



Canadian Stroke Network

Réseau Canadien contre
les accidents cérébrovasculaires



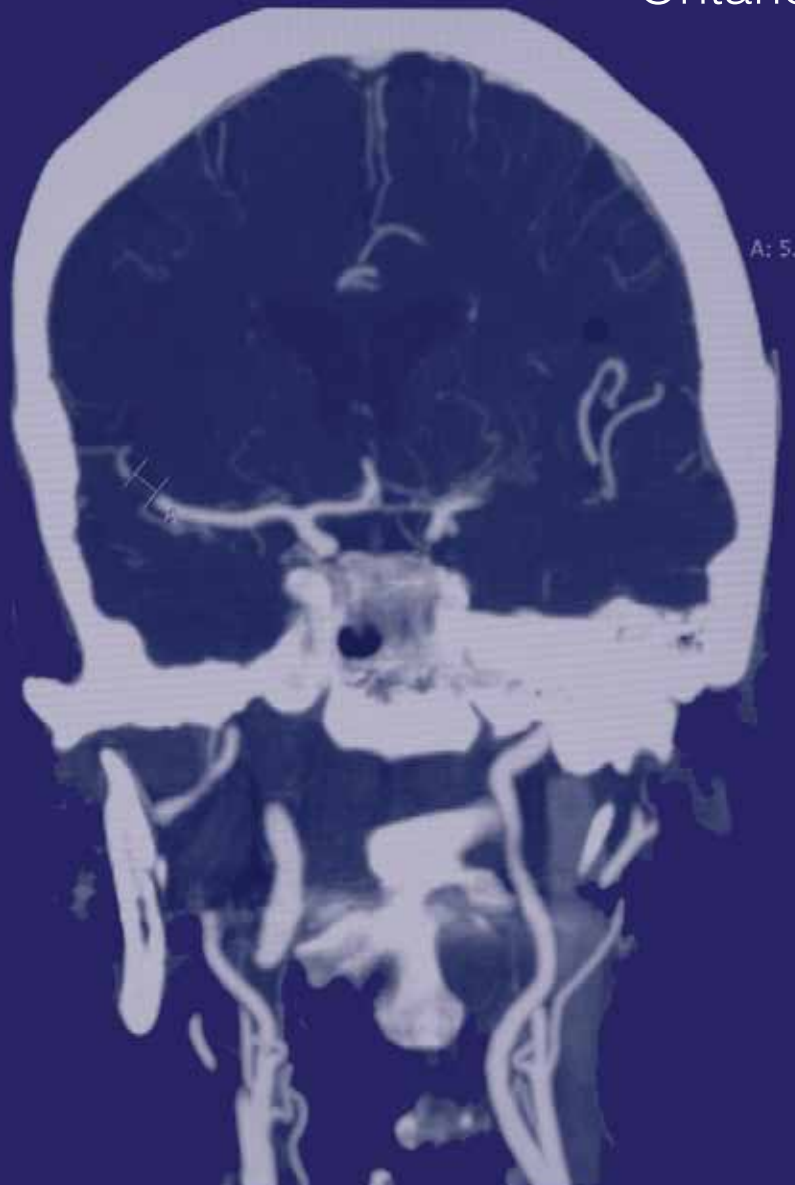
ontario stroke
network

Advancing the Ontario Stroke System

ICES Institute for Clinical
Evaluative Sciences

Registry of the Canadian Stroke Network

Report on the 2008/09
Ontario Stroke Audit



March 2011

Registry of the Canadian Stroke Network

Report on the 2008/09 Ontario Stroke Audit

ICES Investigative Report

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About the Organizations Involved in this Report

The Canadian Stroke Network

The Canadian Stroke Network (CSN; www.canadianstrokenetwork.ca), one of Canada's Networks of Centres of Excellence, is a collaborative effort that brings together researchers, students, government, industry and the non-profit sector. The CSN, a not-for-profit corporation with headquarters at the University of Ottawa, was first funded in 1999. The CSN puts Canada at the forefront of stroke research through its multi-disciplinary research program, high quality training for Canadian scientists and clinicians, and national and global partnerships.

The CSN 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, and
- create added value through partnerships.

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 provides funding to the CSN to measure, monitor and evaluate stroke care in Ontario.

The Ontario Stroke Network and the Ontario Stroke System

The Ontario Stroke Network (OSN) provides provincial leadership and coordination for the Ontario Stroke System (OSS). The OSN recommends, implements and evaluates province-wide goals and standards for the continuum of stroke care, including health promotion and stroke prevention, acute care, recovery and reintegration processes. It also supports the evaluation of and reports on the progress of the OSS, administers the OSS research program and leads provincial projects and initiatives. The OSS is a collaborative system of a provider organization and partners who deliver stroke care across the province and care continuum.

The OSN and OSS share a common vision: fewer strokes and better outcomes. Since the inception of the OSS in 2000, significant improvements have occurred in stroke prevention, diagnosis and treatment across the continuum of care. There have been positive impacts on access to stroke-related services, the integration and coordination of stroke care, treatment for stroke, and client and provider satisfaction.

The Institute for Clinical Evaluative Sciences

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 ICES' work is its 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 researchers 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 ICES 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, ICES 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 funding bodies, which is critical to ICES' success as Ontario's objective, credible source of Evidence Guiding Health Care.

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Executive Summary

Purpose

Stroke is a leading cause of death and disability in Canada and Ontario. In 2000, Ontario implemented the Ontario Stroke System (OSS), a province-wide strategy of coordinated stroke care, with the goal of providing high quality stroke care across the continuum of care—from primary prevention to pre-hospital/emergency care, hospital-based acute care, rehabilitation, secondary prevention and community reengagement. With the Ontario Stroke System, ongoing monitoring and evaluation are performed to ensure implementation of best practices and evidence-based stroke care. Part of this monitoring is done through the Registry of the Canadian Stroke Network (RCSN), which performs a periodic province-wide audit of stroke care delivery. This report presents data from the RCSN Ontario Stroke Audit for fiscal year 2008/09, with comparisons to audits performed in 2002/03 and 2004/05.

Study

The 2008/09 RCSN Ontario Stroke Audit was conducted to evaluate the characteristics, management and outcomes of stroke patients in Ontario. The data were compared by OSS region, by institutional designation within the OSS (regional stroke centre, district stroke centre, non-designated hospital) and by Local Health Integration Network (LHIN). 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 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, 146 acute care institutions were eligible, and 142 agreed to participate. Based on this audit, there were 22,593 hospitalizations or emergency department visits for acute stroke or TIA in Ontario in fiscal year 2008/09. The final audit sample included a total of 3,931 patients (17% of all cases). Please note that a reference of the sample size for each exhibit can be found in Appendix E.

Key Messages and Recommendations for Action

- ▶ This is the third 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 for most of these indicators are currently under development.
- ▶ Stroke is an emergency, and patients with acute stroke or transient ischemic attack (TIA) should be treated as soon as possible after symptom onset. In 2008/09, 33% of patients arrived at hospital within 2.5 hours of stroke onset, with no significant change compared to 2004/05 or 2002/03. Continued public awareness campaigns and other initiatives are needed to encourage people with symptoms of stroke to seek care in a timely fashion.
- ▶ Thrombolytic therapy with tissue plasminogen activator (tPA) improves outcomes after ischemic stroke in appropriately selected patients. In 2008/09, tPA was administered to 27% of those presenting within 2.5 hours of stroke onset—a significant increase compared to 14% in 2004/05 and 9.5% in 2002/03. Thrombolysis rates were 42% at regional stroke centres and 32% at district stroke centres—rates that match or exceed those seen in most jurisdictions worldwide. These excellent tPA rates may be attributable to Ontario's organized system of stroke care which facilitates thrombolysis administration through regional bypass and transfer agreements, increased Telestroke services, and protocols that reflect recently expanded thrombolysis treatment windows.
- ▶ Care on a dedicated stroke unit decreases death and disability after stroke. In 2008/09, 26 out of 142 acute care hospitals in Ontario had a stroke unit, and 24% of patients with stroke or TIA were admitted to a stroke unit—a significant increase compared to 11% in 2004/05 and 3% in 2002/03. Despite these marked improvements, current stroke unit admission rates remain below recommended standards, and institutions and regions are encouraged to develop additional stroke unit capacity. Rates of stroke unit care are particularly low at non-designated centres, and targeted efforts to address gaps in care may be needed in these institutions.
- ▶ Neuroimaging using computed tomography (CT) or magnetic resonance imaging (MRI) is the standard of care for all patients with suspected stroke or TIA, both to confirm the diagnosis and to provide information on stroke type. In 2008/09, 93% of patients underwent neuroimaging during hospitalization—an appropriate rate, and a marked improvement from 82% in 2004/05 and 77% in 2002/03.
- ▶ In many patients with ischemic stroke or TIA, carotid imaging is recommended to determine whether carotid stenosis (narrowing of certain blood vessels in the neck) is present. In 2008/09, 68% of patients had carotid imaging performed or scheduled—an increase from 55% in 2004/05 and 44% in 2002/03.
- ▶ Screening is essential to identify patients with stroke who have swallowing problems (dysphagia) that put them at risk for aspiration. In 2008/09, 57% of patients with stroke underwent dysphagia screening—an increase from 51% in 2004/05 and 47% in 2002/03. Continued efforts are needed to increase swallowing screening rates.
- ▶ A variety of medications, including antithrombotic, antihypertensive and lipid lowering agents are recommended to prevent recurrent stroke in those with ischemic stroke or TIA. In 2008/09, 94% of patients were prescribed antithrombotic therapy—an appropriate rate, and an increase from 92% in 2004/05 and 80% in 2002/03. Warfarin for those with atrial fibrillation was prescribed to 72% in 2008/09, with no significant change compared to previous years. Interventions are needed to improve prescribing rates for warfarin for eligible patients.

*Separation from a health care facility occurs when a patient (or resident) dies, is discharged or transferred, or signs out against medical advice. The number of separations is the most commonly used measure of the utilization of hospital services.

Executive Summary

- ▶ In 2008/09, 57% of patients seen in the emergency department but not admitted to hospital were referred to a stroke secondary prevention clinic—a significant increase compared to 29% in 2004/05 and 14% in 2002/03. It is recommended that all patients not admitted to hospital be referred to a stroke prevention clinic to ensure prompt access to diagnostic testing, risk factor management, and revascularization (if required) to reduce the risk of recurrent stroke and other vascular events.
- ▶ Stroke rehabilitation improves functional status in appropriately selected patients. In 2008/09, 28% of patients admitted to hospital were discharged to an inpatient rehabilitation facility, an increase compared to 25% in 2004/05, and a rate similar to that seen in 2002/03. In the subgroup of patients with more severe disability (modified Rankin score of 3 to 5), where inpatient rehabilitation is likely to be most effective, 46% were discharged to inpatient rehabilitation in 2008/09—an increase from 40% in 2004/05 and a similar rate to that seen in 2002/03. Continued efforts are needed to ensure all patients who could benefit from rehabilitation (inpatient, outpatient or community) are immediately triaged into the most appropriate setting.
- ▶ In 2008/09, the adjusted 30-day mortality rate after ischemic stroke was 14.0%, with no significant change compared to 2004/05. The adjusted 30-day mortality rate after hemorrhagic stroke was 36.1%, with a significant decrease compared to 41.7% in 2004/05.
- ▶ Across the province's 14 Local Health Integration Networks (LHINs) and 11 Ontario Stroke System regions, there were variations in almost all processes of stroke care delivery, including thrombolysis, stroke unit care, neuroimaging, carotid imaging, dysphagia screening, medications for secondary stroke prevention, referrals to secondary prevention clinics and discharges to inpatient rehabilitation. However, almost all regions had improvements in stroke care delivery over time. Regions with low rates for specific indicators should review their results and practice patterns and, where indicated, work on region-specific initiatives to improve the quality of stroke care delivery. Of note, there were no major regional variations in mortality after stroke.
- ▶ Across different hospital types, there were large variations in care, with rates of thrombolysis, stroke unit care, neuroimaging, carotid imaging, and referrals to secondary prevention clinics highest at regional stroke centres, followed by district stroke centres and non-designated hospitals. However, improvements in stroke care delivery over time were observed at all hospital types, which may be attributable in part to effective outreach from Ontario Stroke System expert teams to other acute care facilities in their regions/LHINs. There were no significant differences in mortality after stroke for different hospital types. Where feasible, patients with acute stroke should be managed at designated stroke hospitals.

Implications

The RCSN Ontario Stroke Audits show that there have been marked improvements over time in the use of virtually all evidence-based stroke care interventions, and that Ontarians currently receive high quality stroke care with appropriate rates of use of important interventions such as thrombolysis, neuroimaging and antithrombotic therapy after stroke. These widespread improvements in stroke care were seen across all regions and hospital types and illustrate the impact of the Ontario Stroke System, a mature province-wide system of coordinated stroke care.

Some gaps in care persist, including delays between stroke onset and emergency department arrival, and relatively low rates of prescription of warfarin for atrial fibrillation. Although rates of stroke unit admissions have increased markedly over time, there is still room for improvement in this area. In addition, variations across regions and among different hospital types persist. These variations and gaps in care should continue to be addressed to ensure high quality stroke care across the province.

Background

Stroke is a leading cause of death and disability in Canada.¹ 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 thrombolysis to eligible patients.²⁻⁴ Established interventions for secondary prevention of ischemic stroke include antithrombotic agents, warfarin for those with atrial fibrillation, carotid endarterectomy for symptomatic, high-grade carotid stenosis and control of risk factors such as hypertension and hyperlipidemia.⁵⁻⁷

In Ontario, a province-wide system of coordinated stroke care—the Ontario Stroke System (OSS)—was pilot-tested by the Heart and Stroke Foundation of Ontario in 1998, funded and supported by the Ontario Ministry of Health and Long-Term Care in 2000 and fully implemented in 2005.⁸ The OSS seeks to improve 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 re-engagement. The Ontario Stroke Network provides leadership and coordination to the OSS.

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, were invited to participate 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 (fewer than 33), medium volume (33–99) or high volume (100 or more). Institutions were also classified as regional stroke centres, district stroke centres (including two enhanced district stroke centres), or non-designated hospitals, based on their designation within the OSS.

Patient Sample

All patients (including non-Ontario residents) seen in the emergency department or admitted to hospital between April 1, 2008, and March 31, 2009, with a most responsible diagnosis of stroke or TIA were eligible for inclusion in the audit. Stroke and TIA separations were identified from the Discharge Abstract Database (DAD) and the National Ambulatory Care Reporting System (NACRS), both maintained by the Canadian Institute for Health Information (CIHI), using the International Classification of Diseases, Tenth Revision (ICD-10) codes I60, I61, I63, I64, H34.1 and G45 (excluding G45.4). For individuals with both DAD and NACRS separations, only the DAD separation was included. For individuals with more than one stroke/TIA during the sampling time frame, only the first stroke/TIA event was included. From all eligible cases, a simple random sample of 20% was selected, with over-sampling performed at low-volume institutions such that each institution contributed a minimum of 10 cases and at district stroke centres such that each institution contributed a minimum of 50 cases.

