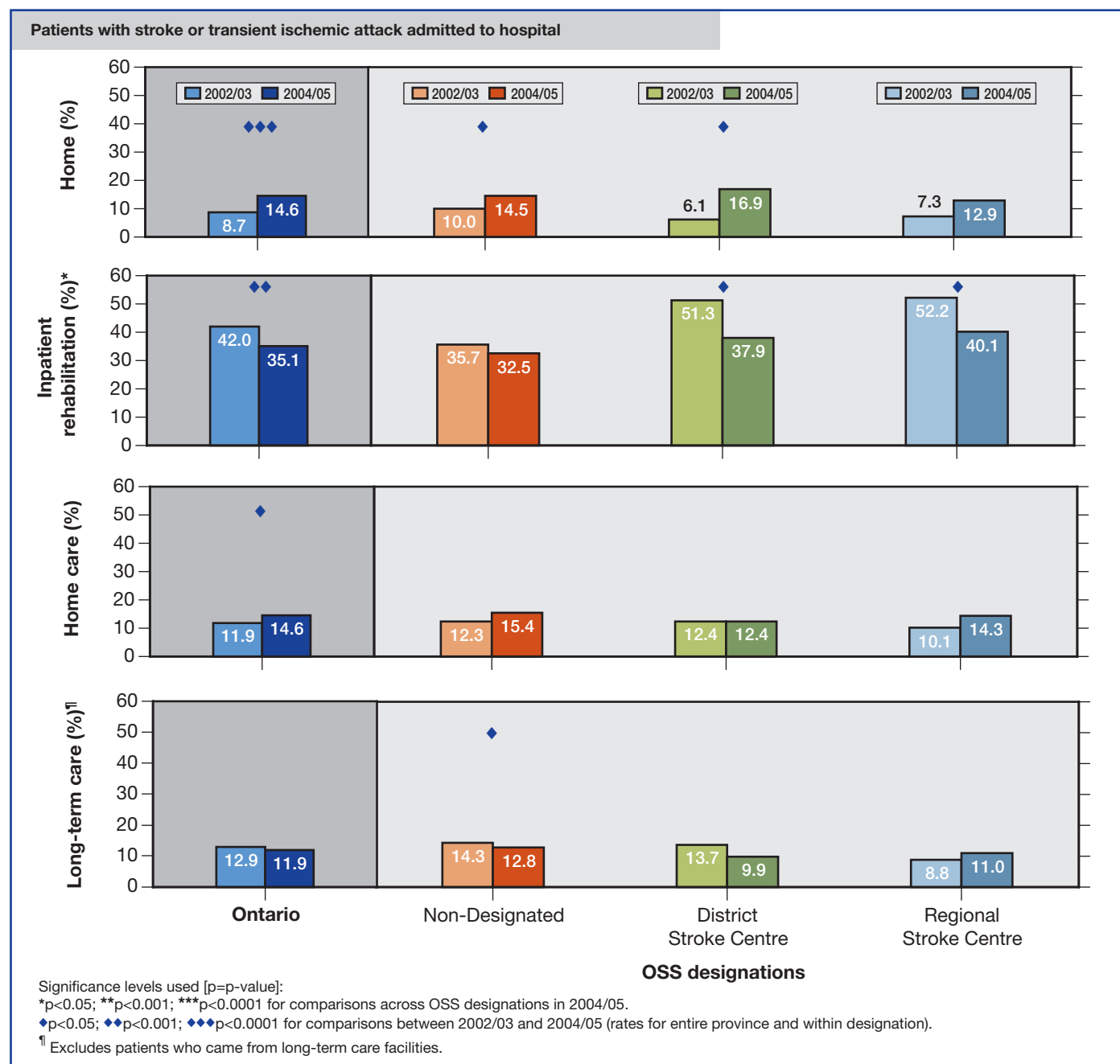
**District Stroke Centre:** Facilities with written stroke protocols for emergency services, emergency department and acute care including: transport and triage protocols; ability to offer thrombolytic therapy to suitable ischemic stroke patients; timely computed tomography (CT) scanning and expert interpretation; clinicians with stroke expertise; and, linkages to rehabilitation and secondary prevention.

**Regional Stroke Centre:**  
All the requirements of a District Stroke Centre, plus neurosurgical facilities and interventional radiology.

**Findings**

- In 2004/05, the discharge destination for patients with no or minimal disability (Rankin score 0–2) was similar across hospital types, with the majority of patients discharged home.
- Patients seen at district stroke centres were more likely than those at regional stroke centres and non-designated hospitals to be discharged to inpatient rehabilitation (5.7 percent vs. 2.7 percent and 1.0 percent, respectively).

**Exhibit 37b Discharge destination of patients with Rankin score 3–5, by Ontario Stroke System (OSS) designation, 2002/03 and 2004/05**



**Non-designated:**  
Acute care hospital that does not fit the definition of District or Regional Stroke Centre.

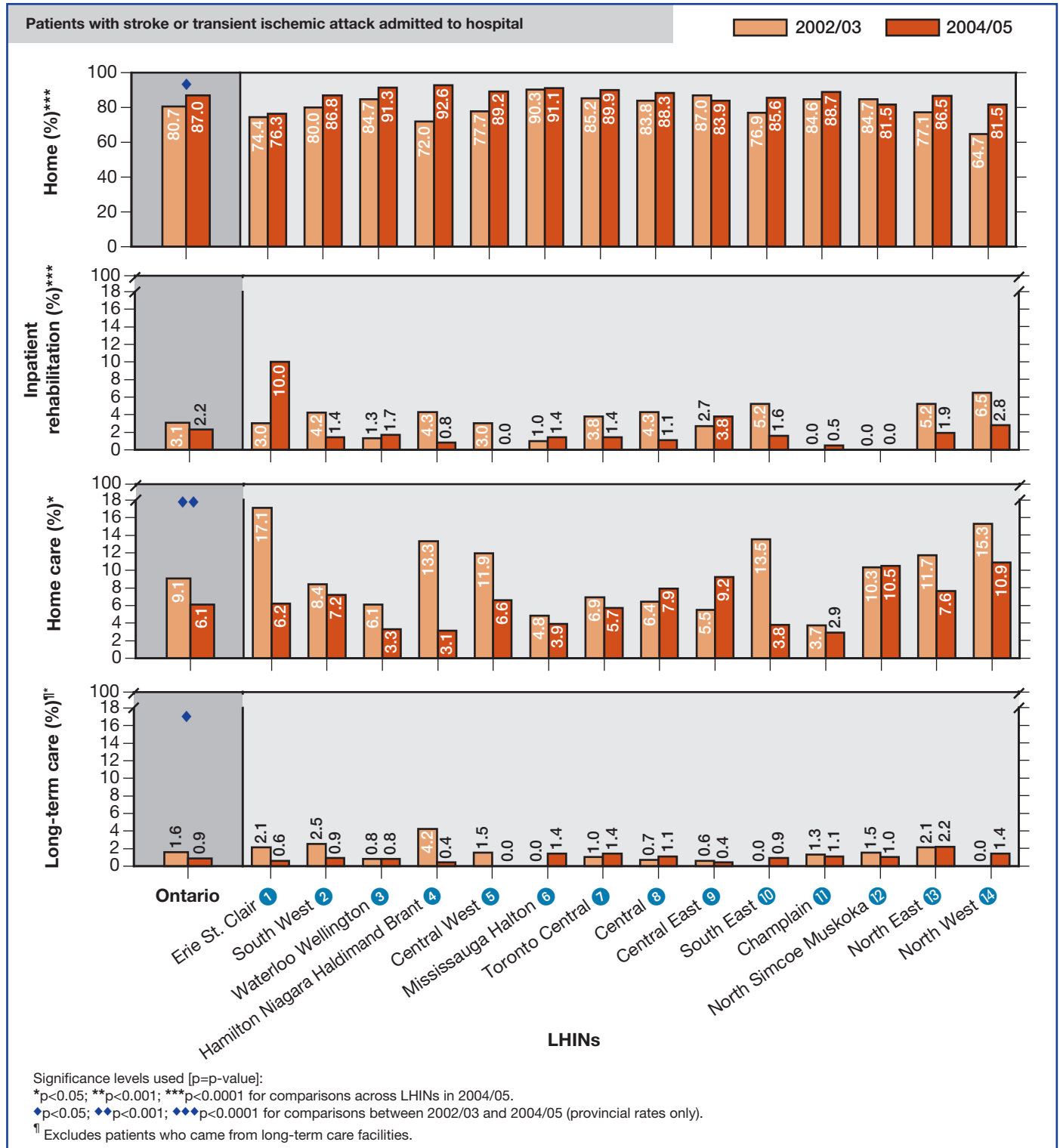
**District Stroke Centre:** Facilities with written stroke protocols for emergency services, emergency department and acute care including: transport and triage protocols; ability to offer thrombolytic therapy to suitable ischemic stroke patients; timely computed tomography (CT) scanning and expert interpretation; clinicians with stroke expertise; and, linkages to rehabilitation and secondary prevention.

**Regional Stroke Centre:**  
All the requirements of a District Stroke Centre, plus neurosurgical facilities and interventional radiology.

**Findings**

- In 2004/05, discharge destinations for patients with moderate to severe disability (Rankin score 3–5) were similar across hospital types, except for discharge to inpatient rehabilitation. These rates were 32.5 percent (non-designated hospitals); 37.9 percent (district stroke centres); and 40.1 percent (regional stroke centres).
- Compared to 2002/03, there was a significant decrease in the proportion of such patients discharged to inpatient rehabilitation from both regional and district stroke centres.