Data Abstraction and Management

Centrally trained neurology research nurses performed chart abstraction at the participating hospitals. Data were collected on all aspects of acute stroke management, including patient demographics, the use of prehospital emergency medical services, and in-hospital and emergency department management, complications and outcomes. Data were entered electronically into a custom designed Microsoft Access database 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 transfer via a secure telephone line to the Institute for Clinical Evaluative Sciences (ICES) in Toronto. The aggregate dataset was managed and analyzed by the RCSN team 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.

The overall research project was approved by the Research Ethics Board at Sunnybrook Health Sciences Centre in Toronto, with additional approval by research ethics boards at participating institutions where required. The RCSN is “prescribed” under provincial privacy legislation and charts are audited without patient consent, for the purposes of monitoring and improving the quality of stroke care delivery.

Statistical Analysis

Results are presented for the entire province, by Ontario Stroke System Region, by Local Health Integration Network (LHIN) and by hospital designation within the OSS (regional or enhanced district stroke centre, district stroke centre or non-designated hospital). To account for over-sampling at certain institutions, results were weighted based on hospital volume and the number of charts sampled. The weight assigned to a record was inversely proportional to the probability of that record being selected for inclusion in the study. By using weights in the analyses, an estimate that applied to the entire “population” of discharge records was obtained.

The characteristics, management and in-hospital outcomes of stroke patients by region and hospital designation were compared using Rao-Scott Chi-square tests for categorical variables. Tests for trends over time were performed using a survey logistic regression model. SAS version 9.2 was used for all data analyses. Analyses by region were based on facility rather than patient location. Age- and sex-adjusted 30-day, post-stroke, all-cause mortality rates were calculated with stratification by stroke type (ischemic or hemorrhagic). For analyses of mortality, the entire CIHI-DAD and NACRS populations were used rather than the audit sample, and statistical significance was assessed only for 2008/09 for regional and facility comparisons. A reference of the sample size for each exhibit can be found in Appendix E.

Results

Participating Institutions (Exhibits 1–2)

Overall, 146 acute care institutions were eligible for participation in the 2008/09 RCSN Ontario Stroke Audit, and almost all (142) agreed to participate (Appendix B). The six hospitals that did not participate had a very small number of patients with a diagnosis of stroke (110 in total). Of the participating sites, 35 (25%) were low volume, 37 (26%) were medium volume and 70 (49%) were high volume (Exhibit 1a). Overall, 59% of sites were located in rural areas, 18% (26 of 142) had a stroke unit and 63% provided computed tomography. Within the Ontario Stroke System, nine sites (6%) were designated as regional stroke centres, 19 (13%) as district stroke centres, and 114 (80%) as non-designated hospitals. The characteristics of participating hospitals by OSS designation and by LHIN are shown in Exhibits 1b and 2.

Baseline Characteristics (Exhibits 3–5)

According to records from the CIHI-DAD and NACRS databases, there were 22,593 hospitalizations or emergency department visits for acute stroke or transient ischemic attack (TIA) during the study period. The audit sample included 4,363 charts, of which 432 were excluded (128 because of missing or invalid health card numbers, 50 because they represented recurrent stroke events for a single patient, and 254 that were determined upon chart review to be “non-strokes”) leaving a final sample of 3,931 charts, representing 17% of the total stroke population. The mean age at stroke presentation was 73 years, 50% of the patients were female and 15% lived in rural areas (Exhibit 3).

Overall, 61% of the study population had a final diagnosis of stroke, 30% had a transient ischemic attack, and in 9% the final diagnosis was uncertain (i.e., after chart review it could not be determined if the diagnosis was stroke, transient ischemic attack or a different diagnosis, such as seizure or syncope). Among those with a diagnosis of stroke, the stroke type was ischemic in 81%, intracerebral hemorrhage in 13%, and subarachnoid hemorrhage in 5%. The prevalence of established stroke risk factors was high: 65% of patients had hypertension, 25% had diabetes mellitus, 37% had hyperlipidemia, 15% had atrial fibrillation and 14% were current smokers. There were variations in patient characteristics across hospital types and regions (Exhibits 4 and 5).

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

In 2008/09, 32.6% of patients presented to hospital within 2.5 hours of stroke onset, 57.1% were transported to hospital by ambulance and 67.1% were admitted to hospital, with variations by hospital type and by region (Exhibits 6–8). These results were similar to those seen in 2004/05.

Thrombolysis (Exhibits 9–14)

Thrombolysis was administered to 8.4% of all patients with ischemic stroke in 2008/09, a significant increase from 3.9% in 2004/05 and 3.2% in 2002/03 (Exhibit 9). During the audit time frame, intravenous thrombolysis was only recommended if it could be administered within three hours of stroke onset, and many patients were not eligible for thrombolysis because of presentation to hospital beyond this time window. In the subgroup of patients presenting to hospital within 2.5 hours within stroke onset, 27.1% of patients received thrombolysis in 2008/09, a significant increase compared to 14.1% in 2004/05 and 9.5% in 2002/03. Thrombolysis rates were highest at regional stroke centres followed by district stroke centres and non-designated hospitals. Increases in thrombolysis rates between 2004/05 and 2008/09 were particularly marked at district stroke centres (Exhibit 10). There were variations in thrombolysis rates across LHINs but not across OSS regions (Exhibits 9 and 11).

For patients receiving intravenous thrombolysis, the provincial median “door-to-needle” time in 2008/09 was 69.7 minutes, a decrease from 84.2 minutes in 2004/05 and 82.0 minutes in 2002/03 (Exhibit 12). Four of 11 OSS regions and three of 14 LHINs achieved median door-to-needle times below the benchmark of 60 minutes (Exhibits 12 and 14). Median thrombolysis treatment times were significantly shorter for patients seen at regional stroke centres compared to other hospital types (Exhibit 13).

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

Neuroimaging

- In 2008/09, 92.8% of patients seen in the emergency department or admitted to hospital underwent neuroimaging with computed tomography (CT) or magnetic resonance imaging (MRI) of the brain prior to discharge from hospital—an increase from 81.6% in 2004/05 and 76.8% in 2002/03 (Exhibits 15–17). Neuroimaging was performed within 24 hours of hospital arrival in 69.8%, with no significant change compared to 67.4% in 2004/05 (Exhibits 16 and 17). Neuroimaging rates were highest at regional stroke centres, followed by district stroke centres, followed by non-designated hospitals, but all hospital types saw increases in neuroimaging rates over time (Exhibit 17). There were regional variations in neuroimaging rates, but all regions had rates within 10% of the provincial average (Exhibits 15 and 16).

Carotid Imaging

- Carotid imaging with carotid Doppler ultrasound, CT angiography, MR angiography or catheter angiography was performed in hospital or scheduled to be done as an outpatient procedure in 67.5% of patients admitted to hospital with ischemic stroke or TIA in 2008/09, an increase from 55.2% in 2004/05 and 44.3% in 2002/03 (Exhibits 18–20). Carotid imaging rates were highest at regional stroke centres, followed by district stroke centres and non-designated hospitals, but all hospital types saw increases in rates over time (Exhibit 20). There were significant regional variations in carotid imaging rates (Exhibits 18 and 19).

Medications for Secondary Stroke Prevention

- In 2008/09, 93.7% of patients admitted to hospital with ischemic stroke or TIA were prescribed antithrombotic agents (ASA, clopidogrel, combination ASA/dipyridole or warfarin) at discharge, 60.2% were prescribed lipid lowering therapy, 77.5% were prescribed antihypertensive agents and 72.0% of those with atrial fibrillation were prescribed warfarin (Exhibits 21–23). There were increases in prescribing rates in 2008/09 compared to both 2004/05 and 2002/03 across all hospital types and for all medications except for warfarin, where the prescribing rate remained stable over time. There were differences in some prescribing rates by hospital type, with higher rates of antithrombotic and lipid lowering therapy at regional and district stroke centres compared to non-designated hospitals (Exhibit 22). There were minor variations across OSS regions in the prescribing rate for antihypertensive therapy (Exhibit 21) and across LHINs in prescribing rates for antithrombotic and antihypertensive therapy (Exhibit 23).

Stroke Unit Care

- Overall, in 2008/09, 29.3% of patients admitted to hospital with stroke or TIA spent some part of their hospital stay in a stroke unit and 24.5% of patients were admitted directly to a stroke unit—a significant increase compared to 10.9% in 2004/05 and 2.7% in 2002/03—and with increases seen across all hospital types and in virtually all regions (Exhibits 24–26).

Dysphagia Screening

- In 2008/09, 56.8% of patients admitted to hospital with stroke underwent dysphagia screening (a swallowing assessment) within 72 hours of hospital arrival, an increase from 51.1% in 2004/05 and 46.7% in 2002/03 (Exhibits 27–29). Dysphagia screening rates were higher at regional and district stroke centres compared to non-designated hospitals, but there were increases in screening rates at all hospital types (Exhibit 28). There were regional variations in dysphagia screening rates (Exhibits 27 and 29).

Length of Stay, Discharge Destination and 30-Day Mortality (Exhibits 30–48)

For patients with stroke or TIA who were admitted to hospital in 2008/09, the median length of hospital stay was 6.4 days, with no significant change compared to 2004/05 (Exhibits 30–32). Among those who survived to discharge, 51.9% were discharged home (15.4% of these with home care services), 27.6% to inpatient rehabilitation, 9.2% to long-term care, 2.2% to complex continuing care) and 5.8% to other acute care facilities (Exhibits 33–35). Compared to 2004/05, there was an increase in the rate of discharge to inpatient rehabilitation, a decrease in the rate of discharge to long-term care and an increase in the rate of discharge to complex continuing care. Similar changes were seen across most regions (Exhibits 33 and 35). In the subgroup of patients most likely to benefit from inpatient rehabilitation—those

with moderate to severe disability (modified Rankin score* of 3 to 5) at discharge—46.2% of patients were discharged to inpatient rehabilitation, a significant increase compared to 39.5% in 2004/05 (Exhibits 36b, 37b and 38b). A similar trend was observed among discharges to complex continuing care, with an increase from 1.4% in 2004/05 to 4.2% in 2008/09 ($p < 0.0001$) (data not shown in exhibits). There were variations in discharge destination by hospital type, with those seen at regional stroke centres more likely than those at other hospital types to be discharged to other acute care facilities (Exhibits 34 and 37b). There were regional variations in discharge destination (Exhibits 33, 35, 36 and 38).

Among patients with stroke or TIA who were seen in the emergency department but not admitted to hospital, 57.2% were referred to a stroke prevention clinic in 2008/09, compared to 29.1% in 2004/05 and 14.1% in 2002/03 (Exhibits 39–41). There were increases in rates of referrals to stroke prevention clinics across all regions and all hospital types; however, there were persistent regional variations in rates of referrals, and rates remained highest at regional stroke centres followed by district stroke centres and non-designated hospitals (Exhibits 39–41).

For patients with ischemic stroke seen in the emergency department or admitted to hospital, the age- and sex-adjusted mortality rate at 30 days was 14.0% in 2008/09, with no significant change from previous years (Exhibit 42). For those with hemorrhagic stroke (intracerebral or subarachnoid hemorrhage), the age- and sex-adjusted 30-day mortality rate was 35.8%, with a statistically significant decrease from 2004/05 (Exhibit 42). There were no significant variations by region or by hospital type in age- and sex-adjusted 30-day mortality rates after ischemic or hemorrhagic stroke (Exhibits 43–48).

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

0 = no symptoms

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; requires constant nursing care and attention.

Discussion

This is the third population-based audit of stroke care and outcomes in the province of Ontario. Compared to 2004/05, the 2008/09 audit found significant improvements in almost all aspects of stroke care delivery, including rates of thrombolysis, time to administration of thrombolysis, and rates of neuroimaging, carotid imaging, stroke unit care, dysphagia screening, prescribing of antithrombotic, lipid lowering and antihypertensive therapy, discharges to inpatient rehabilitation and referrals to stroke secondary prevention clinics. Age- and sex-adjusted 30-day mortality rates after hemorrhagic stroke have decreased significantly since the 2004/05 audit. These widespread improvements in stroke care were seen across regions and across all hospital types, and illustrate the impact of a mature province-wide system of coordinated stroke care through the Ontario Stroke System.

Rates of discharge to inpatient rehabilitation were higher in 2008/09 compared to 2004/05 but similar to 2002/03, and likely represent an underuse of rehabilitation services for individuals with severe stroke. Continued efforts are needed to ensure all patients who could benefit from rehabilitation—either inpatient, outpatient or community rehabilitation—are immediately triaged into the most appropriate setting. Information on important long-term stroke outcomes such as functional status or quality of life is not available, and future work should focus on a more detailed evaluation of the processes and outcomes of stroke rehabilitation and reintegration in Ontario.

For many aspects of stroke care delivery, benchmarks do not yet exist, so the “right rate” is not known. Further work is needed to develop reasonable benchmarks for stroke care delivery and outcomes that can be used for monitoring the quality of care and for quality improvement initiatives. However, based on the existing literature, the current provincial rates for many indicators, including neuroimaging, antithrombotic therapy and thrombolysis, likely meet or exceed recommended targets. Rates for other indicators, including stroke unit admissions and warfarin for atrial fibrillation, are likely below target. Addressing these deficiencies in care will require both provincial and local initiatives, including interventions to increase stroke unit capacity and improve the management of atrial fibrillation.

Despite significant overall improvements in stroke care in Ontario, it is worth noting that 53% of Ontario's patients with stroke or TIA were cared for at non-designated centres, where the proportion of patients receiving best practice stroke care is the lowest. In addition, there were significant regional variations in many aspects of stroke care delivery. Future efforts should focus on consolidating stroke care in regional stroke centres, where feasible, and on improving care in non-designated facilities and across all regions. Regions with low rates for specific indicators may wish to review their practice patterns and consider region-specific quality improvement initiatives, and may also wish to use the resources of

the Ontario Stroke System to learn from other regions. The Ontario Stroke System facilitates communication around performance and initiatives to improve care through regular meetings of regional program managers, medical directors and through events such as the annual Ontario Stroke Collaborative. Information about regional stroke care performance is also shared with the LHINs through the annual stroke report prepared by the Ontario Stroke Evaluation and Quality Committee.

In summary, the 2008/09 RCSN Ontario Stroke Audit shows marked improvements in stroke care delivery over time. Future work should include targeted quality improvement initiatives and ongoing performance monitoring to ensure high quality stroke care across the province.

Exhibit 1a Characteristics of hospitals participating in the 2008/09 Ontario Stroke Audit, by Ontario Stroke System (OSS) region, April 1, 2008 to March 31, 2009

Ontario Stroke System (OSS) Regions →		Ontario Institutions	1 Southwest	2 Central South	3 West GTA	4 Toronto - West	5 Toronto - Southeast	6 Toronto - North and East	7 Central East	8 South East	9 East - Champlain	10 Northeast	11 Northwest
Number of hospitals		142	34	22	8	5	4	4	19	9	13	16	8
Designation within the OSS (n)	Non-designated	114	28	18	7	4	3	3	14	7	11	12	7
	District Stroke Centre	19	5	3	0	0	0	0	5	1	1	4	0
	Regional Stroke Centre	9	1	1	1	1	1	1	0	1	1	0	1
Annual stroke patient volume (n) ^{***}	Low (<33 patients)	35	15	3	0	0	0	0	0	0	5	7	5
	Medium (33–99 patients)	37	9	5	2	0	0	0	6	6	1	6	2
	High (≥100 patients)	70	10	14	6	5	4	4	13	3	7	3	1
Location (n) ^{**}	Urban	83	14	17	6	5	4	4	14	4	7	6	2
	Rural	59	20	5	2	0	0	0	5	5	6	10	6
Ontario hospital peer group (n) ^{**}	Large community	97	28	14	6	3	3	3	16	7	6	8	3
	Small community	32	4	4	2	0	0	0	3	1	5	8	5
	Academic	13	2	4	0	2	1	1	0	1	2	0	0
Stroke unit on site (n) ^{††}		26	3	2	1	3	1	3	5	2	2	3	1
Computed tomography on site (n) [†]		90	15	14	8	6	4	4	16	4	9	6	4
Magnetic resonance imaging on site (n) [†]		50	8	10	4	5	3	3	8	1	4	3	1
Telestroke capability (n) ^{††}		10	0	2	0	0	0	0	2	0	1	4	1

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

Non-designated: An acute care hospital that does not fit the definition of district or regional stroke centre.