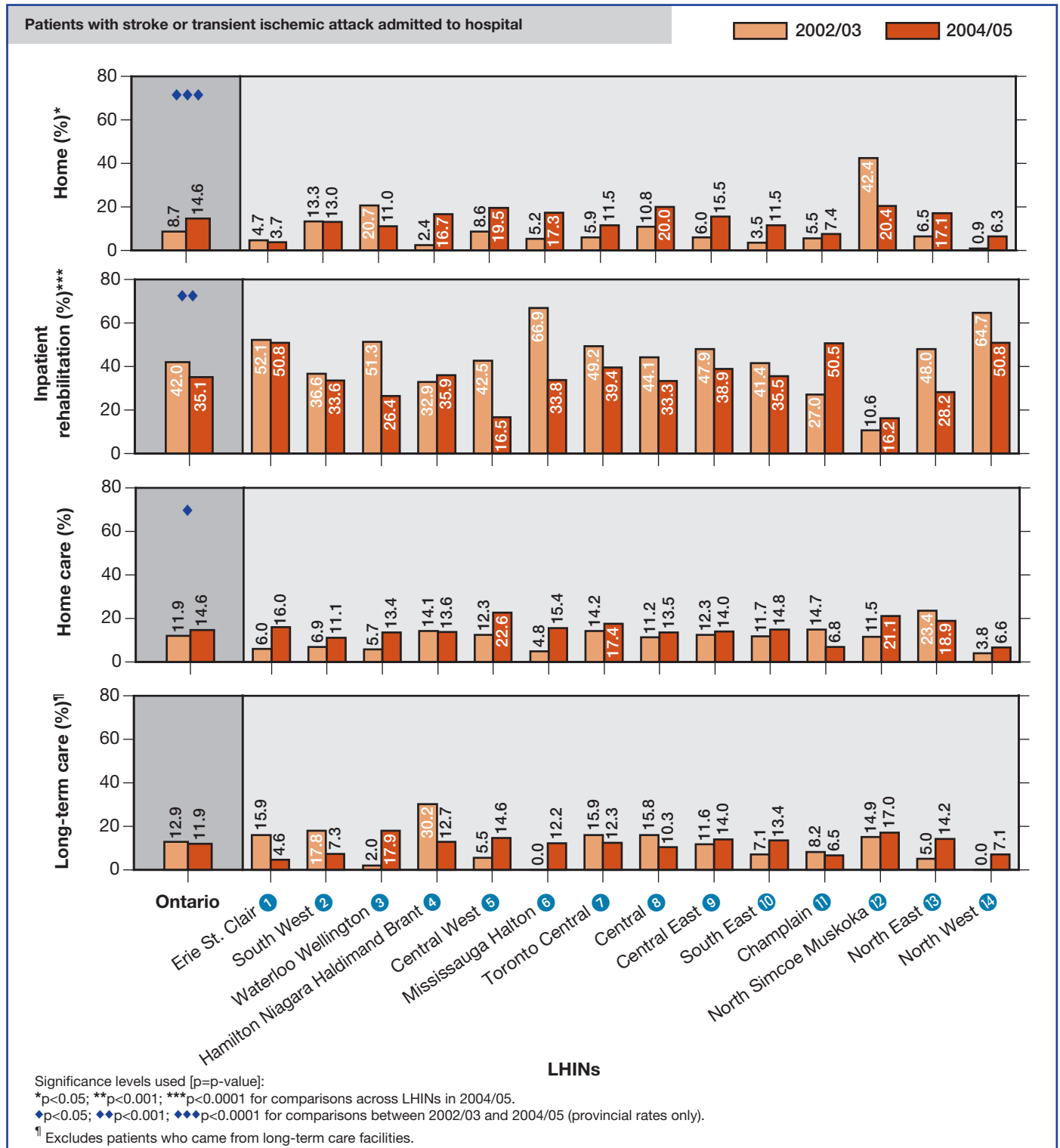
**Exhibit 38a Discharge destination of patients with Rankin score 0–2, by Ontario Local Health Integration Network (LHIN), 2002/03 and 2004/05**



**Findings**

- There were regional variations in discharge destination among patients with minimal or no disability at discharge (Rankin score 0–2).
- Among stroke patients with no or minimal disability at discharge (Rankin score 0–2), the majority (87.0 percent) were discharged home in 2004/05—from 80.7 percent in 2002/03.

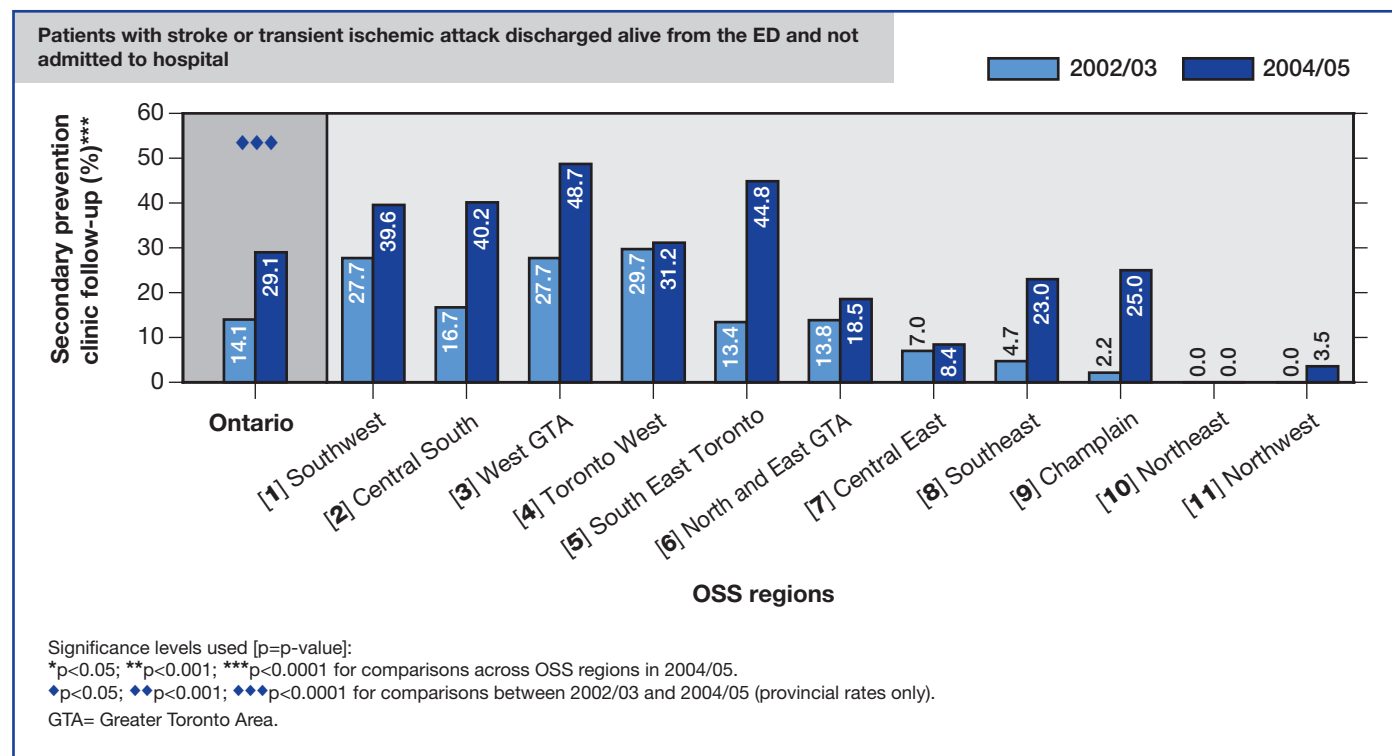
**Exhibit 38b Discharge destination of patients with Rankin score 3–5, by Ontario Local Health Integration Network (LHIN), 2002/03 and 2004/05**



**Findings**

- There were regional variations in discharge destination among stroke patients with moderate to severe disability (Rankin score 3–5).
- In 2004/05, there were variations by Local Health Integration Network (LHIN) in the proportion of stroke patients with moderate to severe disability (Rankin score 3–5) discharged to home or to inpatient rehabilitation.

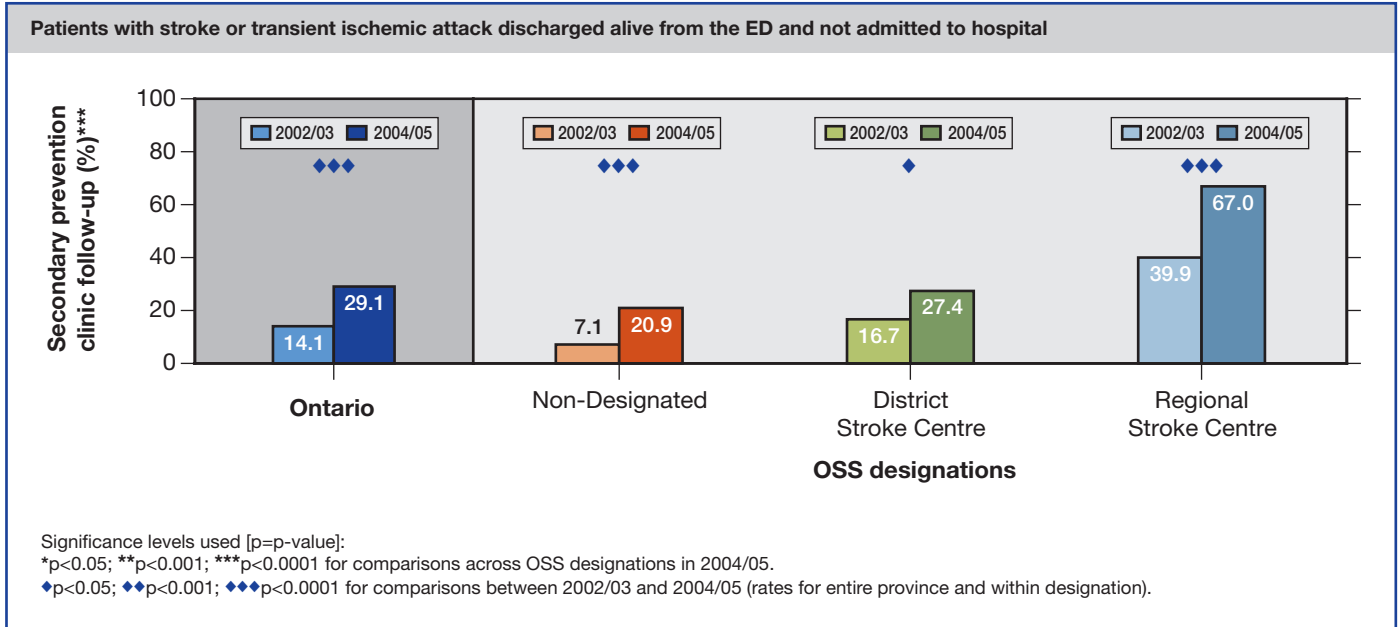
**Exhibit 39 Proportion (%) of stroke patients referred to a Secondary Prevention Clinic, by Ontario Stroke System (OSS) region, 2002/03 and 2004/05**



**Findings**

- There has been a marked increase in the proportion of patients referred to stroke secondary prevention clinics, from 14.1 percent in 2002/03 to 29.1 percent in 2004/05.
- In 2004/05, there were wide variations in rates of stroke secondary prevention clinic referrals across OSS regions, ranging from 3.5 percent to 48.7 percent.