District Stroke Centre: A facility with written stroke protocols (e.g., transport and triage, thrombolytic therapy, neuroimaging), clinicians with stroke expertise, and linkages to rehabilitation and secondary prevention

Regional Stroke Centre: A facility that meets all the requirements of a district stroke centre, plus neurosurgical facilities and interventional radiology.

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

Significance levels used [p=p-value]: *p<0.05; **p<0.01; ***p<0.001 for comparisons across OSS regions in 2008/09.

[†] Based on a survey of provincial hospital resources in November 2009; only includes institutions abstracted in 2008/09.

^{††} All referring Telestroke sites, including those not participating in the provincial program.

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 facilities; members of the Council of Academic Hospitals of Ontario.

Large community hospitals: All other hospitals.

Findings

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

Exhibit 1b Characteristics of hospitals participating in the 2008/09 Ontario Stroke Audit, by Ontario Stroke System (OSS) designation, April 1, 2008 to March 31, 200

Ontario Stroke System (OSS) Designations →		Ontario	Non-designated Hospital	District Stroke Centre	Regional Stroke Centre
Number of hospitals		142	114	19	9
Annual stroke patient volume (n)^{***}	Low (<33 patients)	35	35	0	0
	Medium (33–99 patients)	37	35	2	0
	High (≥100 patients)	70	44	17	9
Location (n)^{***}	Urban	83	56	18	9
	Rural	59	58	1	0
Ontario hospital peer group (n)^{***}	Large community	97	76	19	2
	Small community	32	32	0	0
	Academic	13	6	0	7
Stroke unit on site (n)^{****}		26	6	12	8
Computed tomography on site (n)[†]		90	62	19	9
Magnetic resonance imaging on site (n)[†]		50	27	14	9
Telestroke capability (n)^{††}		10	1	9	0

Annual stroke patient volume: The annual number of hospital separations (inpatient and emergency) for stroke or transient ischemic attack.	Non-designated: An acute care hospital that does not fit the definition of district or regional stroke centre.	District Stroke Centre: A facility with written stroke protocols (e.g., transport and triage, thrombolytic therapy, neuroimaging), clinicians with stroke expertise, and linkages to rehabilitation and secondary prevention.	Regional Stroke Centre: A facility that meets all the requirements of a district stroke centre, plus neurosurgical facilities and interventional radiology.	Stroke unit: Specialized, geographically-located hospital unit with a dedicated stroke team and stroke resources.
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Significance levels used [p=p-value]: *p<0.05; **p<0.01; ***p<0.001 for comparisons across OSS designations in 2008/09.

[†] Based on a survey of provincial hospital resources in November 2009; only includes institutions abstracted in 2008/09.

^{††} All referring Telestroke sites, including those not participating in the provincial program.

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 facilities; members of the Council of Academic Hospitals of Ontario.

Large community hospitals: All other hospitals.

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 have low annual volumes of stroke patients, to be located in rural areas and to be small community hospitals, and were less likely to have stroke units or neuroimaging available.
- Only 6 of 114 non-designated hospitals had stroke units on site.

Exhibit 2 Characteristics of hospitals participating in the 2008/09 Ontario Stroke Audit, by Ontario Local Health Integration Network (LHIN), April 1, 2008 to March 31, 2009

Local Health Integration Networks →		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
Number of hospitals		142	7	27	7	15	3	5	6	7	13	9	13	6	16	8
Designation within the OSS (n)	Non-designated	114	4	24	6	12	3	4	3	6	11	7	11	4	12	7
	District Stroke Centre	19	3	2	1	2	0	0	0	1	2	1	1	2	4	0
	Regional Stroke Centre	9	0	1	0	1	0	1	3	0	0	1	1	0	0	1
Annual stroke patient volume (n) ^{***}	Low (<33 patients)	35	2	13	1	2	0	0	0	0	0	0	5	0	7	5
	Medium (33–99 patients)	37	0	9	2	3	0	2	0	1	4	6	1	1	6	2
	High (≥100 patients)	70	5	5	4	10	3	3	6	6	9	3	7	5	3	1
Location (n) ^{***}	Urban	83	6	8	4	13	2	4	6	7	10	4	7	4	6	2
	Rural	59	1	19	3	2	1	1	0	0	3	5	6	2	10	6
Ontario hospital peer group (n) ^{***}	Large community	97	7	21	5	9	2	4	2	6	11	7	6	6	8	3
	Small community	32	0	4	2	2	1	1	0	1	2	1	5	0	8	5
	Academic	13	0	2	0	4	0	0	4	0	0	1	2	0	0	0
Stroke unit on site (n) ^{††}		26	2	1	1	1	0	1	3	5	3	2	2	1	3	1
Computed tomography on site (n) [†]		90	5	10	4	10	3	5	7	6	11	4	9	6	6	4
Magnetic resonance imaging on site (n) [†]		50	4	4	2	8	1	3	7	4	6	1	4	2	3	1
Telestroke capability (n) ^{††}		10	0	0	0	2	0	0	0	0	2	0	1	0	4	1

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

Non-designated: An acute care hospital that does not fit the definition of district or regional stroke centre.

District Stroke Centre: A facility with written stroke protocols (e.g., transport and triage, thrombolytic therapy, neuroimaging), clinicians with stroke expertise, and linkages to rehabilitation and secondary prevention

Regional Stroke Centre: A facility that meets all the requirements of a district stroke centre, plus neurosurgical facilities and interventional radiology.

Stroke unit: Specialized, geographically-located hospital unit with a 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 facilities; members 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 2008/09.

[†] Based on a survey of provincial hospital resources in November 2009; only includes institutions abstracted in 2008/09.

^{††} All referring Telestroke sites, including those not participating in the provincial program.

Findings

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

Exhibits and Findings

Exhibit 3 Patient characteristics, stroke type and medical history, by Ontario Stroke System (OSS) region, April 1, 2008 to March 31, 2009

Patients with stroke or transient ischemic attack seen in the emergency department or admitted to hospital		Ontario	1 Southwest	2 Central South	3 West GTA	4 Toronto - West	5 Toronto - Southeast	6 Toronto - North and East	7 Central East	8 South East	9 East - Champlain	10 Northeast	11 Northwest
Ontario Stroke System (OSS) Regions →													
Number (provincial total)		22,593	3,269	3,858	2,688	1,643	1,327	1,487	3,353	973	2,113	1,356	526
Number (audit sample)		3,931	675	630	401	249	208	237	570	177	381	294	109
Female (%)		50.3	49.7	49.8	51.0	47.3	51.1	54.0	51.4	46.5	54.3	45.4	47.7
Mean age (years)*		72.9	72.7	73.6	71.5	73.1	71.2	75.4	73.4	73.1	72.6	72.3	70.9
Persons living alone (%)**		17.9	26.3	16.6	12.9	21.0	13.1	17.3	13.8	13.6	21.8	16.8	28.2
Persons residing in long-term care facilities (%)		6.2	7.2	7.6	7.4	4.4	6.2	5.9	5.2	4.4	4.9	4.6	6.5
Rural residence (%)***		15.3	28.2	6.6	2.9	2.0	1.5	0.4	19.9	45.5	18.9	30.6	40.7
Medical history (%)	Independent prior to admission***	83.6	81.8	85.5	81.0	81.1	80.3	86.0	87.3	92.2	77.7	81.7	91.1
	Prior stroke/TIA***	34.1	37.0	31.9	42.5	34.2	37.6	27.2	31.0	29.3	36.5	32.9	24.1
	Diabetes*	24.6	25.1	22.0	22.0	31.9	28.3	22.3	24.8	30.0	25.0	18.8	33.2
	Hypertension***	65.0	64.9	55.8	72.2	64.7	71.9	73.2	61.9	65.4	70.9	62.3	60.3
	Current smoker**	13.6	16.6	14.0	8.8	12.8	13.0	8.8	11.9	16.3	17.1	17.0	17.3
	Hyperlipidemia***	36.7	38.0	23.9	43.0	40.2	50.0	37.7	38.7	34.5	42.3	33.5	20.6
	Atrial fibrillation	15.2	17.3	15.5	11.5	14.8	16.7	16.7	14.9	17.6	14.6	11.7	22.6
	Myocardial infarction***	12.9	18.1	9.3	8.0	12.3	11.5	13.6	14.2	14.5	16.3	14.9	5.2
Final diagnosis (%)***	Stroke	61.7	61.8	59.7	65.8	75.5	66.1	69.3	51.4	58.6	60.7	57.3	64.8
	Transient ischemic attack	29.7	28.9	35.8	32.1	14.5	28.7	25.3	31.9	8.8	32.9	38.6	29.2
	Unable to determine	8.6	9.3	4.6	2.1	10.0	5.2	5.4	16.7	32.6	6.4	4.1	6.0
Stroke type (n)***		2,370	405	373	263	188	137	164	292	101	225	159	63
Intracerebral hemorrhage (%)		12.8	12.0	14.1	12.9	11.8	12.6	12.1	11.2	14.8	10.1	21.5	8.1
Ischemic stroke (%)		80.8	82	80.8	82.1	76.9	75.5	81.2	86	77.0	83.3	71.4	85.5
Subarachnoid hemorrhage (%)		5.4	4.7	4.6	3.8	11.3	11.2	5.5	1.5	5.5	5.7	5.1	6.0
Unable to determine (%)		1.0	1.2	0.4	1.1	0.0	0.7	1.2	1.3	2.7	0.9	1.9	0.4

Significance levels used [p=p-value]: *p<0.05; **p<0.01; ***p<0.001 for comparisons across OSS regions in 2008/09.

Findings

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

Exhibit 4 Patient characteristics, stroke type and medical history, by Ontario Stroke System (OSS) designation, April 1, 2008 to March 31, 2009

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 →					
Number (provincial total)		22,593	11,829	5,087	5,677
Number (audit sample)		3,931	2,107	965	859
Female (%)		50.3	51.5	46.8	51.0
Mean age (years)***		72.9	74.1	72.5	70.5
Persons living alone (%)		17.9	17.4	18.9	18.2
Persons residing in long-term care facilities (%)		6.2	6.9	5.8	4.9
Rural residence (%)***		15.3	19.5	12.5	9.0
Medical history (%)	Independent prior to admission	83.6	82.7	85.2	84.2
	Prior stroke/TIA	34.1	35.6	33.0	31.9
	Diabetes	24.6	25.2	24.6	23.3
	Hypertension	65.0	64.4	63.4	68.1
	Current smoker**	13.6	12.0	16.7	14.2
	Hyperlipidemia	36.7	35.1	37.7	39.3
	Atrial fibrillation	15.2	14.8	14.1	17.4
	Myocardial infarction**	12.9	11.3	14.1	15.3
Final diagnosis (%)***	Stroke	61.7	55.4	59.6	76.4
	Transient ischemic attack	29.7	33.6	32.1	19.4
	Uncertain	8.6	10.9	8.3	4.2
Stroke type (n)***		2,370	1,136	577	657
Intracerebral hemorrhage (%)		12.8	11.1	12.5	15.5
Ischemic stroke (%)		80.8	85.1	84.2	71.9
Subarachnoid hemorrhage (%)		5.4	2.1	2.5	12.5
Uncertain (%)		1.0	1.6	0.8	0.2

Non-designated: An acute care hospital that does not fit the definition of district or regional stroke centre.

District Stroke Centre: A facility with written stroke protocols (e.g., transport and triage, thrombolytic therapy, neuroimaging), clinicians with stroke expertise, and linkages to rehabilitation and secondary prevention.

Regional Stroke Centre: A facility that meets all the requirements of a district stroke centre, plus neurosurgical facilities and interventional radiology.

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.

Significance levels used [p=p-value]: *p<0.05; **p<0.01; ***p<0.001 for comparisons across OSS designations in 2008/09.

Exhibits and Findings

Exhibit 5 Patient characteristics, stroke type and medical history, by Ontario Local Health Integration Network (LHIN), April 1, 2008 to March 31, 2009

Patients with stroke or transient ischemic attack seen in the emergency department or admitted to hospital		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
Local Health Integration Networks →																
Number (provincial total)		22,593	1,387	1,882	1,132	2,725	934	1,753	2,548	2,004	2,257	973	2,113	1,002	1,356	526
Number (audit sample)		3,931	243	432	184	446	140	261	391	312	372	177	381	189	294	109
Female (%)		50.3	47.8	51.1	55.3	47.5	48.8	52.2	50.9	48.3	53.3	46.5	54.3	51.6	45.4	47.7
Mean age (years)*		72.9	72.3	72.9	74.5	73.2	70.5	72.0	71.3	74.7	74.2	73.1	72.6	73.8	72.3	70.9
Persons living alone (%)***		17.9	27.1	25.7	17.1	16.4	10.2	14.3	18.6	11.1	15.2	13.6	21.8	19.6	16.8	28.2
Persons residing in long-term care facilities (%)		6.2	7.9	6.7	8.3	7.4	7.7	7.3	4.8	6.0	6.0	4.4	4.9	4.1	4.6	6.5
Rural residence (%)**		15.3	7.0	43.8	11.7	4.5	4.2	2.3	2.1	1.3	9.4	45.5	18.9	43.4	30.6	40.7
Medical history (%)	Independent prior to admission***	83.6	79.8	83.3	86.2	85.2	82.3	80.2	82.7	82.0	87.8	92.2	77.7	87.4	81.7	91.1
	Prior stroke/TIA***	34.1	38.9	35.6	35.6	30.3	44.0	41.6	34.3	29.3	27.8	29.3	36.5	41.4	32.9	24.1
	Diabetes*	24.6	27.0	23.6	22.3	21.9	27.5	19.0	25.9	29.3	24.5	30.0	25.0	25.6	18.8	33.2
	Hypertension***	65.0	67.0	63.4	52.2	57.3	69.7	73.6	68.6	62.3	64.7	65.4	70.9	72.6	62.3	60.3
	Current smoker**	13.6	16.8	16.5	11.7	14.9	10.1	8.1	13.3	7.9	11.4	16.3	17.1	16.0	17.0	17.3
	Hyperlipidemia***	36.7	44.0	33.5	21.0	25.1	39.5	45.0	41.5	38.7	43.4	34.5	42.3	36.6	33.5	20.6
	Atrial fibrillation	15.2	16.1	18.3	14.5	16.0	10.0	12.4	16.9	17.7	12.2	17.6	14.6	15.3	11.7	22.6
	Myocardial infarction***	12.9	15.7	19.9	6.6	10.4	5.9	9.1	15.0	11.2	10.3	14.5	16.3	20.1	14.9	5.2
Final diagnosis (%)***	Stroke	61.7	57.2	65.2	61.4	59.0	60.6	68.6	74.4	61.0	53.6	58.6	60.7	54.2	57.3	64.8
	Transient ischemic attack	29.7	31.0	27.4	34.9	36.2	35.4	30.3	19.6	28.8	26.3	8.8	32.9	39.0	38.6	29.2
	Uncertain	8.6	11.8	7.4	3.8	4.9	4.0	1.1	5.9	10.1	20.1	32.6	6.4	6.8	4.1	6.0
Stroke type (n)***		2,370	137	268	113	260	85	178	291	190	197	101	225	103	159	63
Intracerebral hemorrhage (%)		12.8	7.5	15.0	8.8	16.4	11.9	13.5	13.5	11.1	11.2	14.8	10.1	8.7	21.5	8.1
Ischemic stroke (%)		80.8	88.7	77.7	87.0	78.1	85.9	80.3	73.2	87.4	83.2	77.0	83.3	86.9	71.4	85.5
Subarachnoid hemorrhage (%)		5.4	3.8	5.3	2.7	5.5	1.0	5.2	13.3	1.5	3.6	5.5	5.7	1.3	5.1	6.0
Uncertain (%)		1.0	0.0	2.0	1.5	0.0	1.2	1.0	0.0	0.0	2.0	2.7	0.9	3.1	1.9	0.4