**Exhibit 40 Proportion (%) of stroke patients referred to a Secondary Prevention Clinic, by Ontario Stroke System (OSS) designation, 2002/03 and 2004/05**



**Non-designated:**  
Acute care hospital that does not fit the definition of District or Regional Stroke Centre.

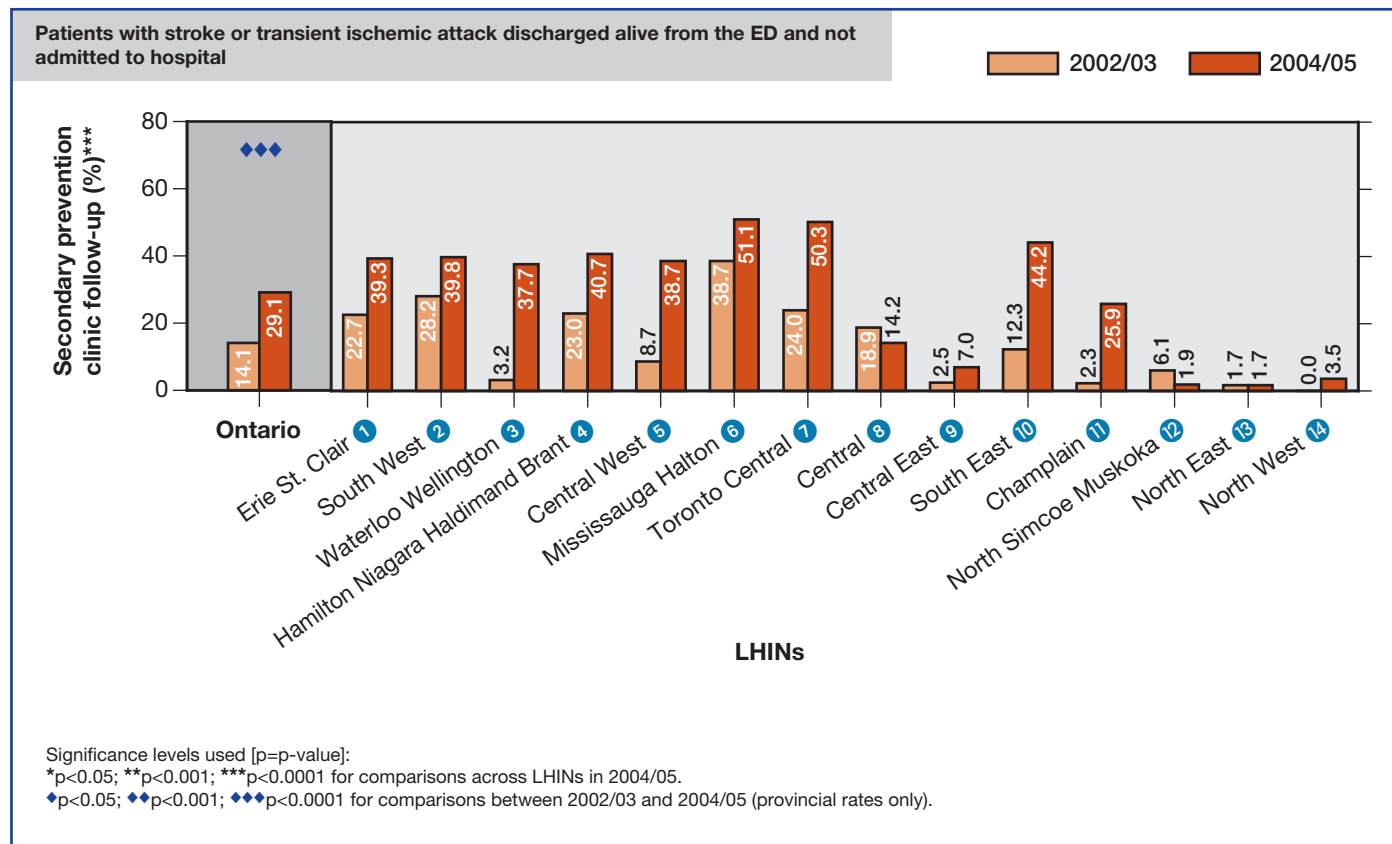
**District Stroke Centre:** Facilities with written stroke protocols for emergency services, emergency department and acute care including: transport and triage protocols; ability to offer thrombolytic therapy to suitable ischemic stroke patients; timely computed tomography (CT) scanning and expert interpretation; clinicians with stroke expertise; and, linkages to rehabilitation and secondary prevention.

**Regional Stroke Centre:** All the requirements of a District Stroke Centre, plus neurosurgical facilities and interventional radiology.

**Findings**

- There has been a marked increase in the proportion of patients referred to stroke secondary prevention clinics, from 14.1 percent in 2002/03 to 29.1 percent in 2004/05.
- The largest increase in referral rates between 2002/03 and 2004/05 was seen at non-designated hospitals, where referral rates increased from 7.1 percent in 2002/03 to 20.9 percent in 2004/05.
- Referrals to stroke secondary prevention clinics were highest at regional stroke centres compared to other types of hospitals, with referral rates in 2004/05 of 67.0 percent, compared with 27.4 percent at district stroke centres and 20.9 percent at non-designated hospitals.

**Exhibit 41 Proportion (%) of stroke patients referred to a Secondary Prevention Clinic, by Ontario Local Health Integration Network (LHIN), 2002/03 and 2004/05**

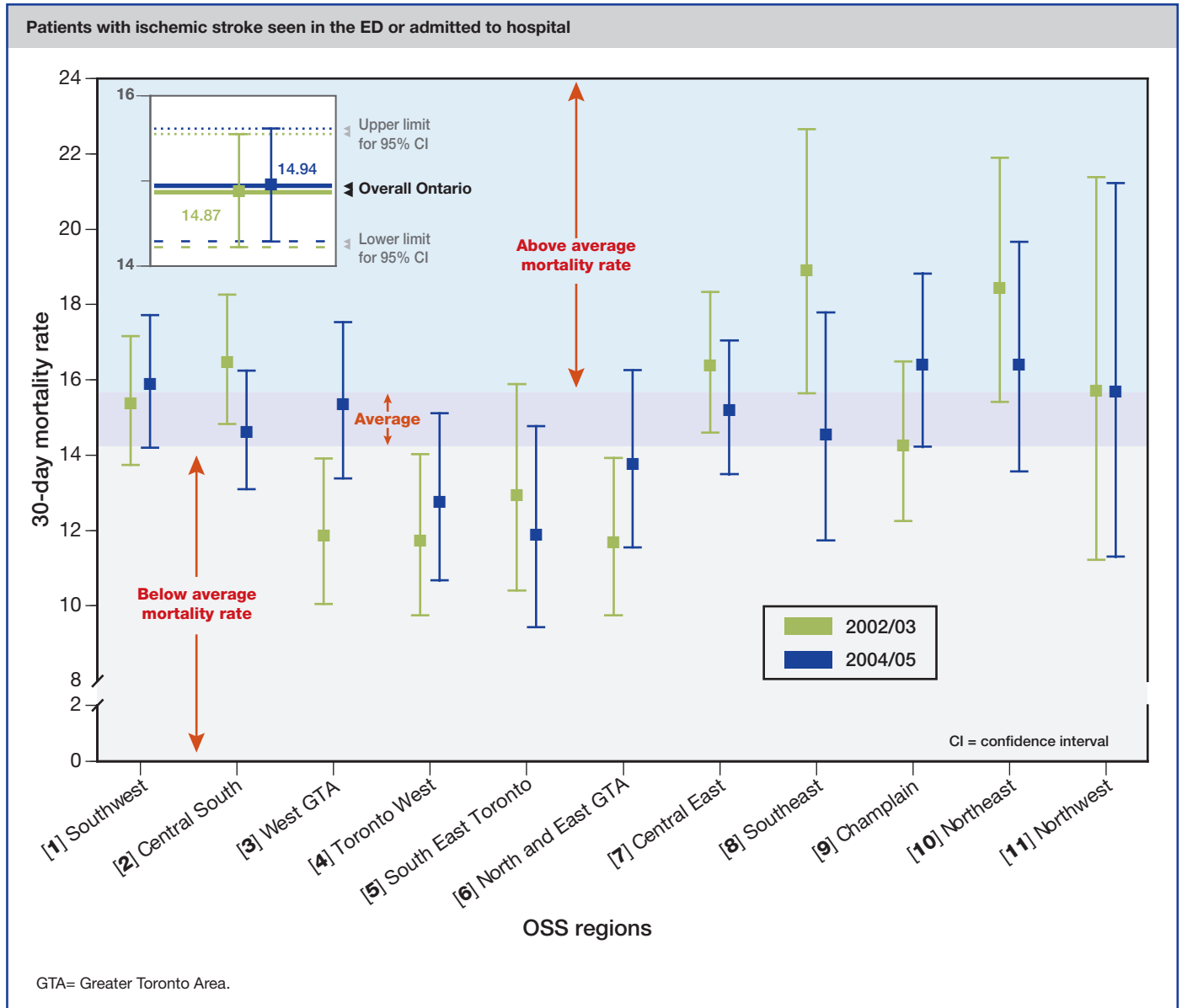


**Findings**

- There has been a marked increase in the proportion of patients referred to stroke secondary prevention clinics, from 14.1 percent in 2002/03 to 29.1 percent in 2004/05.
- There were regional variations in rates of referrals to stroke secondary prevention clinics, with the lowest rates seen in northern Local Health Integration Networks (LHINs) where few clinics exist.



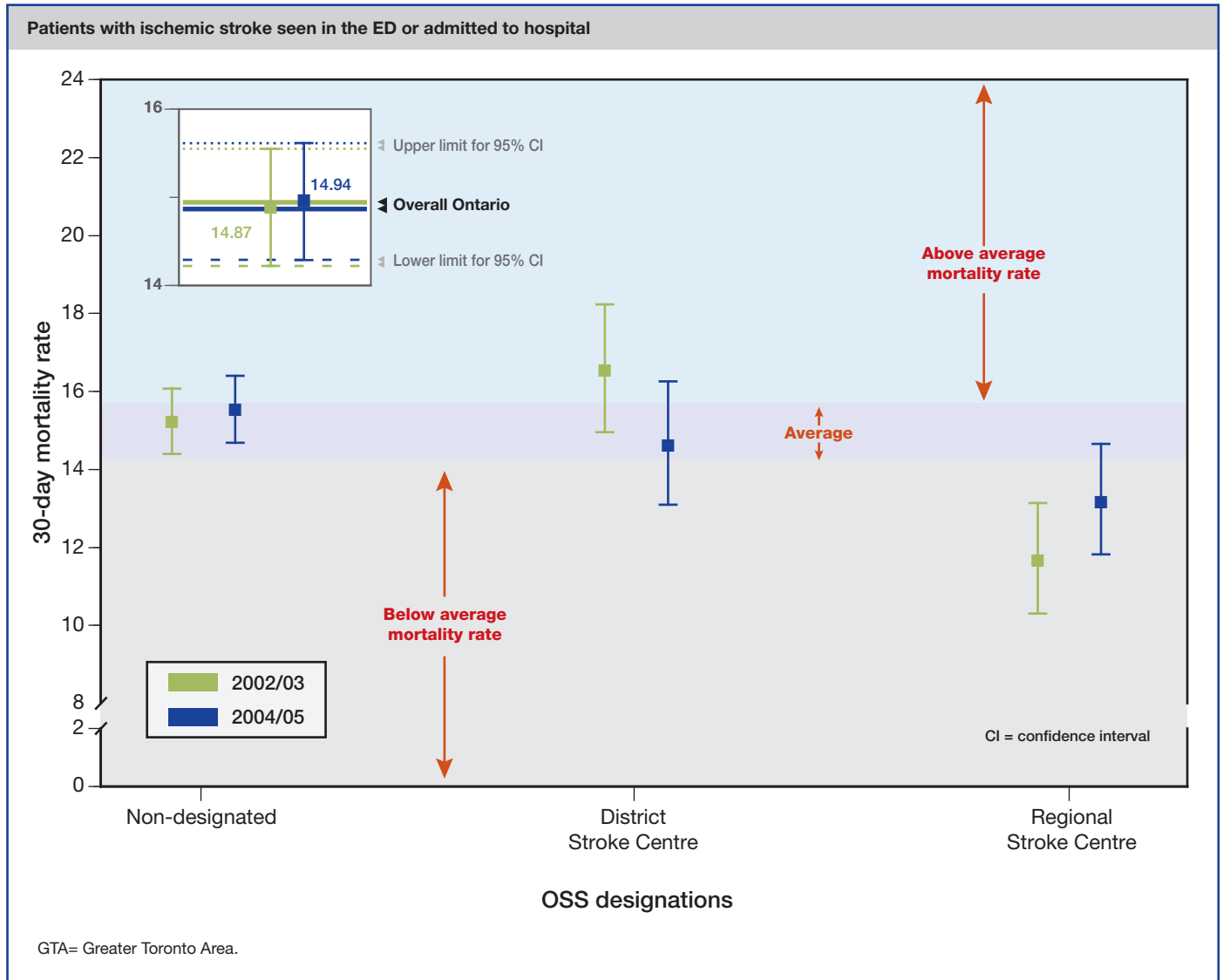
**Exhibit 42 Age- and sex-adjusted 30-day ischemic stroke mortality rate, by Ontario Stroke System (OSS) region, 2002/03 and 2004/05**



**Findings**

- In 2004/05, the adjusted provincial 30-day ischemic stroke mortality rate was 14.94 percent, with no significant change compared to 2002/03, and no statistically significant variations across OSS regions.

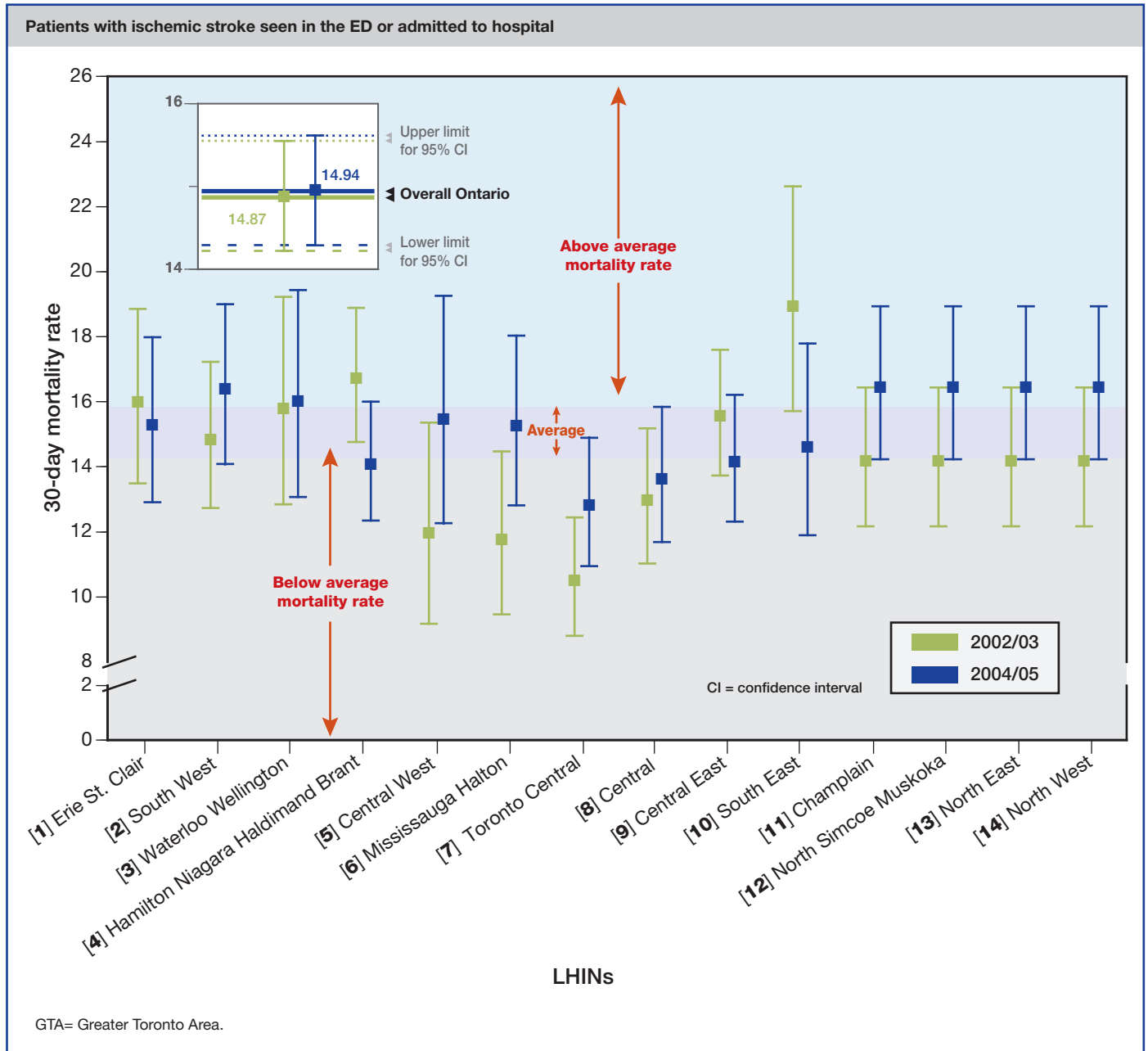
**Exhibit 43 Age- and sex-adjusted 30-day ischemic stroke mortality rate, by Ontario Stroke System (OSS) designation, 2002/03 and 2004/05**



**Findings**

- In 2004/05, the adjusted provincial 30-day ischemic stroke mortality rate was 14.94 percent, with no significant change compared to 2002/03. Mortality rates were lower at regional stroke centres compared to those at non-designated hospitals.