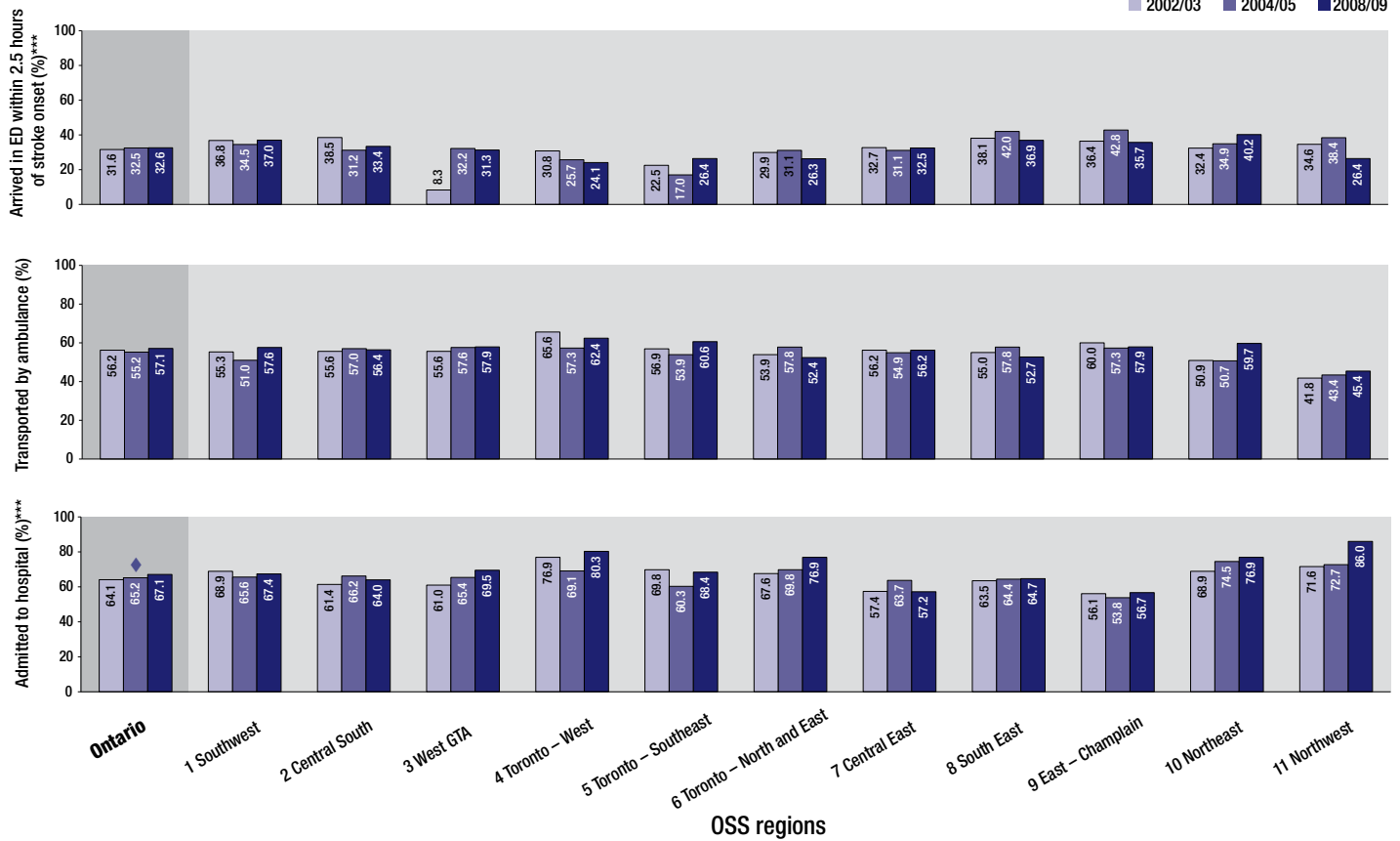
Significance levels used [p=p-value]: *p<0.05; **p<0.01; ***p<0.001 for comparisons across LHINs in 2008/09.

Findings

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

Exhibit 6 Pre-hospital and emergency stroke/TIA care, by Ontario Stroke System (OSS) region, 2002/03, 2004/05 and 2008/09

Patients with stroke or transient ischemic attack seen in the ED or admitted to hospital



Significance levels used [p=p-value]:
 *p<0.05; **p<0.001; ***p<0.0001 for comparisons across OSS regions in 2008/09.
 ◆p<0.05; ◆◆p<0.001; ◆◆◆p<0.0001 for comparisons between 2002/03, 2004/05 and 2008/09 (provincial rates only).

ED = emergency department; GTA = Greater Toronto Area.

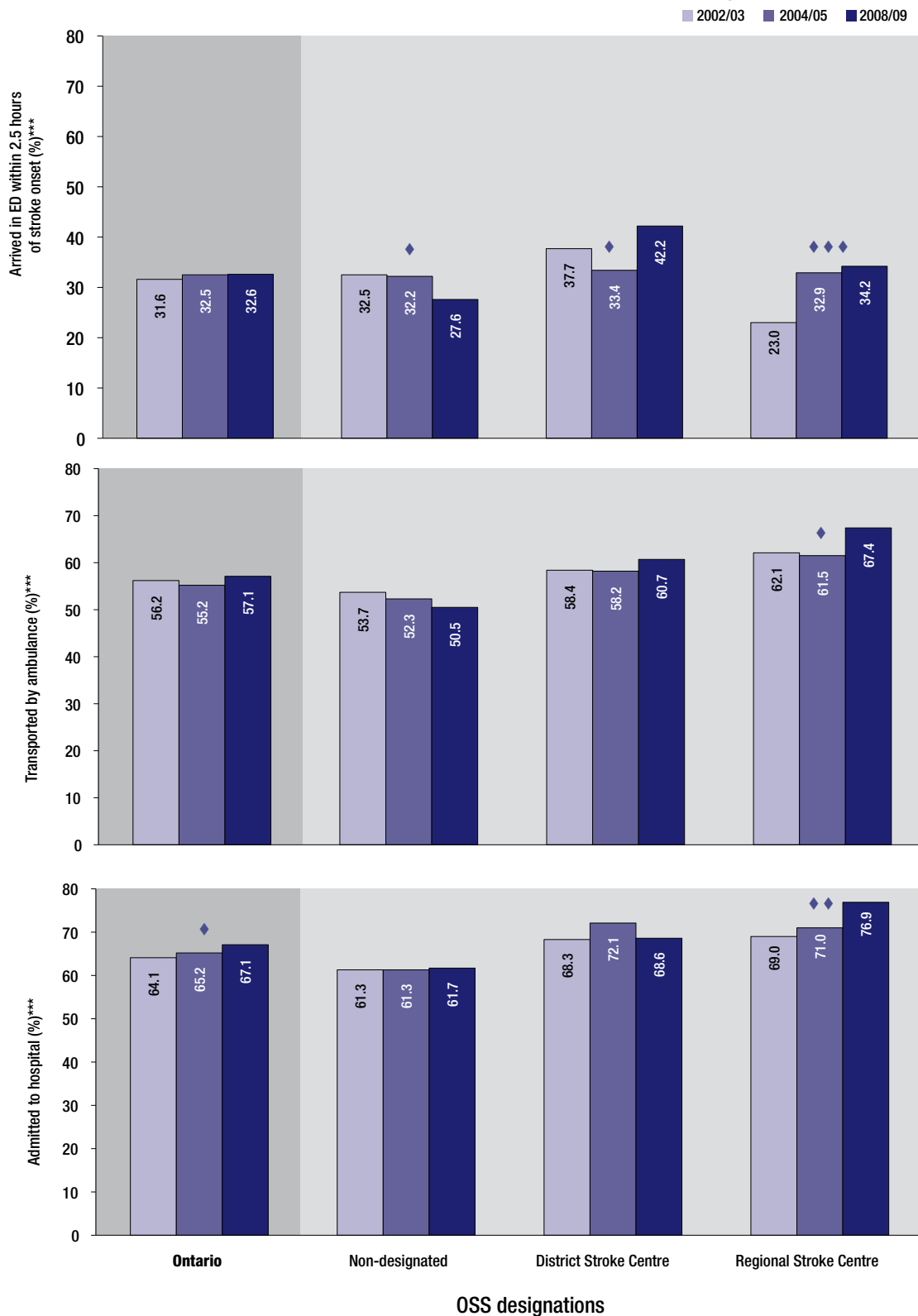
Findings

- Overall, 32.6% of patients arrived at hospital within 2.5 hours of stroke onset in 2008/09, with no significant change from 2004/05. There were variations in the proportion of patients arriving within 2.5 hours of stroke onset across OSS regions, ranging from 24.1% (Toronto West) to 40.2% (Northeast).
- In 2008/09, 57.1% of patients were transported to hospital by ambulance, with no significant change from 2004/05. There was no significant regional variation.
- Overall, 67.1% of patients were admitted to hospital in 2008/09, with no significant change from 2004/05. There were variations in admission rates by OSS region ranging from 56.7% (Champlain) to 86.0% (Northwest).

Exhibits and Findings

Exhibit 7 Pre-hospital and emergency stroke/TIA care, by Ontario Stroke System (OSS) designation, 2002/03, 2004/05 and 2008/09

Patients with stroke or transient ischemic attack seen in the ED or admitted to hospital



Non-designated: An acute care hospital that does not fit the definition of district or regional stroke centre.

District Stroke Centre: A facility with written stroke protocols (e.g., transport and triage, thrombolytic therapy, neuroimaging), clinicians with stroke expertise, and linkages to rehabilitation and secondary prevention.

Regional Stroke Centre: A facility that meets all the requirements of a district stroke centre, plus neurosurgical facilities and interventional radiology.

Findings

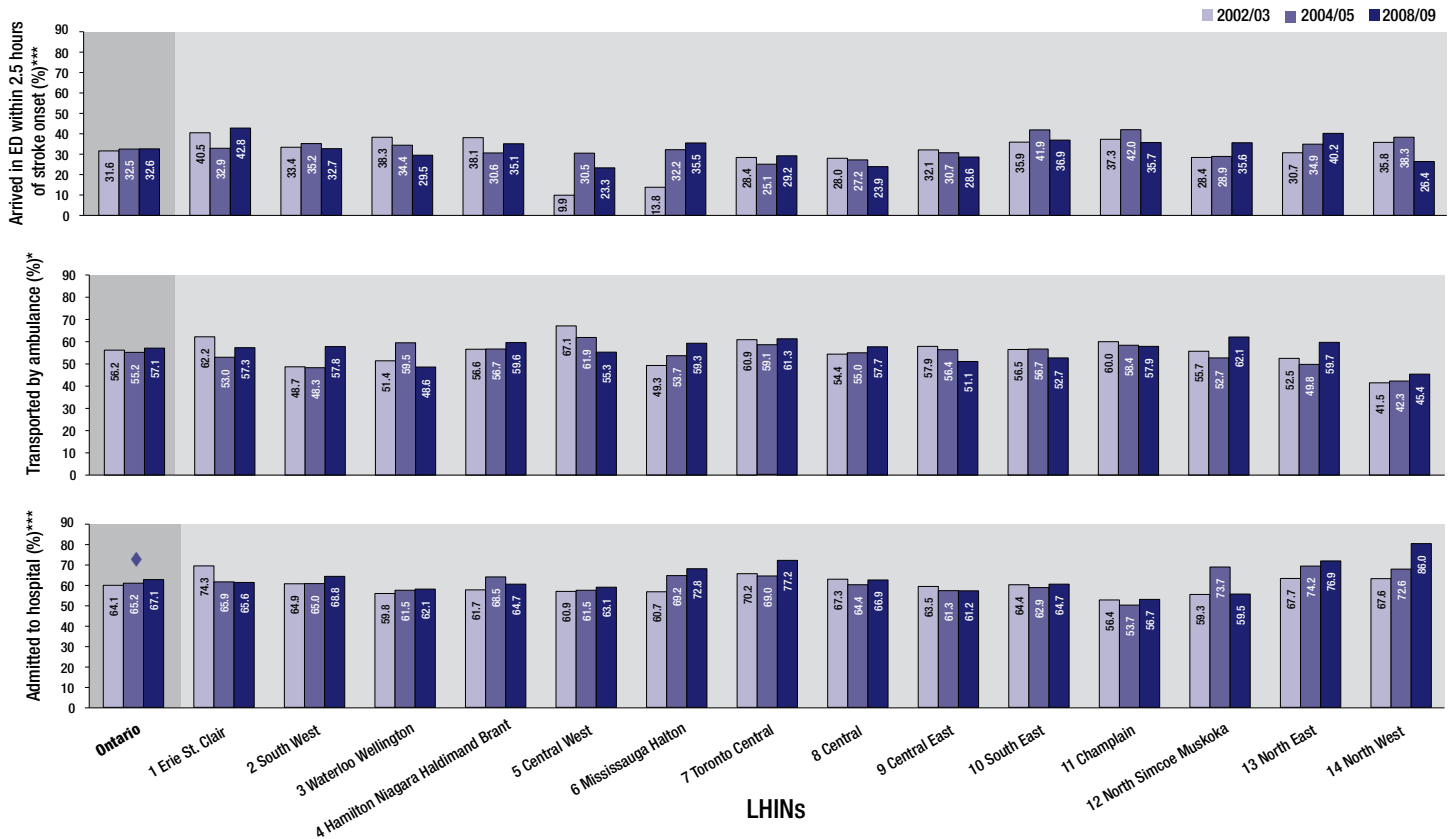
- In 2008/09, patients seen at regional stroke centres were more likely than those at other hospital types to arrive within 2.5 hours of stroke onset, to be transported by ambulance and to be admitted to hospital.

Significance levels used [p=p-value]: *p<0.05; **p<0.001; ***p<0.0001 for comparisons across OSS designations in 2008/09. ◆p<0.05; ◆◆p<0.001; ◆◆◆p<0.0001 for comparisons between 2002/03, 2004/05 and 2008/09 (rates for entire province and within designation).