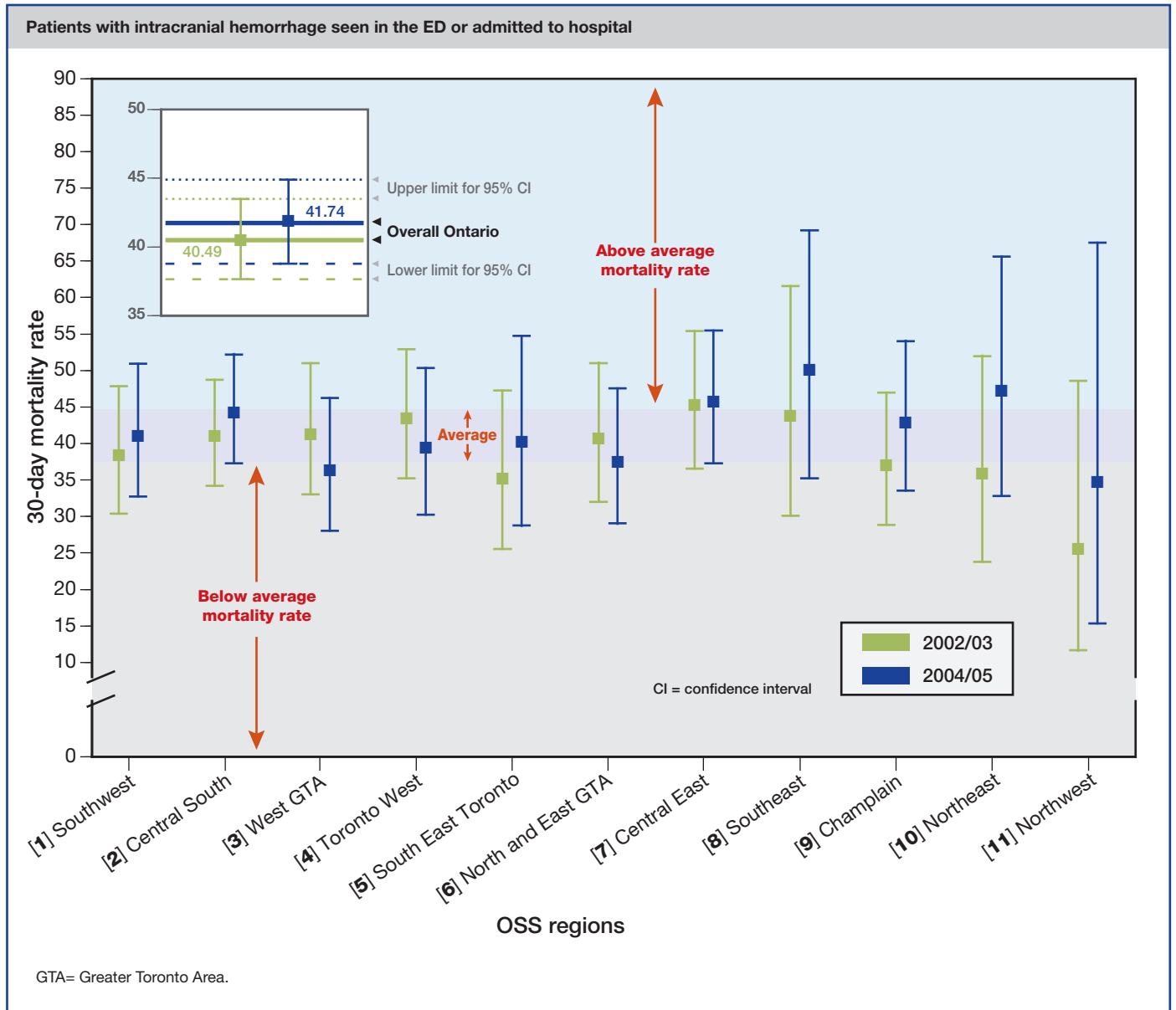
**Exhibit 44 Age- and sex-adjusted 30-day ischemic stroke mortality rate, by Ontario Local Health Integration Network (LHIN), 2002/03 and 2004/05**



**Findings**

- In 2004/05, the adjusted provincial 30-day ischemic stroke mortality rate was 14.94 percent, with no significant change compared to 2002/03, and no statistically significant variations across Local Health Integration Networks (LHINs).

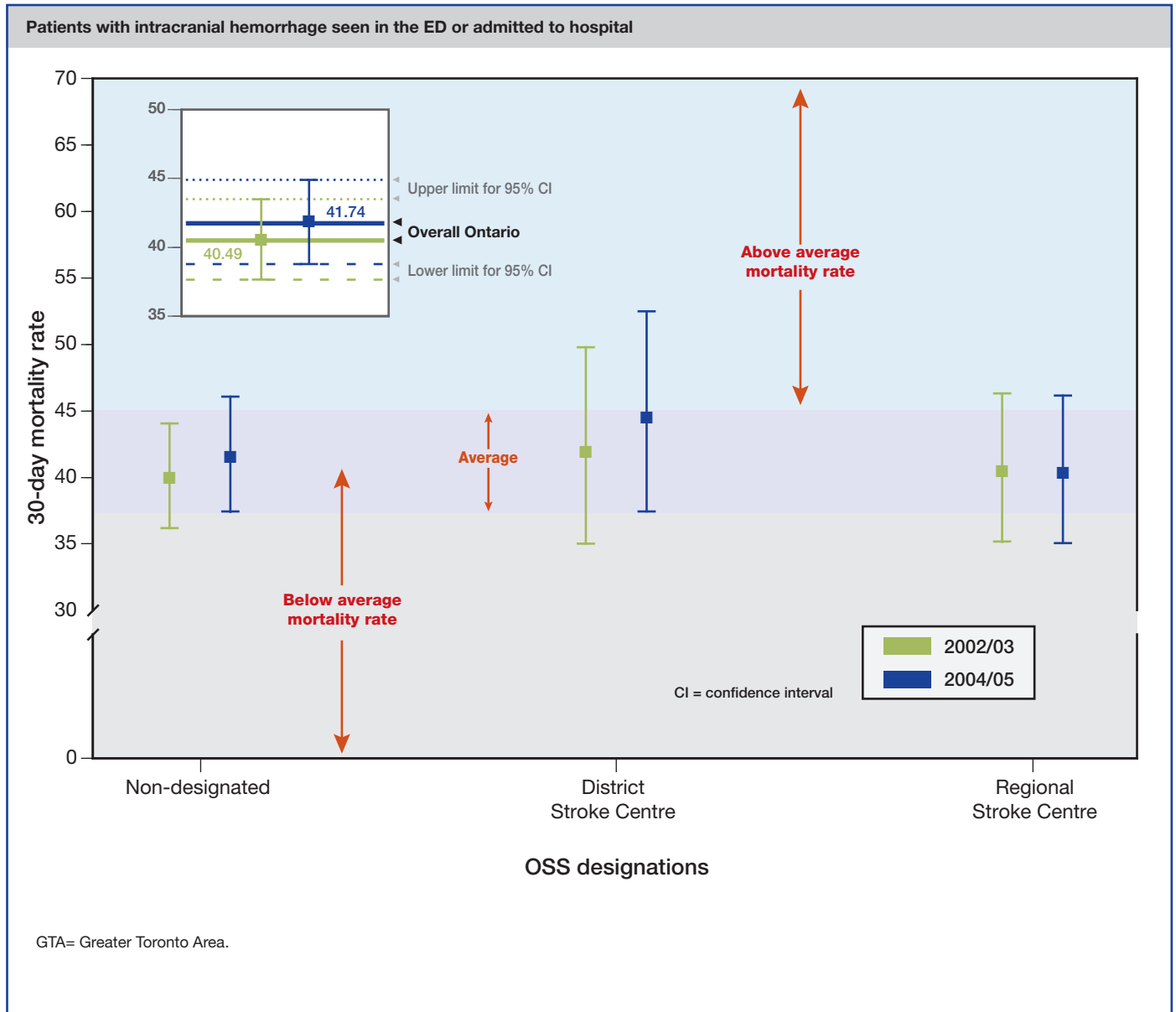
**Exhibit 45 Age- and sex-adjusted 30-day intracranial hemorrhagic stroke mortality rate, by Ontario Stroke System (OSS) region, 2002/03 and 2004/05**



**Findings**

- In 2004/05, the adjusted provincial 30-day hemorrhagic stroke mortality rate was 41.74 percent, with no significant change compared to 2002/03, and no statistically significant variations across OSS regions.

**Exhibit 46 Age- and sex-adjusted 30-day intracranial hemorrhagic stroke mortality rate, by Ontario Stroke System (OSS) designation, 2002/03 and 2004/05**