ED = emergency department.

Exhibit 8 Pre-hospital and emergency stroke/TIA care, by Ontario Local Health Integration Network (LHIN), 2002/03, 2004/05 and 2008/09

Patients with stroke or transient ischemic attack seen in the ED or admitted to hospital



Significance levels used p=p-value:
 *p<0.05; **p<0.001; ***p<0.0001 for comparisons across LHINs in 2008/09.
 ◆p<0.05; ◆◆p<0.001; ◆◆◆p<0.0001 for comparisons between 2002/03, 2004/05 and 2008/09 (provincial rates only).

ED = emergency department.

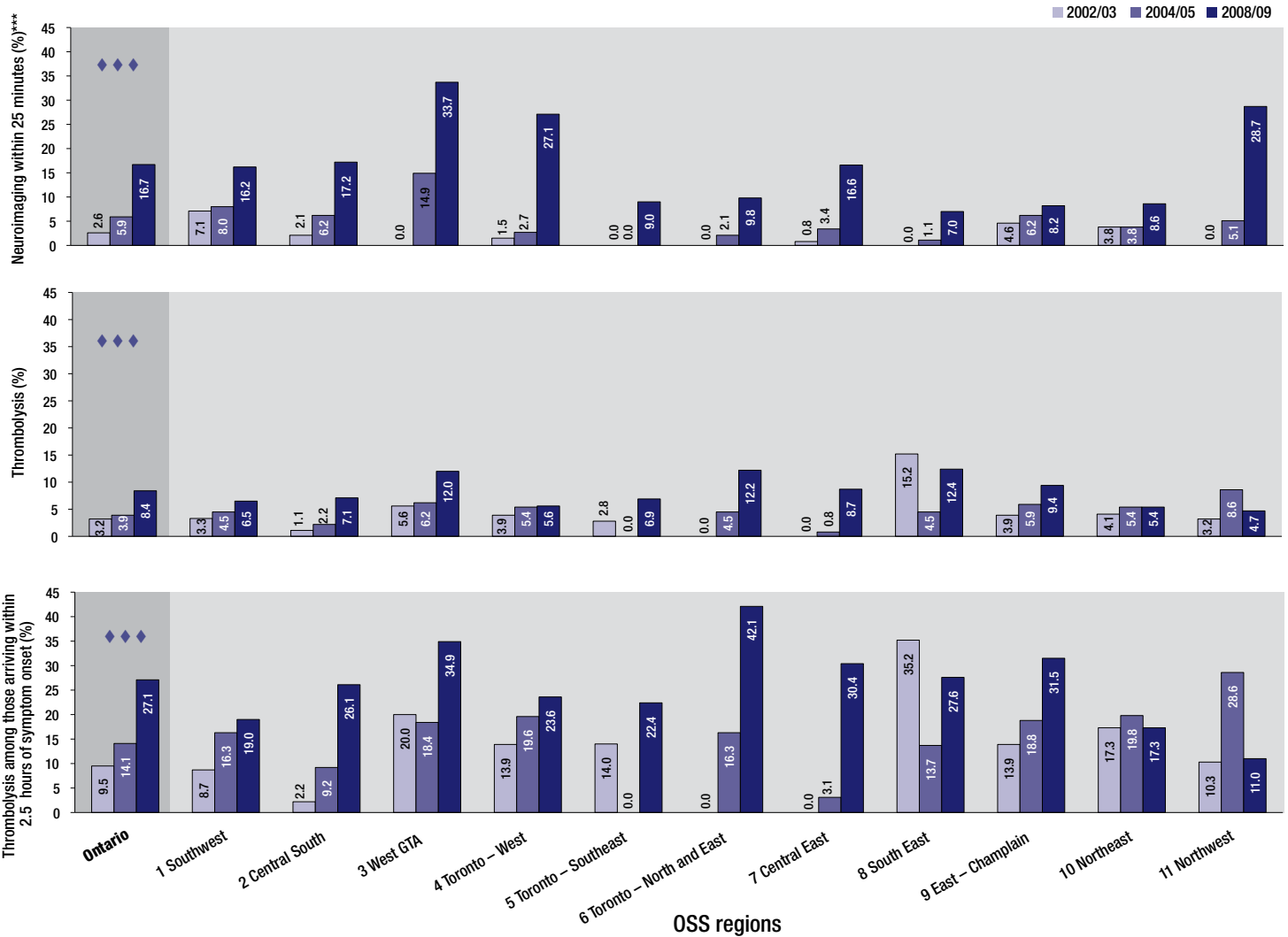
Findings

- There were variations across LHINs in the proportion of patients presenting to the ED within 2.5 hours of stroke onset, with a low of 23.9% in the Central West LHIN and a high of 42.8% in the Erie St. Clair LHIN.
- There were variations across LHINs in the proportion of patients admitted to hospital.

Exhibits and Findings

Exhibit 9 Proportion of patients with ischemic stroke receiving neuroimaging[†] and thrombolysis[‡], by Ontario Stroke System (OSS) region, 2002/03, 2004/05 and 2008/09[†]

Patients with ischemic stroke seen in the ED or admitted to hospital



Significance levels used [p=p-value]:
 *p<0.05; **p<0.001; ***p<0.0001 for comparisons across OSS regions in 2008/09.
 ◆p<0.05; ◆◆p<0.001; ◆◆◆p<0.0001 for comparisons between 2002/03, 2004/05 and 2008/09 (provincial rates only).

[†] Where the date or time of the procedure was missing, neuroimaging was considered not to have been performed within 24 hours.
[‡] Although some regions appear to have administered no thrombolysis in 2004/05, other data sources confirm that thrombolysis was given in up to 1% of all ischemic stroke patients and in up to 2% of those arriving within 2.5 hours.

ED = emergency department; GTA = Greater Toronto Area.

OSS regions

Findings

- The overall rate of neuroimaging within 25 minutes of arrival was 16.7% in 2008/09, an increase from 5.9% in 2004/05 and 2.6% in 2002/03. There were significant regional variations in rates of neuroimaging.
- The overall rate of thrombolysis administration in patients with ischemic stroke in 2008/09 was 8.4%, a significant increase from 3.9% in 2004/05 and 3.2% in 2002/03. There were no variations in thrombolysis administration rates by OSS 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 2008/09 was 27.1%, an increase from 14.1% in 2004/05 and 9.5% in 2002/03. There were no significant variations in thrombolysis rates by OSS region.

Exhibit 10 Proportion of patients with ischemic stroke receiving neuroimaging[†] and thrombolysis[‡], by Ontario Stroke System (OSS) designation, 2002/03, 2004/05 and 2008/09

Patients with ischemic stroke seen in the ED or admitted to hospital

Non-designated: An acute care hospital that does not fit the definition of district or regional stroke centre.

District Stroke Centre: A facility with written stroke protocols (e.g., transport and triage, thrombolytic therapy, neuroimaging), clinicians with stroke expertise, and linkages to rehabilitation and secondary prevention.

Regional Stroke Centre: A facility that meets all the requirements of a district stroke centre, plus neurosurgical facilities and interventional radiology.

Findings

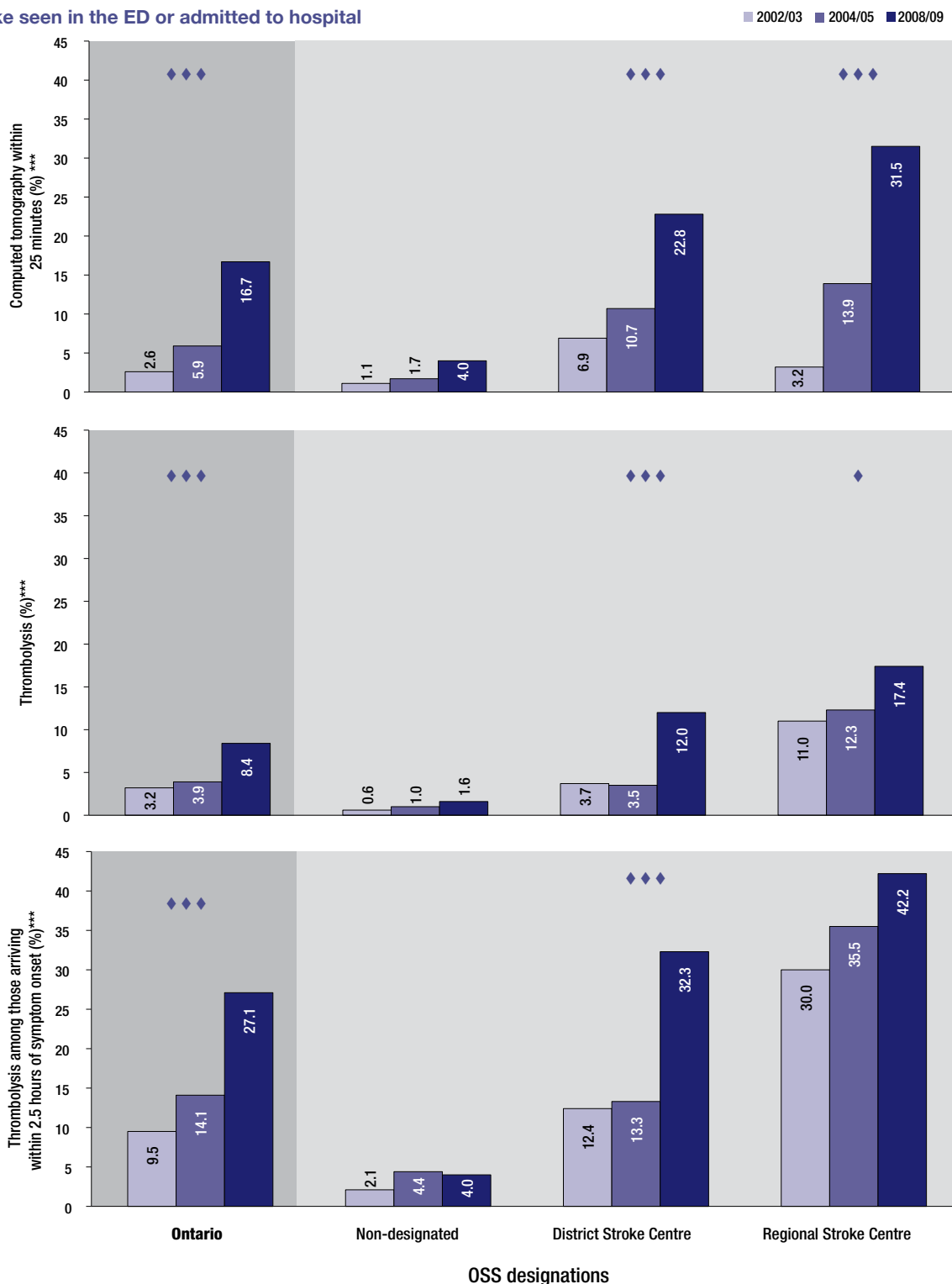
- Between 2004/05 and 2008/09, there were significant increases in neuroimaging rates (within 25 minutes of hospital arrival) and thrombolysis administration rates at regional and district stroke centres.
- Rates of neuroimaging and thrombolysis administration were highest at regional stroke centres and lowest at non-designated hospitals.

Significance levels used [p=p-value]: *p<0.05; **p<0.001; ***p<0.0001 for comparisons across OSS designations in 2008/09. ◆p<0.05; ◆◆p<0.001; ◆◆◆p<0.0001 for comparisons between 2002/03, 2004/05 and 2008/09 (rates for entire province and within designation).

[†] Where the date or time of the procedure was missing, neuroimaging was considered not to have been performed within 24 hours.

[‡] Although some regions appear to have administered no thrombolysis in 2004/05, other data sources confirm that thrombolysis was given in up to 1% of all ischemic stroke patients and in up to 2% of those arriving within 2.5 hours.

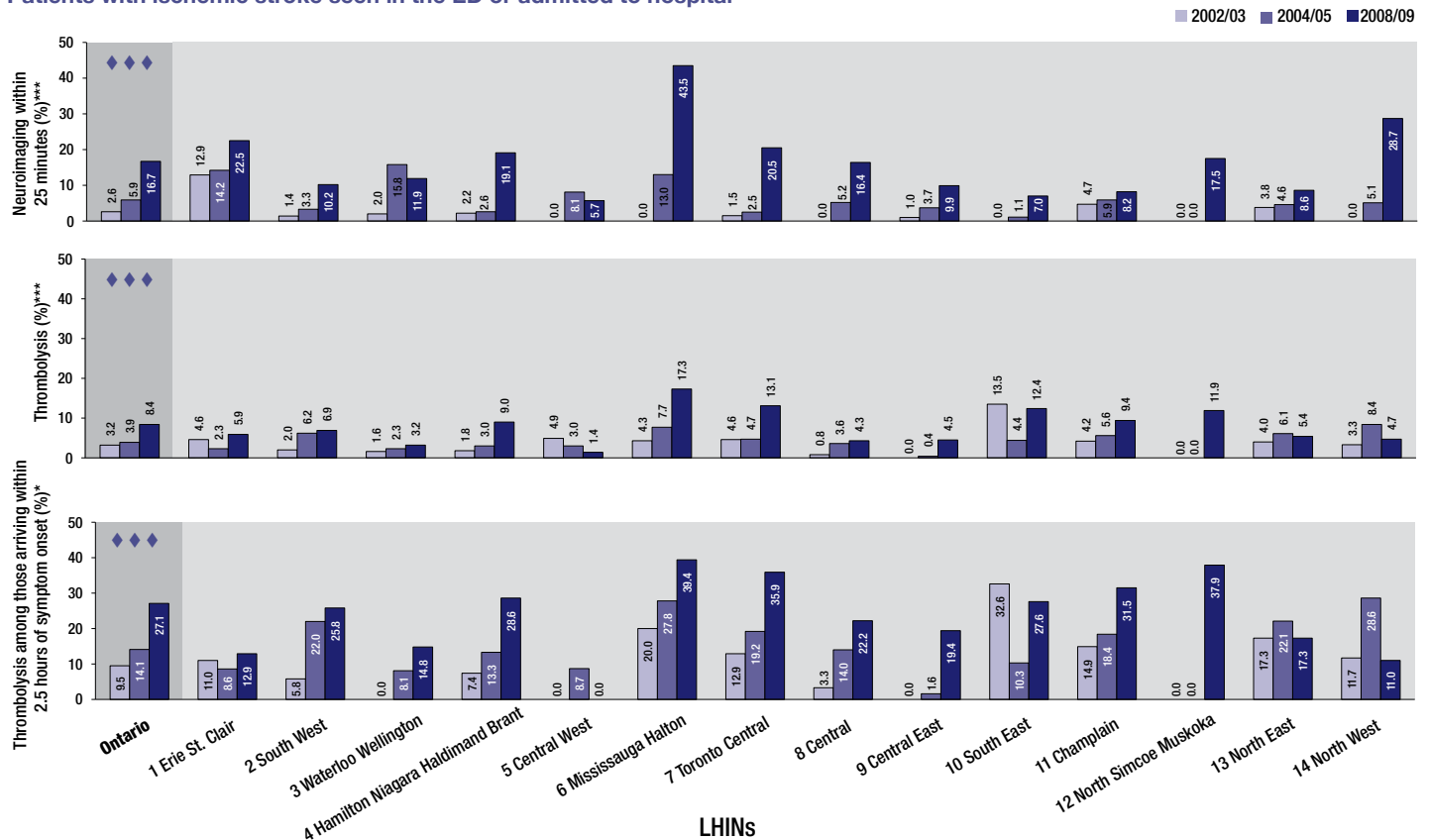
ED = emergency department.