**Non-designated:**  
Acute care hospital that does not fit the definition of District or Regional Stroke Centre.

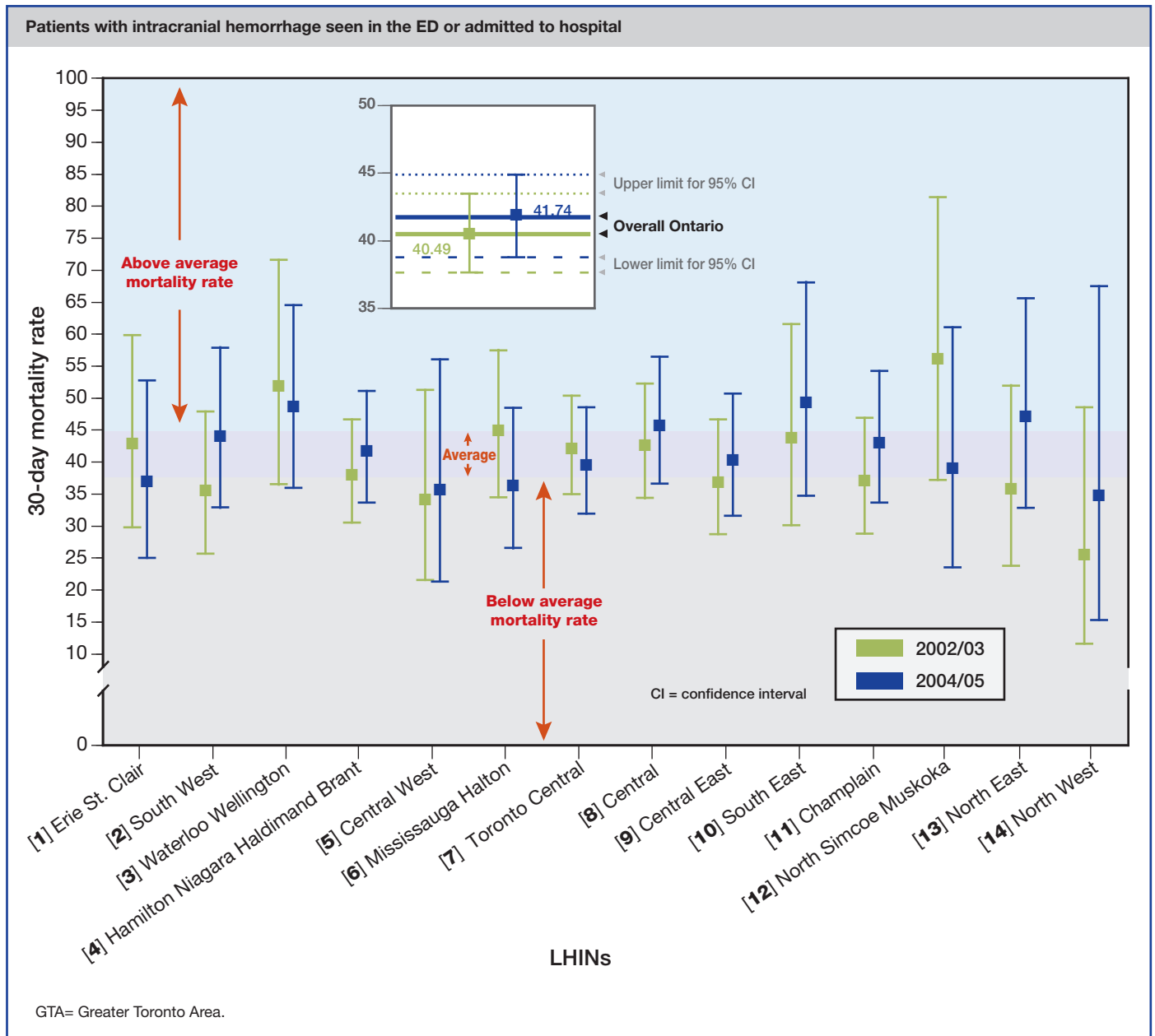
**District Stroke Centre:** Facilities with written stroke protocols for emergency services, emergency department and acute care including: transport and triage protocols; ability to offer thrombolytic therapy to suitable ischemic stroke patients; timely computed tomography (CT) scanning and expert interpretation; clinicians with stroke expertise; and, linkages to rehabilitation and secondary prevention.

**Regional Stroke Centre:**  
All the requirements of a District Stroke Centre, plus neurosurgical facilities and interventional radiology.

**Findings**

- In 2004/05, the adjusted provincial 30-day hemorrhagic stroke mortality rate was 41.74 percent, with no significant change compared to 2002/03, and no statistically significant variations across hospital types.

**Exhibit 47 Age- and sex-adjusted 30-day intracranial hemorrhagic stroke mortality rate, by Ontario Local Health Integration Network (LHIN), 2002/03 and 2004/05**



**Findings**

- In 2004/05, the adjusted provincial 30-day hemorrhagic stroke mortality rate was 41.74 percent, with no significant change compared to 2002/03, and no statistically significant variations across Local Health Integration Networks (LHINs).

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## Appendices—Appendix A. Ontario Stroke Audit 2004/05 Indicator List

Section	Indicator Statements
Baseline characteristics	Incidence of stroke across province by stroke type, region and LHIN
	Impact of public awareness campaigns on number of patients arriving at hospital within 2.5 hours of stroke symptom onset
	Time to patient arrival in ED from stroke symptom onset
Thrombolysis	All eligible patients who arrive at hospital within 2.5 hours of symptom onset should receive tPA, and receive it within one hour of hospital arrival.
	Median door-to-needle time for administration of IV thrombolysis from time of ED arrival (registration) to time of administration (start-time), for ischemic stroke patients
	Patients potentially eligible for tPA should have CT brain scan completed within 25 minutes of ED arrival.
Emergency and Inpatient Care	CT/MRI should be completed within 24 hours for stroke patients.
	All stroke patients should have a CT/MRI before hospital discharge.
	Carotid imaging during hospitalization or documentation to have tests completed as outpatient following hospital discharge
	Patients with acute stroke should be managed on a designated stroke unit
	A protocol or screen for dysphagia assessment should be initiated on all acute ischemic stroke patients before they are given food or drink and results documented in patient chart
	All acute ischemic stroke patients discharged on antithrombotic therapy unless contraindicated.
	Patients with an acute ischemic stroke and non-valvular atrial fibrillation should be discharged on appropriate anticoagulants unless contraindicated.
	Patients discharged following an ischemic stroke event should be assessed for and prescribed a lipid-lowering agent if appropriate.
	Patients discharged following an ischemic stroke event should be assessed for and prescribed a blood-pressure lowering agent if appropriate.
	Proportion of patients who receive inpatient rehabilitation following a stroke admission to acute care
Proportion of TIA or ischemic stroke patients who are discharged directly from the ED who receive referral to a secondary prevention clinic	
Outcomes	Inpatient length of stay
	Discharge disposition from acute care hospitals following stroke
	Rankin score at discharge from acute inpatient care
	Age- and sex-adjusted 30-day mortality rates for stroke patients in Ontario



## Appendices—Appendix B. Provincial resources for stroke (2005/06)

Institute Name	Location	Ontario Stroke Strategy Region	Ontario Stroke Strategy Designation	Local Health Integration Network (LHIN)	Stroke Unit on Site (Y/N)	Stroke Prevention Clinic on Site* (Y/N)
Alexandra Hospital	Ingersoll	Southwest	Non-designated	South West	N	N
Alexandra Marine and General Hospital	Goderich	Southwest	Non-designated	South West	N	N
Almonte General Hospital	Almonte	Champlain	Non-designated	Champlain	N	N
Arnprior and District Memorial Hospital	Arnprior	Champlain	Non-designated	Champlain	N	N
Atikokan General Hospital	Atikokan	Northwest	Non-designated	North West	N	N
Blind River District Health Centre	Blind River	Northeast	Non-designated	North East	N	N
Bluewater Health (Charlotte Eleanor Englehart)	Petrolia	Southwest	Non-designated	Erie St. Clair	N	N
Bluewater Health (Mitton Street, Sarnia)	Sarnia	Southwest	District Stroke Centre	Erie St. Clair	Y	Y
Brant Community Health Care System (Brantford General)	Brantford	Central South	District Stroke Centre	Hamilton Niagara Haldimand Brant	N	Y
Brockville General Hospital	Brockville	Southeast	Non-designated	South East	N	Y
Cambridge Memorial Hospital	Cambridge	Central South	Non-designated	Waterloo Wellington	N	N
Campbellford Memorial Hospital	Campbellford	Central East	Non-designated	Central East	N	N
Carleton Place & District Memorial Hospital	Carleton Place	Champlain	Non-designated	Champlain	N	N
Chatham Kent Health Alliance (Public General)	Chatham	Southwest	District Stroke Centre	Erie St. Clair	N	Y
Chatham Kent Health Alliance (Sydenham District)	Wallaceburg	Southwest	Non-designated	Erie St. Clair	N	N
Collingwood General and Marine Hospital	Collingwood	Central East	Non-designated	North Simcoe Muskoka	N	N
Cornwall Community Hospital	Cornwall	Champlain	Non-designated	Champlain	N	N
Deep River and District Hospital	Deep River	Champlain	Non-designated	Champlain	N	N
Dryden Regional Health Centre	Dryden	Northwest	Non-designated	North West	N	N
Englehart & District Hospital	Englehart	Northeast	Non-designated	North East	N	N
Espanola General Hospital	Espanola	Northeast	Non-designated	North East	N	N
Glangarry Memorial Hospital	Alexandria	Champlain	Non-designated	Champlain	N	N
Grand River Hospital Corporation (Kitchener Waterloo Health Centre)	Kitchener	Central South	District Stroke Centre	Waterloo Wellington	Y	Y
Grey Bruce Health Services (Markdale)	Markdale	Southwest	Non-designated	South West	N	N

\* Ministry of Health and Long-Term Care designated Secondary Prevention Clinics.