Exhibits and Findings

Exhibit 11 Proportion of patients with ischemic stroke receiving neuroimaging[†] and thrombolysis[‡], by Ontario Local Health Integration Network (LHIN), 2002/03, 2004/05 and 2008/09[†]

Patients with ischemic stroke seen in the ED or admitted to hospital



Significance levels used [p=p-value]:
 *p<0.05; **p<0.001; ***p<0.0001 for comparisons across LHINs in 2008/09.
 ◆p<0.05; ◆◆p<0.001; ◆◆◆p<0.0001 for comparisons between 2002/03, 2004/05 and 2008/09 (provincial rates only).

[†] Where the date or time of the procedure was missing, neuroimaging was considered not to have been performed within 24 hours.

[‡] Although some regions appear to have administered no thrombolysis in 2004/05, other data sources confirm that thrombolysis was given in up to 1% of all ischemic stroke patients and in up to 2% of those arriving within 2.5 hours.

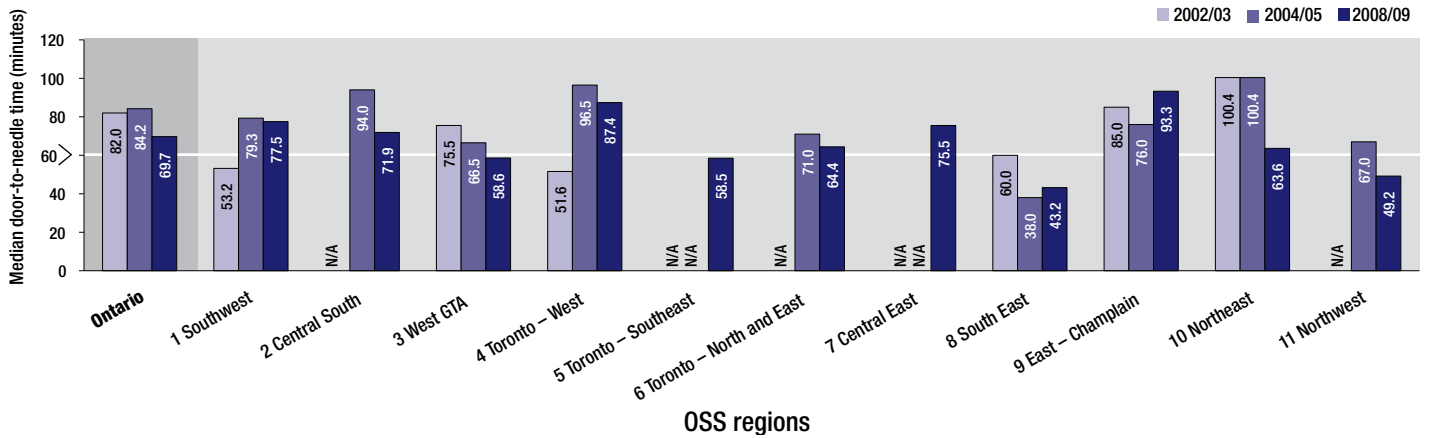
ED = emergency department.

Findings

- There were variations by LHIN in rates of neuroimaging (within 25 minutes of hospital arrival) and thrombolysis administration.

Exhibit 12 Median door-to-needle time among patients receiving intravenous thrombolysis, by Ontario Stroke System (OSS) region, 2002/03, 2004/05 and 2008/09

Patients with ischemic stroke seen in the ED or admitted to hospital



ED = emergency department; N/A = not available; GTA = Greater Toronto Area.

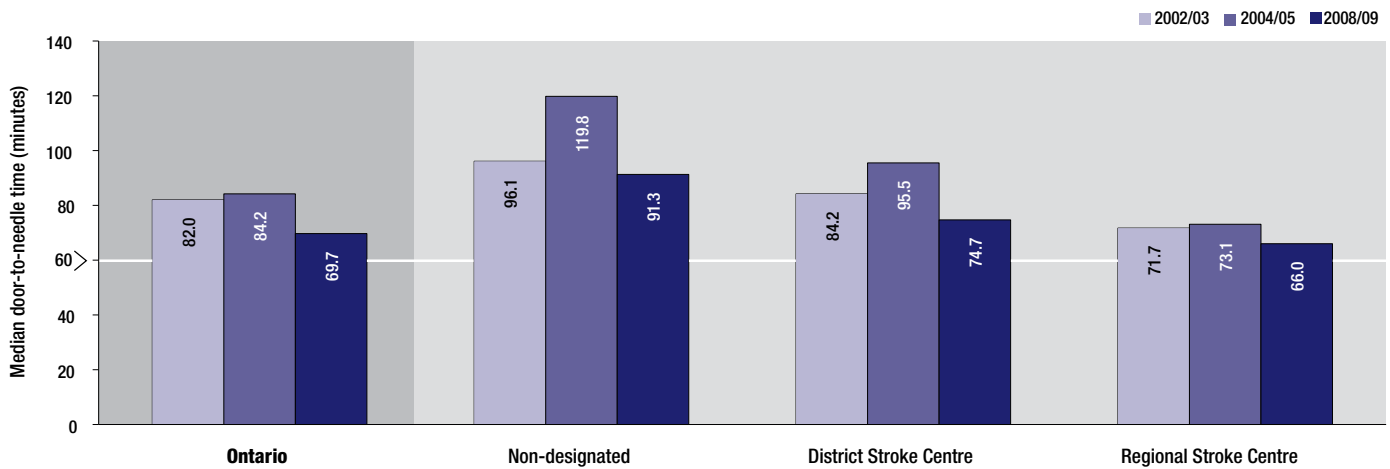
Findings

- Among patients receiving intravenous thrombolysis in 2008/09, the median door-to-needle time was 69.7 minutes, a significant decrease from 84.2 minutes in 2004/05.
- The benchmark for door-to-needle time is 60 minutes. This was achieved in four OSS regions.

Exhibits and Findings

Exhibit 13 Median door-to-needle time among patients receiving intravenous thrombolysis, by Ontario Stroke System (OSS) designation, 2002/03, 2004/05 and 2008/09

Patients with ischemic stroke seen in the ED or admitted to hospital



OSS designations

Non-designated: An acute care hospital that does not fit the definition of district or regional stroke centre.

District Stroke Centre: A facility with written stroke protocols (e.g., transport and triage, thrombolytic therapy, neuroimaging), clinicians with stroke expertise, and linkages to rehabilitation and secondary prevention.

Regional Stroke Centre: A facility that meets all the requirements of a district stroke centre, plus neurosurgical facilities and interventional radiology.

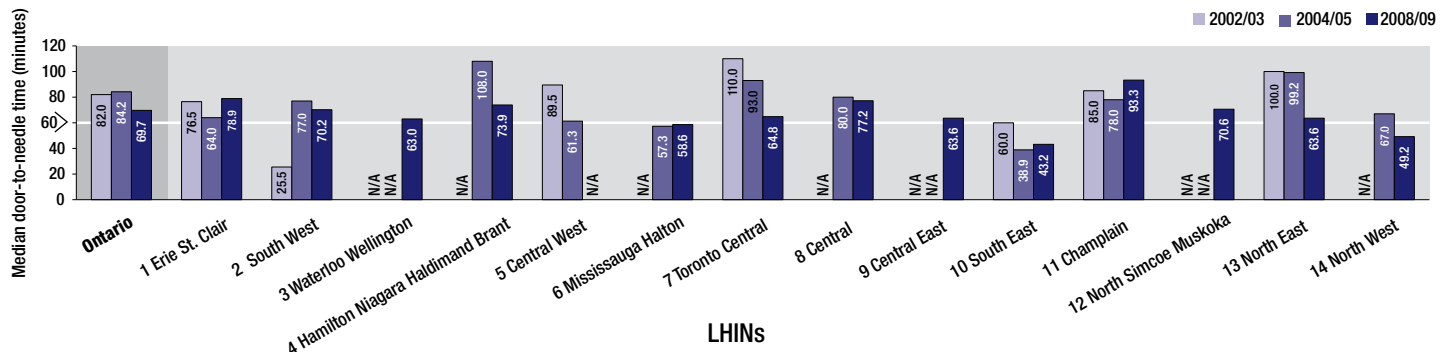
Findings

- Among patients receiving intravenous thrombolysis in 2008/09, the median door-to-needle times were 66.0, 74.7 and 91.3 minutes at regional stroke centres, district stroke centres and non-designated hospitals, respectively. These were improved compared to 2004/05 but still above the benchmark of 60 minutes.

ED = emergency department.

Exhibit 14 Median door-to-needle time among patients receiving intravenous thrombolysis, by Ontario Local Health Integration Network (LHIN), 2002/03, 2004/05 and 2008/09

Patients with ischemic stroke seen in the ED or admitted to hospital



ED = emergency department; N/A = not available.

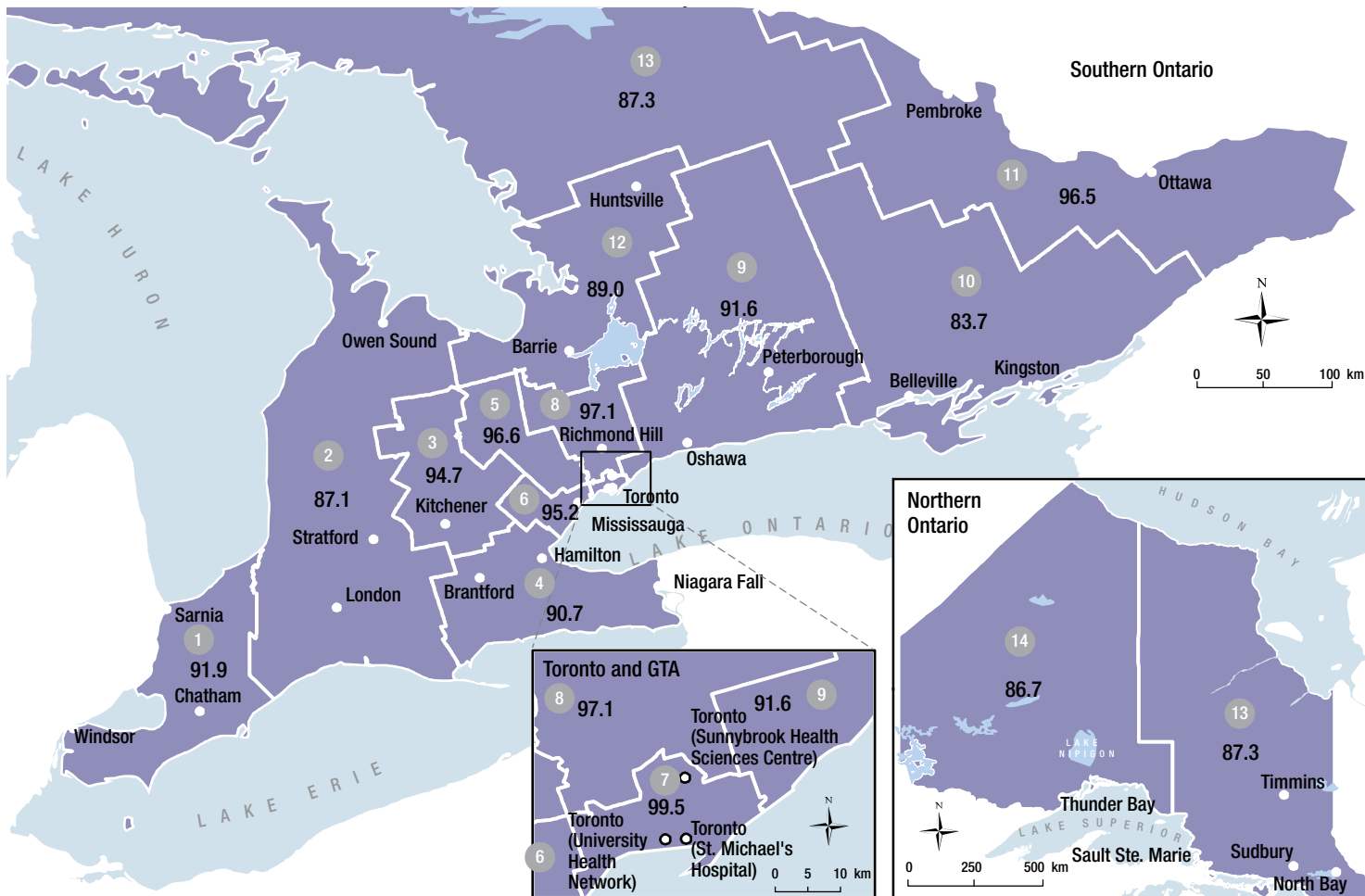
Findings

- There were variations in median door-to-needle time by LHIN; however due to small sample sizes, data on this indicator were not available for some regions.
- In 2008/09, the Mississauga Halton, South East and Northwest LHINs had a median door-to-needle time that was below the benchmark of 60 minutes.

Exhibits and Findings

Exhibit 15 Neuroimaging rate[†] per 100 stroke/TIA patients, by Ontario Local Health Integration Network (LHIN), April 1, 2008 to March 31, 2009

Patients with stroke or transient ischemic attack seen in the ED or admitted to hospital



Local Health Integration Networks (LHINs)

- | | |
|------------------------------------|-------------------------|
| 1 Erie St. Clair | 8 Central |
| 2 South West | 9 Central East |
| 3 Waterloo Wellington | 10 South East |
| 4 Hamilton Niagara Haldimand Brant | 11 Champlain |
| 5 Central West | 12 North Simcoe Muskoka |
| 6 Mississauga Halton | 13 North East |
| 7 Toronto Central | 14 North West |

Neuroimaging rate per 100 stroke patients by Ontario LHIN, April 1, 2008 to March 31, 2009

Ontario rate (OR) = 92.8 per 100 stroke/TIA patients

LHIN rate per 100 stroke/TIA patients	LHIN rate compared to OR	Number of LHINs in each category
N/A	More than 20% above OR	0
N/A	10% to 20% above OR	0
83.7-99.5	Within 10% of OR	14
N/A	10% to 20% below OR	0
N/A	More than 20% below OR	0

[†]Neuroimaging includes computed tomography (CT) and magnetic resonance imaging (MRI) of the brain performed at any time during hospitalization. Where the date or time of the procedure was missing, neuroimaging was considered not to have been performed within 24 hours.