Institute Name	Location	Ontario Stroke Strategy Region	Ontario Stroke Strategy Designation	Local Health Integration Network (LHIN)	Stroke Unit on Site (Y/N)	Stroke Prevention Clinic on Site* (Y/N)
Grey Bruce Health Services (Bruce Peninsula)	Warton	Southwest	Non-designated	South West	N	N
Grey Bruce Health Services (Meaford)	Meaford	Southwest	Non-designated	South West	N	N
Grey Bruce Health Services (Owen Sound)	Owen Sound	Southwest	District Stroke Centre	South West	Y	Y
Grey Bruce Health Services (Southampton)	Southampton	Southwest	Non-designated	South West	N	N
Groves Memorial Community Hospital	Fergus	Central South	Non-designated	Waterloo Wellington	N	N
Guelph General Hospital	Guelph	Central South	Non-designated	Waterloo Wellington	N	N
Haldimand War Memorial Hospital	Dunnville	Central South	Non-designated	Hamilton Niagara Haldimand Brant	N	N
Haliburton Highlands Health Services (Minden)	Minden	Central East	Non-designated	Central East	N	N
Halton Healthcare Services Corporation (Milton District )	Milton	West GTA	Non-designated	Mississauga Halton	N	N
Halton Healthcare Services Corporation (Oakville Trafalgar Memorial)	Oakville	West GTA	Non-designated	Mississauga Halton	Y	N
Hamilton Health Sciences Centre (Hamilton General)	Hamilton	Central South	Regional Stroke Centre	Hamilton Niagara Haldimand Brant	Y	Y
Hamilton Health Sciences Centre (Henderson)	Hamilton	Central South	Non-designated	Hamilton Niagara Haldimand Brant	N	N
Hamilton Health Sciences Centre (McMaster)	Hamilton	Central South	Non-designated	Hamilton Niagara Haldimand Brant	N	N
Hanover and District Hospital	Hanover	Southwest	Non-designated	South West	N	N
Hawkesbury District General Hospital	Hawkesbury	Champlain	Non-designated	Champlain	N	Y
Headwaters Health Care Centre (Orangeville)	Orangeville	West GTA	Non-designated	Central West	N	N
Hôpital Montfort	Ottawa	Champlain	Non-designated	Champlain	N	N
Hôpital Notre Dame Hospital	Hearst	Northeast	Non-designated	North East	N	N
Hôpital Regional de Sudbury Regional Hospital	Sudbury	Northeast	Enhanced District Stroke Centre	North East	Y	Y
Hôtel Dieu Hospital	Kingston	Southeast	Non-designated	South East	N	N
Hôtel Dieu Hospital of St. Catharines	St. Catharines	Central South	Non-designated	Hamilton Niagara Haldimand Brant	N	N
Hôtel-Dieu Grace Hospital (Grace Site)	Windsor	Southwest	Enhanced District Stroke Centre	Erie St. Clair	Y	Y

\* Ministry of Health and Long-Term Care designated Secondary Prevention Clinics.

Institute Name	Location	Ontario Stroke Strategy Region	Ontario Stroke Strategy Designation	Local Health Integration Network (LHIN)	Stroke Unit on Site (Y/N)	Stroke Prevention Clinic on Site* (Y/N)
Humber River Regional Hospital (Church St.)	Weston	Toronto West	Non-designated	Central	N	N
Humber River Regional Hospital (York-Finch)	Downsview	Toronto West	Non-designated	Central	N	N
Huron-Perth Hospital Partnership (Clinton Public)	Clinton	Southwest	Non-designated	South West	N	N
Huron-Perth Hospital Partnership (Seaforth Community)	Seaforth	Southwest	Non-designated	South West	N	N
Huron-Perth Hospital Partnership (St. Marys Memorial)	St. Marys	Southwest	Non-designated	South West	N	N
Huron-Perth Hospital Partnership (Stratford General)	Stratford	Southwest	District Stroke Centre	South West	N	Y
Joseph Brant Memorial Hospital	Burlington	Central South	Non-designated	Hamilton Niagara Haldimand Brant	N	N
Kemptville District Hospital	Kemptville	Champlain	Non-designated	Champlain	N	N
Kingston General Hospital	Kingston	Southeast	Regional Stroke Centre	South East	Y	Y
Kirkland and District Hospital	Kirkland Lake	Northeast	Non-designated	North East	N	N
Lake of the Woods District Hospital	Kenora	Northwest	Non-designated	North West	N	Y
Lakeridge Health Corporation (Bowmanville)	Bowmanville	Central East	Non-designated	Central East	N	N
Lakeridge Health Corporation (Oshawa General)	Oshawa	Central East	Non-designated	Central East	N	Y
Lakeridge Health Corporation (Port Perry)	Port Perry	Central East	Non-designated	Central East	N	N
Leamington District Memorial Hospital	Leamington	Southwest	Non-designated	Erie St. Clair	N	N
Lennox & Addington County General Hospital	Napanee	Southeast	Non-designated	South East	N	N
Listowel and Wingham Hospitals Alliance (Listowel Memorial)	Listowel	Southwest	Non-designated	South West	N	N
Listowel and Wingham Hospitals Alliance (Wingham & District)	Wingham	Southwest	Non-designated	South West	N	N
London Health Sciences Centre (University Hospital)	London	Southwest	Regional Stroke Centre	South West	Y	Y
London Health Sciences Centre (Victoria Campus)	London	Southwest	Non-designated	South West	N	N
Manitoulin Health Centre (Little Current)	Little Current	Northeast	Non-designated	North East	N	N
Manitoulin Health Centre (Mindemoya)	Mindemoya	Northeast	Non-designated	North East	N	N
Markham Stouffville Hospital (Markham)	Markham	Central East	Non-designated	Central	N	N

\* Ministry of Health and Long-Term Care designated Secondary Prevention Clinics.

Institute Name	Location	Ontario Stroke Strategy Region	Ontario Stroke Strategy Designation	Local Health Integration Network (LHIN)	Stroke Unit on Site (Y/N)	Stroke Prevention Clinic on Site* (Y/N)
Markham Stouville Hospital (Uxbridge)	Uxbridge	Central East	Non-designated	Central East	N	N
Mattawa General Hospital	Mattawa	Northeast	Non-designated	North East	N	N
McCausland Hospital	Terrace Bay	Northwest	Non-designated	North West	N	N
MICs (Matheson Iroquois Falls, Cochrane) Group of Health Services (Anson General)	Iroquois Falls	Northeast	Non-designated	North East	N	N
MICs (Matheson Iroquois Falls, Cochrane) Group of Health Services (Lady Minto)	Cochrane	Northeast	Non-designated	North East	N	N
Middlesex Hospital Alliance (Four Counties)	Newbury	Southwest	Non-designated	South West	N	N
Middlesex Hospital Alliance (Strathroy Middlesex)	Strathroy	Southwest	Non-designated	South West	N	N
Mount Sinai Hospital	Toronto	Toronto West	Non-designated	Toronto Central	N	N
Muskoka-East Parry Sound Health Services (Huntsville Hospital)	Huntsville	Central East	District Stroke Centre	North Simcoe Muskoka	N	N
Muskoka-East Parry Sound Health Services (South Muskoka Memorial Hospital)	Bracebridge	Central East	Non-designated	North Simcoe Muskoka	N	N
Niagara Health System (Douglas Memorial)	Fort Erie	Central South	Non-designated	Hamilton Niagara Haldimand Brant	N	N
Niagara Health System (Greater Niagara General)	Niagara Falls	Central South	District Stroke Centre	Hamilton Niagara Haldimand Brant	N	Y
Niagara Health System (Port Colborne)	Port Colborne	Central South	Non-designated	Hamilton Niagara Haldimand Brant	N	N
Niagara Health System (St. Catharines General)	St. Catharines	Central South	Non-designated	Hamilton Niagara Haldimand Brant	N	N
Niagara Health System (Welland County)	Welland	Central South	Non-designated	Hamilton Niagara Haldimand Brant	N	N
Nipigon District Memorial Hospital	Nipigon	Northwest	Non-designated	North West	N	N
Norfolk General Hospital	Simcoe	Central South	Non-designated	Hamilton Niagara Haldimand Brant	N	N
North Bay General Hospital	North Bay	Northeast	District Stroke Centre	North East	Y	Y
North Simcoe Hospital Alliance (Huron District)	Midland	Central East	Non-designated	North Simcoe Muskoka	N	N
North Wellington Health Care Corporation (Louise Marshall)	Mount Forest	Central South	Non-designated	Waterloo Wellington	N	N
North Wellington Health Care Corporation (Palmerston)	Palmerston	Central South	Non-designated	Waterloo Wellington	N	N

\* Ministry of Health and Long-Term Care designated Secondary Prevention Clinics.

Institute Name	Location	Ontario Stroke Strategy Region	Ontario Stroke Strategy Designation	Local Health Integration Network (LHIN)	Stroke Unit on Site (Y/N)	Stroke Prevention Clinic on Site* (Y/N)
North York General Hospital	Toronto	North and East GTA	Non-designated	Central	Y	N
Northumberland Health Care Corporation	Cobourg	Central East	Non-designated	Central East	N	N
Orillia Soldiers' Memorial Hospital	Orillia	Central East	Non-designated	North Simcoe Muskoka	N	N
Pembroke General Hospital	Pembroke	Champlain	District Stroke Centre	Champlain	Y	N
Perth & Smiths Falls District Hospital (Great War Memorial Perth)	Perth	Southeast	Non-designated	South East	N	Y
Perth & Smiths Falls District Hospital (Smiths Falls)	Smiths Falls	Southeast	Non-designated	South East	N	N
Peterborough Regional Health Centre (Peterborough Civic)	Peterborough	Central East	District Stroke Centre	Central East	Y	N
Queensway Carleton General Hospital	Nepean	Champlain	Non-designated	Champlain	N	N
Quinte Healthcare Corporation (Belleville)	Belleville	Southeast	District Stroke Centre	South East	N	Y
Quinte Healthcare Corporation (North Hastings)	Bancroft	Southeast	Non-designated	South East	N	N
Quinte Healthcare Corporation (Prince Edward County)	Picton	Southeast	Non-designated	South East	N	N
Quinte Healthcare Corporation (Trenton)	Trenton	Southeast	Non-designated	South East	N	N
Renfrew Victoria Hospital	Renfrew	Champlain	Non-designated	Champlain	N	N
Religious Hospitallers of St. Joseph (RHSJ) Health Centre of Cornwall - Hotel Dieu Hospital	Cornwall	Champlain	Non-designated	Champlain	N	N
Riverside Health Care Facilities Inc. (Fort Frances)	Fort Frances	Northwest	Non-designated	North West	N	Y
Ross Memorial Hospital	Lindsay	Central East	Non-designated	Central East	N	N
Rouge Valley Health System (Ajax & Pickering)	Ajax	South East Toronto	Non-designated	Central East	N	N
Rouge Valley Health System (Centenary)	Scarborough	South East Toronto	Non-designated	Central East	N	N
Royal Victoria Hospital	Barrie	Central East	Enhanced District Stroke Centre	North Simcoe Muskoka	Y	Y
Sault Area Hospitals	Sault Ste. Marie	Northeast	District Stroke Centre	North East	Y	Y
Sensenbrenner Hospital	Kapuskasing	Northeast	Non-designated	North East	N	N
Sioux Lookout District Health Centre	Sioux Lookout	Northwest	Non-designated	North West	N	N

\* Ministry of Health and Long-Term Care designated Secondary Prevention Clinics.

Institute Name	Location	Ontario Stroke Strategy Region	Ontario Stroke Strategy Designation	Local Health Integration Network (LHIN)	Stroke Unit on Site (Y/N)	Stroke Prevention Clinic on Site* (Y/N)
South Bruce Grey Health Centre (Chesley)	Chesley	Southwest	Non-designated	South West	N	N
South Bruce Grey Health Centre (Durham)	Durham	Southwest	Non-designated	South West	N	N
South Bruce Grey Health Centre (Kincardine)	Kincardine	Southwest	Non-designated	South West	N	N
South Bruce Grey Health Centre (Walkerton)	Walkerton	Southwest	Non-designated	South West	N	N
South Huron Hospital Association	Exeter	Southwest	Non-designated	South West	N	N
Southlake Regional Health Centre	Newmarket	Central East	Non-designated	Central	Y	N
St. Francis Memorial Hospital	Barry's Bay	Champlain	Non-designated	Champlain	N	N
St. Joseph's General Hospital	Elliot Lake	Northeast	Non-designated	North East	N	N
St. Joseph's Health Care	London	Southwest	Non-designated	South West	Y	N
St. Joseph's Health Care System (St. Joseph's Hospital)	Hamilton	Central South	Non-designated	Hamilton Niagara Haldimand Brant	Y	Y
St. Joseph's Health Care System (Stoney Creek)	Hamilton	Central South	Non-designated	Hamilton Niagara Haldimand Brant	N	N
St. Joseph's Health Centre	Toronto	Toronto West	Non-designated	Toronto Central	Y	N
St. Mary's General Hospital	Kitchener	Central South	Non-designated	Waterloo Wellington	N	N
St. Michael's Hospital (Bond Street)	Toronto	South East Toronto	Regional Stroke Centre	Toronto Central	Y	N
St. Thomas Elgin General Hospital	St. Thomas	Southwest	Non-designated	South West	N	N
Stevenson Memorial Hospital	Alliston	Central East	Non-designated	Central	N	N
Sunnybrook & Women's College Health Sciences Centre	Toronto	North and East GTA	Regional Stroke Centre	Toronto Central	Y	Y
Temiskaming Hospital	New Liskeard	Northeast	Non-designated	North East	N	N
The Credit Valley Hospital	Mississauga	West GTA	Non-designated	Mississauga Halton	N	N
The Ottawa Hospital (Civic Campus)	Ottawa	Champlain	Non-designated	Champlain	N	N
The Ottawa Hospital (General Campus)	Ottawa	Champlain	Regional Stroke Centre	Champlain	Y	Y
The Scarborough Hospital (Grace)	Scarborough	North and East GTA	Non-designated	Central East	N	N
The Scarborough Hospital (Scarborough General)	Scarborough	Northeast	Non-designated	Central East	Y	N
Thunder Bay Regional Hospital	Thunder Bay	Northwest	Regional Stroke Centre	North West	Y	Y
Tillsonburg District Memorial Hospital	Tillsonburg	Southwest	Non-designated	South West	N	N

\* Ministry of Health and Long-Term Care designated Secondary Prevention Clinics.



Institute Name	Location	Ontario Stroke Strategy Region	Ontario Stroke Strategy Designation	Local Health Integration Network (LHIN)	Stroke Unit on Site (Y/N)	Stroke Prevention Clinic on Site* (Y/N)
Timmins & District Hospital	Timmins	Northeast	District Stroke Centre	North East	Y	Y
Toronto East General Hospital	Toronto	South East Toronto	Non-designated	Toronto Central	N	N
Trillium Health Centre	Mississauga	West GTA	Regional Stroke Centre	Mississauga Halton	Y	Y
University Health Network (General)	Toronto	Toronto West	Non-designated	Toronto Central	Y	N
University Health Network (Western)	Toronto	Toronto West	Regional Stroke Centre	Toronto Central	Y	Y
West Haldimand General Hospital	Hagersville	Central South	Non-designated	Hamilton Niagara Haldimand Brant	N	N
West Lincoln Memorial Hospital	Grimsby	Central South	Non-designated	Hamilton Niagara Haldimand Brant	N	N
West Nipissing General Hospital	Sturgeon Falls	Northeast	Non-designated	North East	N	N
West Parry Sound Health Centre (James Street)	Parry Sound	Northeast	Non-designated	North East	N	N
William Osler Health Centre (Brampton Memorial)	Brampton	West GTA	Non-designated	Central West	Y	N
William Osler Health Centre (Etobicoke General)	Etobicoke	West GTA	Non-designated	Central West	Y	N
William Osler Health Centre (Georgetown)	Georgetown	West GTA	Non-designated	Mississauga Halton	Y	N
Winchester District Memorial Hospital	Winchester	Champlain	Non-designated	Champlain	N	N
Windsor Regional Hospital (Metropolitan)	Windsor	Southwest	Non-designated	Erie St. Clair	N	N
Woodstock General Hospital	Woodstock	Southwest	Non-designated	South West	N	N
York Central Hospital	Richmond Hill	Central East	District Stroke Centre	Central	Y	N

<p><b>Enhanced District Stroke Centre:</b>          Established to provide leadership and integration in the regions of Ontario where the designation of a Regional Stroke Centre cannot be met. These enhanced District Stroke Centres were not established until after the 2002/03 audit had been completed. For the purposes of analysis, calculations for these centres were included in the District Stroke Centre designation.</p>	<p><b>Non-designated:</b>          Acute care hospital that does not fit the definition of District or Regional Stroke Centre.</p>	<p><b>District Stroke Centre:</b> Facilities with written stroke protocols for emergency services, emergency department and acute care including: transport and triage protocols; ability to offer thrombolytic therapy to suitable ischemic stroke patients; timely computed tomography (CT) scanning and expert interpretation; clinicians with stroke expertise; and, linkages to rehabilitation and secondary prevention.</p>	<p><b>Regional Stroke Centre:</b>          All the requirements of a District Stroke Centre, plus neurosurgical facilities and interventional radiology.</p>
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**Ontario hospital peer group:**

**Small community hospitals:** Facilities that generally provide less than 3,500 weighted cases per year, have a referral population of less than 20,000 people, and are the only hospital in their community, as defined by the Joint Policy and Planning Committee.

**Academic hospitals:** University-affiliated facility; member of the Council of Academic Hospitals of Ontario.

**Large community hospitals:** All other hospitals.

\* Ministry of Health and Long-Term Care designated Secondary Prevention Clinics.

## Appendices—Appendix C. Glossary of terms

Term/Acronym	Definition
1. Academic hospital	University-affiliated facility; member of the Council of Academic Hospitals of Ontario
2. Acute stroke unit	Specialized, geographically-located hospital unit with dedicated stroke team and stroke resources
3. AF	Atrial fibrillation
4. Alternative level of care (ALC)	An ALC patient is one who has finished the acute care phase of their treatment but remains in an acute bed. This classification occurs when the patient's physician gives an order to change the level of care from acute care and requests a transfer for the patient.
5. Annual stroke patient volume	Indicates the annual number of hospital separations (inpatient and emergency) for stroke or transient ischemic attack.
6. Charlson Score	A comorbidity index score, where higher scores indicate more comorbid illness.
7. Canadian Neurological Scale (CNS) Score	Canadian Neurological Scale, designed to assess neurological function in conscious stroke patients. The score could range from 0–11.5 with higher scores indicating less impairment. CNS score <8 indicates a severe stroke.
8. CSN	Canadian Stroke Network
9. CSS	Canadian Stroke Strategy (or System)
10. CT	Computed Tomography
11. District Stroke Centre	A centre that has written stroke protocols for emergency services, emergency department and acute care including: transport and triage protocols; ability to offer thrombolytic therapy to suitable ischemic stroke patients; timely computed tomography (CT) scanning and expert interpretation; clinicians with stroke expertise; and, linkages to rehabilitation and secondary prevention.
12. ICH	Intracerebral hemorrhage
13. Large community hospital	All hospitals that do not qualify for small hospitals, academic hospitals, or District or Regional Stroke Centres.
14. Local Health Integration Network (LHIN)	14 Local Health Integration Networks (LHINs) have been established in Ontario, each with specific geographic boundaries. The intent is that LHINs will eventually be responsible for planning, integrating and funding local health services.
15. LSN	Last Seen Normal; time prior to onset of stroke symptoms
16. MOHLTC	Ontario Ministry of Health and Long-Term Care
17. MRI	Magnetic Resonance Imaging
18. OHA	Ontario Hospital Association
19. OSS	Ontario Stroke Strategy (or System)
20. Rankin Score	A measure of functional status after stroke with a range from 0 (no disability) to 6 (death)
21. Regional Stroke Centre	A centre that has all the requirements of a District Stroke Centre, plus neurosurgical facilities and interventional radiology.
22. Small community hospital	Facilities that generally provide less than 3,500 weighted cases, have a referral population of less than 20,000 people, and are the only hospital in their community, as defined by the Joint Policy and Planning Committee.
23. TIA	Transient ischemic attack, or “mini-stroke”
24. tPA	Tissue plasminogen activator
25. UTD	Unable to Determine; based on available data in the patient’s medical records, or based on clinical presentation and/or findings



## Appendices—Appendix D. Local Health Integration Network (LHIN) Boundaries, Ontario Stroke System (OSS) Regions\* and OSS Stroke Centre Classifications