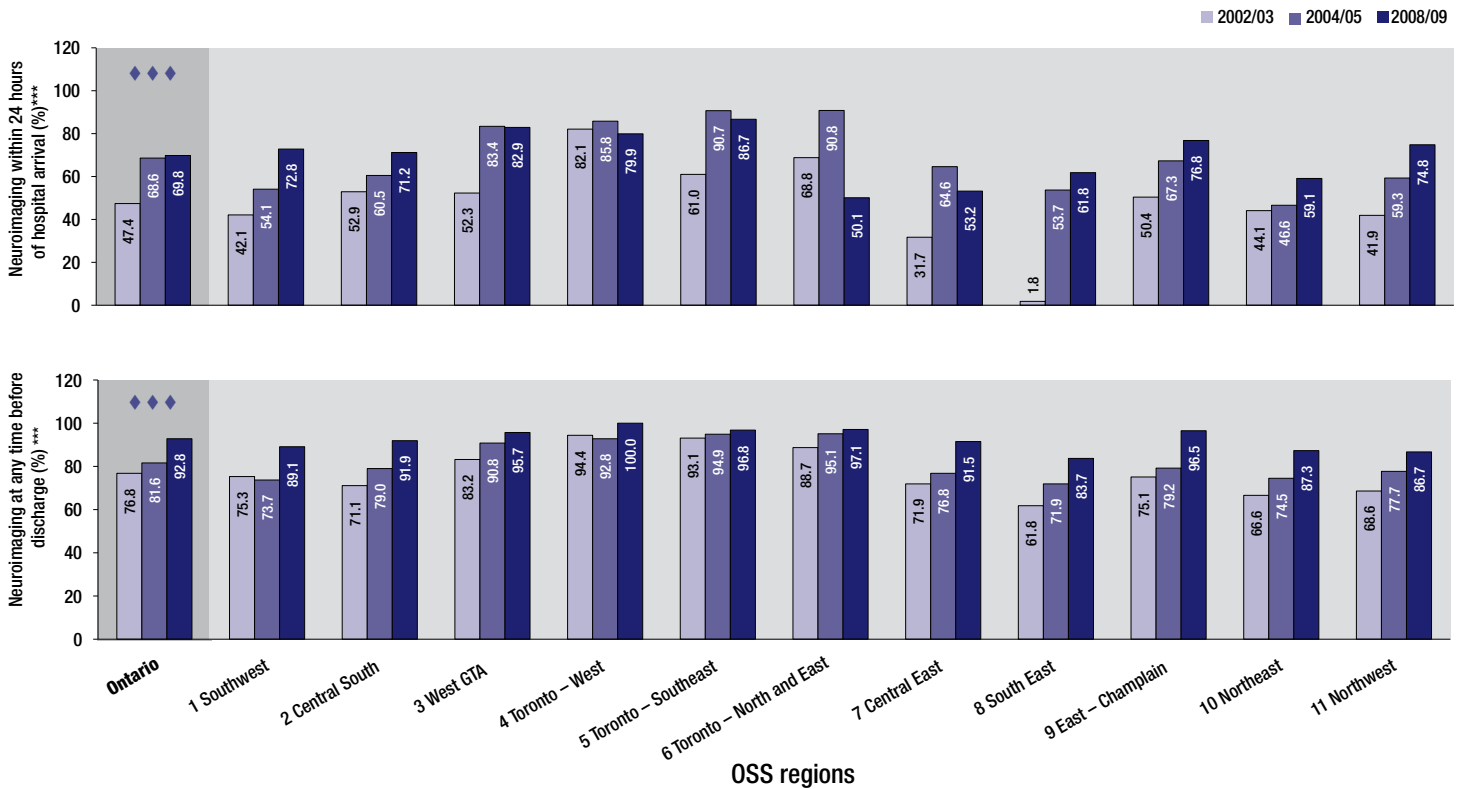
ED = emergency department; GTA = Greater Toronto Area; N/A = not available.

Findings

- In 2008/09, the overall neuroimaging rate was 92.8% and was similar across all LHINs.

Exhibit 16 Proportion of stroke/TIA patients who underwent neuroimaging[†], by Ontario Stroke System (OSS) region, 2002/03, 2004/05 and 2008/09

Patients with stroke or transient ischemic attack seen in the ED or admitted to hospital



Significance levels used [p=p-value]:
 *p<0.05; **p<0.01; ***p<0.001 for comparisons across OSS regions in 2008/09.
 ◆p<0.05; ◆◆p<0.001; ◆◆◆p<0.0001 for comparisons between 2002/03, 2004/05 and 2008/09 (provincial rates only).

[†] Neuroimaging includes computed tomography (CT) and magnetic resonance imaging (MRI) of the brain performed at any time during hospitalization. Patients with missing scan dates or times, as well as patients who had a scan prior to arrival at the hospital where the chart was abstracted were considered to have not had a scan performed.

ED = emergency department; GTA = Greater Toronto Area.

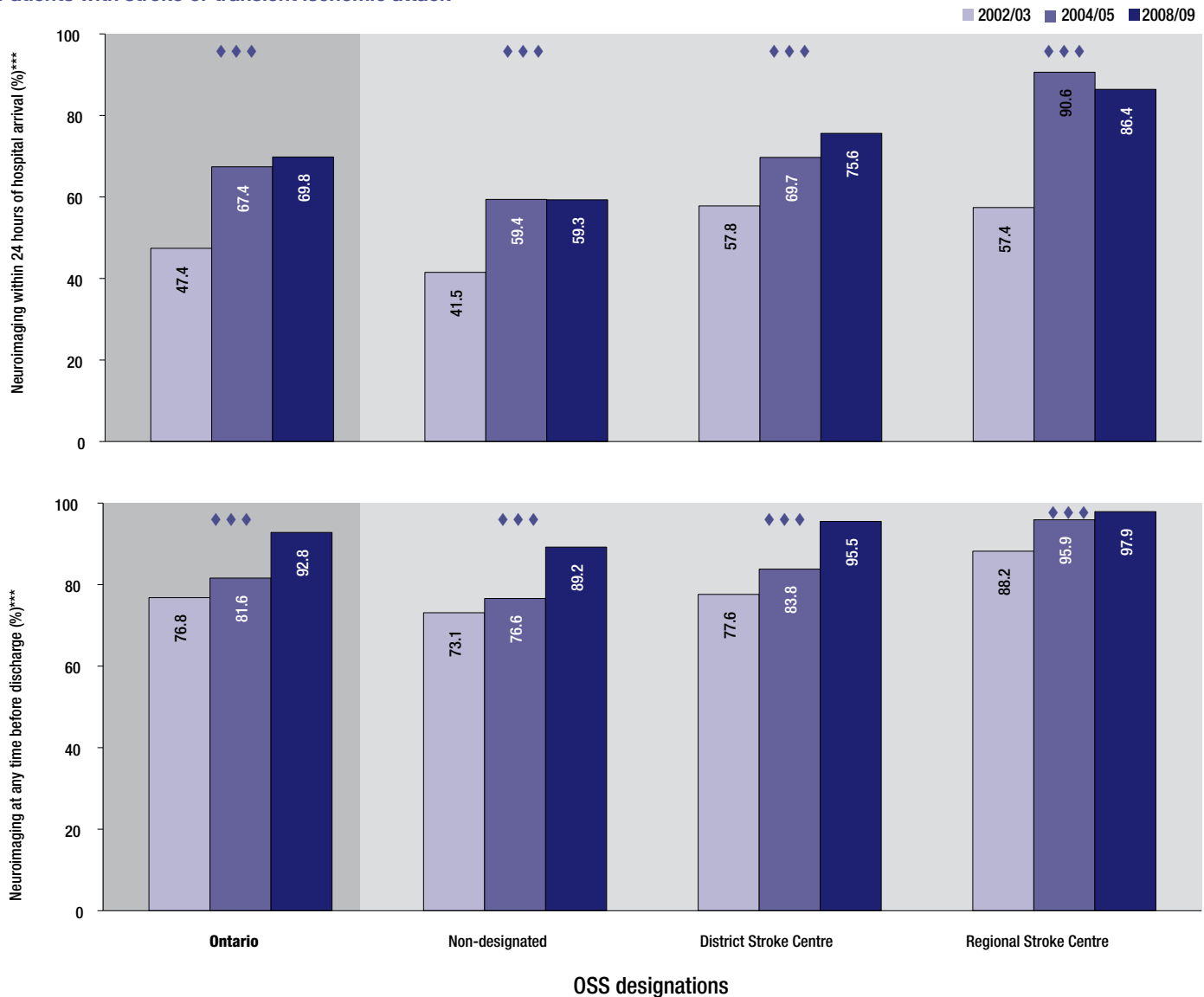
Findings

- In 2008/09, 69.8% of patients underwent neuroimaging within 24 hours of hospital arrival—not a significant change from 2004/05—while 92.8% underwent neuroimaging prior to discharge from hospital, a significant improvement from 81.6% in 2004/05.
- There were variations in neuroimaging rates by OSS region; however, these were less pronounced than in previous years.

Exhibits and Findings

Exhibit 17 Proportion of stroke/TIA patients who underwent neuroimaging†, by Ontario Stroke System (OSS) designation, 2002/03, 2004/2005 and 2008/09

Patients with stroke or transient ischemic attack



Significance levels used [p=p-value]: *p<0.05; **p<0.01; ***p<0.001 for comparisons across OSS designations in 2008/09.
 ◆p<0.05; ◆◆p<0.001; ◆◆◆p<0.0001 for comparisons between 2002/03, 2004/05 and 2008/09 (rates for entire province and within designation).

†Neuroimaging includes computed tomography (CT) and magnetic resonance imaging (MRI) of the brain performed at any time during hospitalization. Patients with missing scan dates or times, as well as patients who had a scan prior to arrival at the hospital where the chart was abstracted, were considered to have not had a scan performed.

Non-designated: An acute care hospital that does not fit the definition of district or regional stroke centre.

District Stroke Centre: A facility with written stroke protocols (e.g., transport and triage, thrombolytic therapy, neuroimaging), clinicians with stroke expertise, and linkages to rehabilitation and secondary prevention.

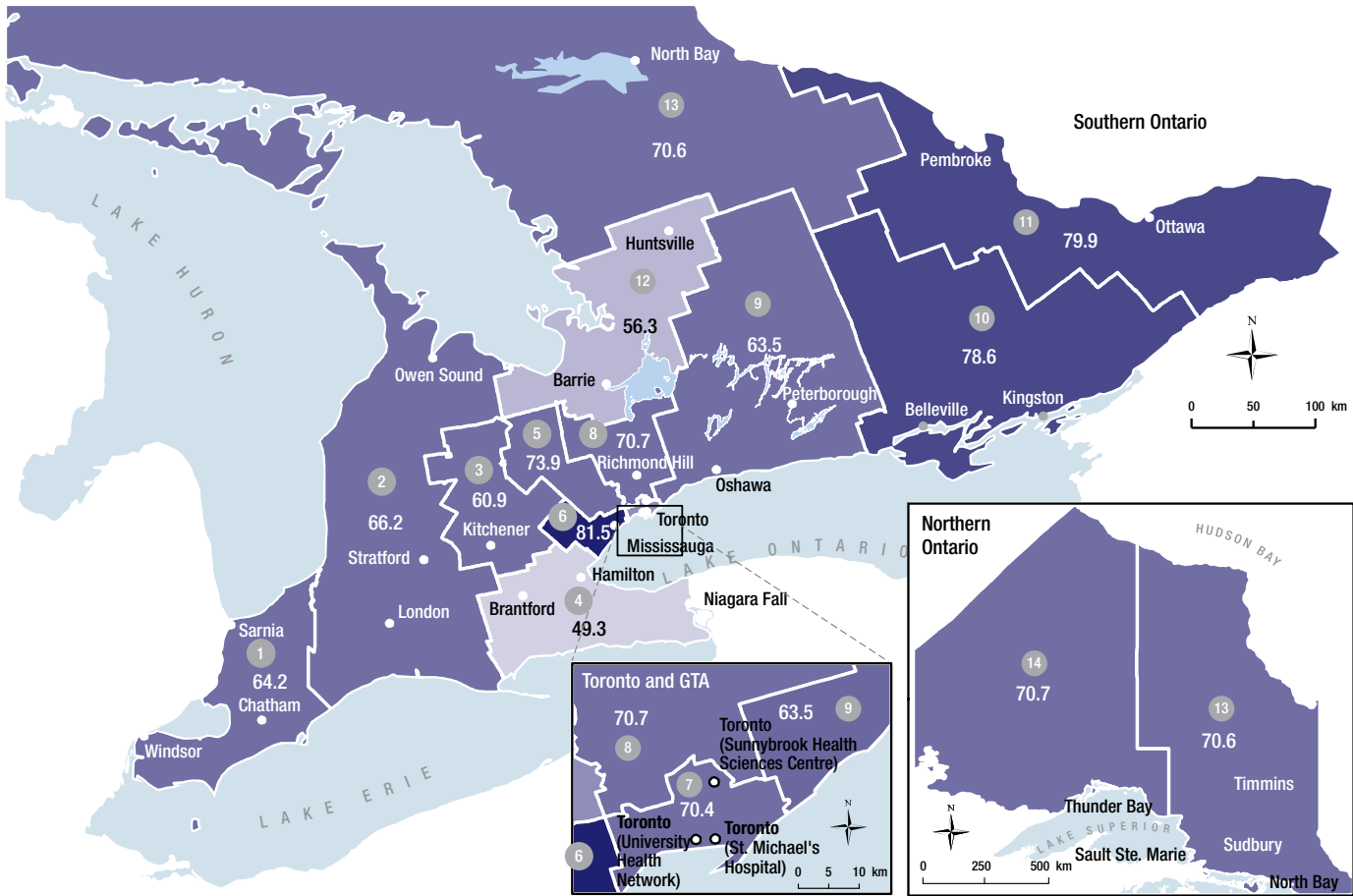
Regional Stroke Centre: A facility that meets all the requirements of a district stroke centre, plus neurosurgical facilities and interventional radiology.

Findings

- Neuroimaging rates were higher at regional stroke centres compared to other types of hospitals, with imaging rates prior to discharge of 97.9%, 95.5% and 89.2% 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 2004/05 and 2008/09.

Exhibit 18 Carotid imaging rate per 100 patients with ischemic stroke or TIA, by Ontario Local Health Integration Network (LHIN), 2008/09

Patients with ischemic stroke or transient ischemic attack admitted to hospital



Local Health Integration Networks (LHINs)

- | | |
|------------------------------------|-------------------------|
| 1 Erie St. Clair | 8 Central |
| 2 South West | 9 Central East |
| 3 Waterloo Wellington | 10 South East |
| 4 Hamilton Niagara Haldimand Brant | 11 Champlain |
| 5 Central West | 12 North Simcoe Muskoka |
| 6 Mississauga Halton | 13 North East |
| 7 Toronto Central | 14 North West |

GTA = Greater Toronto Area.

Carotid imaging rate per 100 stroke patients, by Ontario LHIN, 2008/09

Ontario rate (OR) = 67.5 per 100 stroke/TIA patients

LHIN rate per 100 stroke/TIA patients	LHIN rate compared to OR	Number of LHINs in each category
81.5	More than 20% above OR	1
78.6 - 79.9	10% to 20% above OR	2
60.9 - 73.9	Within 10% of OR	9
56.3	10% to 20% below OR	1
49.3	More than 20% below OR	1

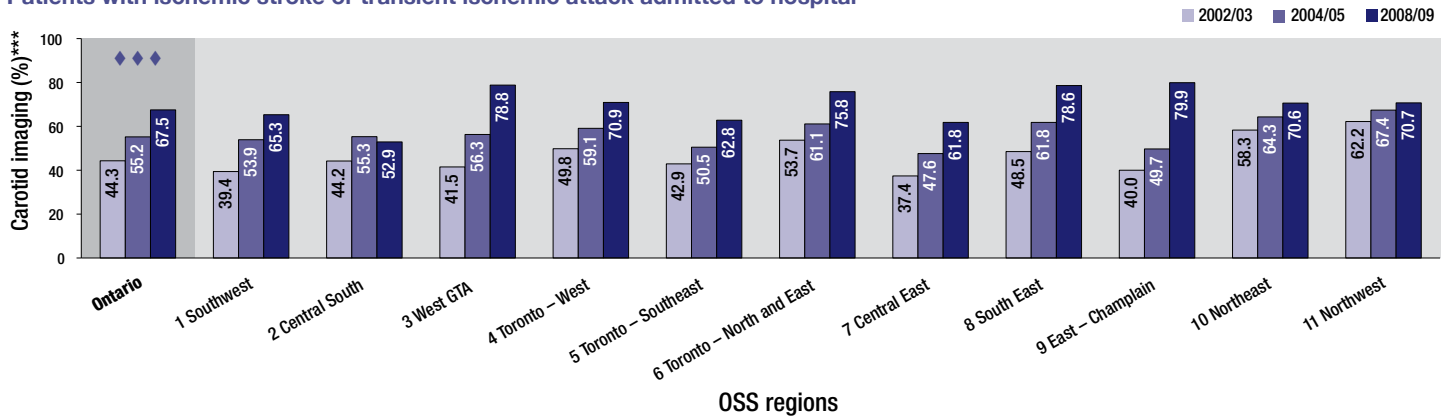
Findings

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

Exhibits and Findings

Exhibit 19 Proportion of patients with ischemic stroke or TIA who received carotid imaging, by Ontario Stroke System (OSS) region, 2002/2003, 2004/05 and 2008/09

Patients with ischemic stroke or transient ischemic attack admitted to hospital



Significance levels used [p=p-value]:
 *p<0.05; **p<0.01; ***p<0.001 for comparisons across OSS regions in 2008/09.
 ◆p<0.05; ◆◆p<0.001; ◆◆◆p<0.0001 for comparisons between 2002/03, 2004/05 and 2008/09 (provincial rates only).

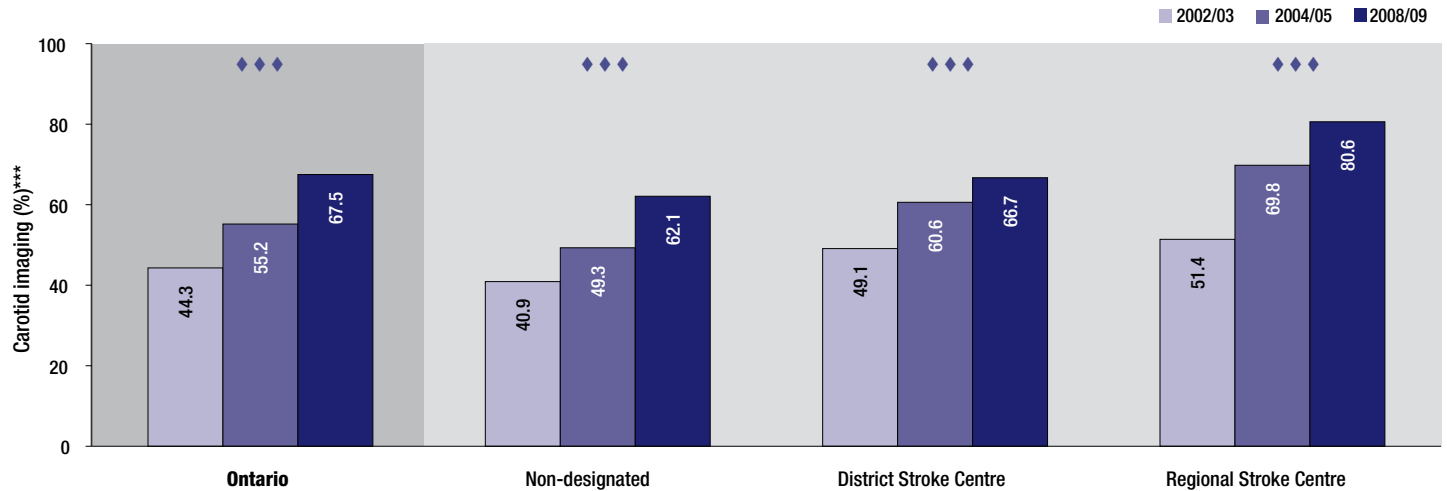
GTA = Greater Toronto Area.

Findings

- Overall in 2008/09, 67.8% 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 from 55.2% of patients in 2004/05. Improvements in 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 patients with ischemic stroke or TIA who received carotid imaging, by Ontario Stroke System (OSS) designation, 2002/03, 2004/05 and 2008/09

Patients with stroke or transient ischemic attack admitted to hospital



OSS designations

Significance levels used [p=p-value]:
 *p<0.05; **p<0.01; ***p<0.001 for comparisons across OSS designations in 2008/09.
 ◆p<0.05; ◆◆p<0.001; ◆◆◆p<0.0001 for comparisons between 2002/03, 2004/05 and 2008/09 (rates for entire province and within designation).

Non-designated: An acute care hospital that does not fit the definition of district or regional stroke centre.

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Regional Stroke Centre: A facility that meets all the requirements of a district stroke centre, plus neurosurgical facilities and interventional radiology.

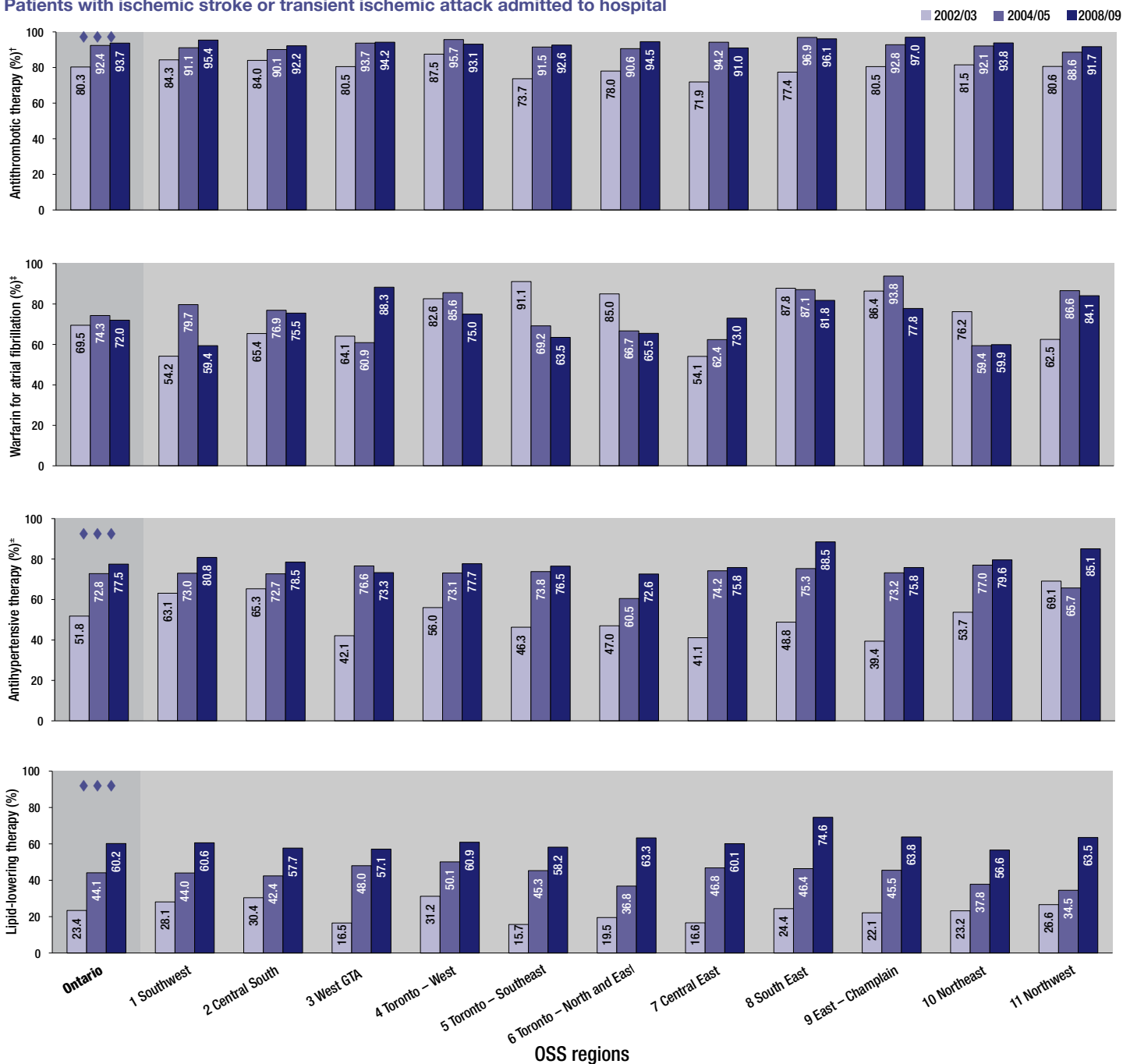
Findings

- Carotid imaging rates were higher at regional stroke centres compared to other types of hospitals, with rates of 80.6%, 66.7% and 62.1% 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 2004/05 and 2008/09.

Exhibits and Findings

Exhibit 21 Proportion of patients with ischemic stroke or TIA who received drug therapy at discharge, by Ontario Stroke System (OSS) region, 2002/03, 2004/05 and 2008/09

Patients with ischemic stroke or transient ischemic attack admitted to hospital



Significance levels used [p=p-value]:
 *p<0.05; **p<0.01; ***p<0.001 for comparisons across OSS regions in 2008/09.
 ◆p<0.05; ◆◆p<0.001; ◆◆◆p<0.0001 for comparisons between 2002/03, 2004/05 and 2008/09 (provincial rates only).

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

‡ Patients with potential contraindications to warfarin were not excluded from the analyses.

§ All antihypertensive agents are included in the present analyses. Previous reports assessed ACE inhibitor use only.

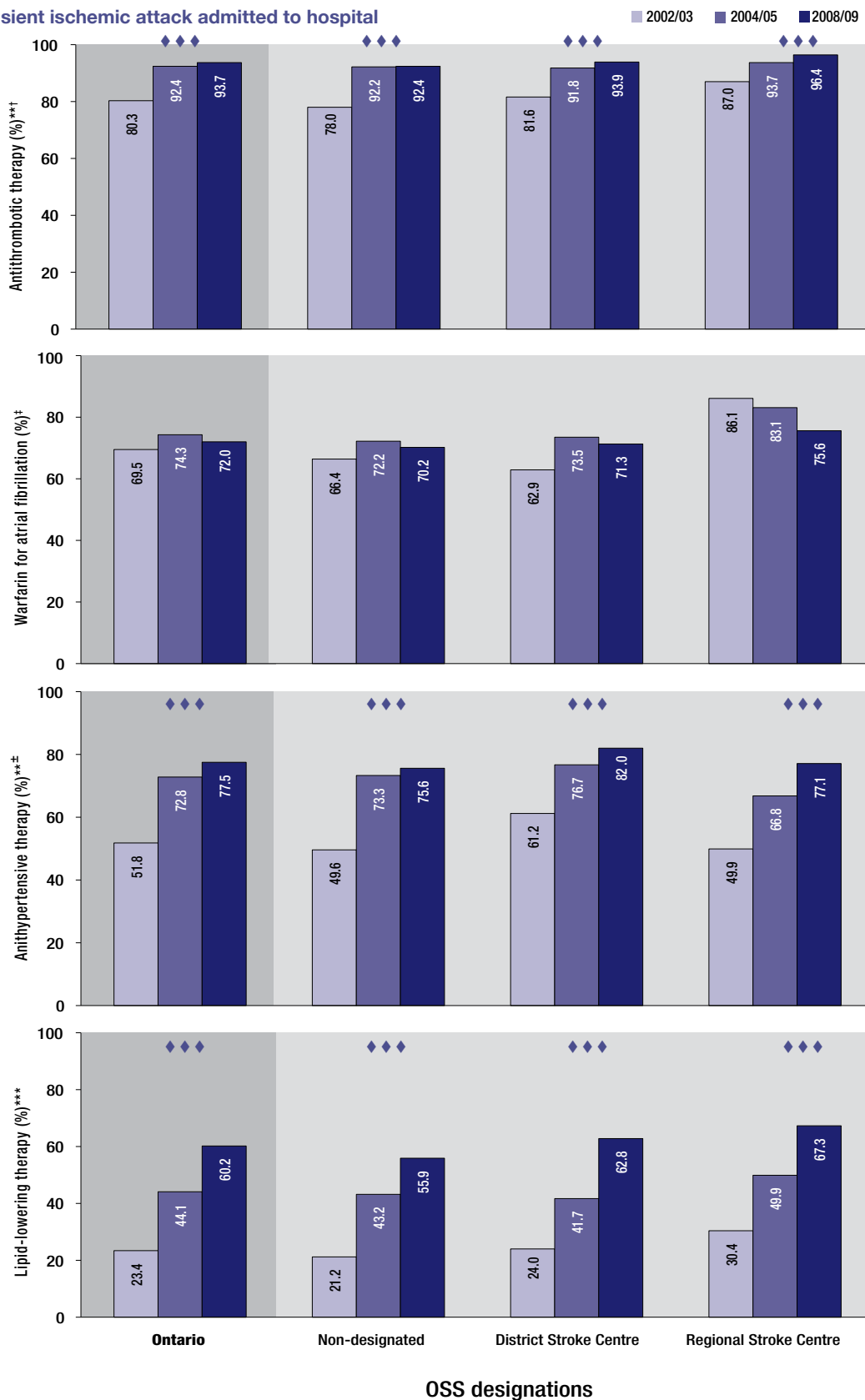
GTA = Greater Toronto Area.

Findings

- In 2008/09, 93.7% of patients with ischemic stroke or transient ischemic attack (TIA) were discharged on antithrombotic therapy, 72.0% on warfarin (in the subgroup with atrial fibrillation), 77.5% on antihypertensive agents, and 60.2% on lipid-lowering therapy.
- There were no significant variations in prescribing rates by OSS region.

Exhibit 22 Proportion of patients with ischemic stroke or TIA who received drug therapy at discharge, by Ontario Stroke System (OSS) designation, 2002/03, 2004/05 and 2008/09

Patients with ischemic stroke or transient ischemic attack admitted to hospital



Non-designated: An acute care hospital that does not fit the definition of district or regional stroke centre.

District Stroke Centre: A facility with written stroke protocols (e.g., transport and triage, thrombolytic therapy, neuroimaging), clinicians with stroke expertise, and linkages to rehabilitation and secondary prevention.

Regional Stroke Centre: A facility that meets all the requirements of a district stroke centre, plus neurosurgical facilities and interventional radiology.

Findings

- In 2008/09, there were variations in rates of antithrombotic, antihypertensive and lipid-lowering therapy after discharge across facility types, but no significant variations in prescribing of warfarin for atrial fibrillation.

Significance levels used [p=p-value]:
 *p<0.05; **p<0.01; ***p<0.001 for comparisons across OSS designations in 2008/09.

◆p<0.05; ◆◆p<0.001; ◆◆◆p<0.0001 for comparisons between 2002/03, 2004/05 and 2008/09 (rates for entire province and within designation).

[†] Antithrombotic therapy includes ASA, combination ASA and dipyridamole, clopidogrel and warfarin.

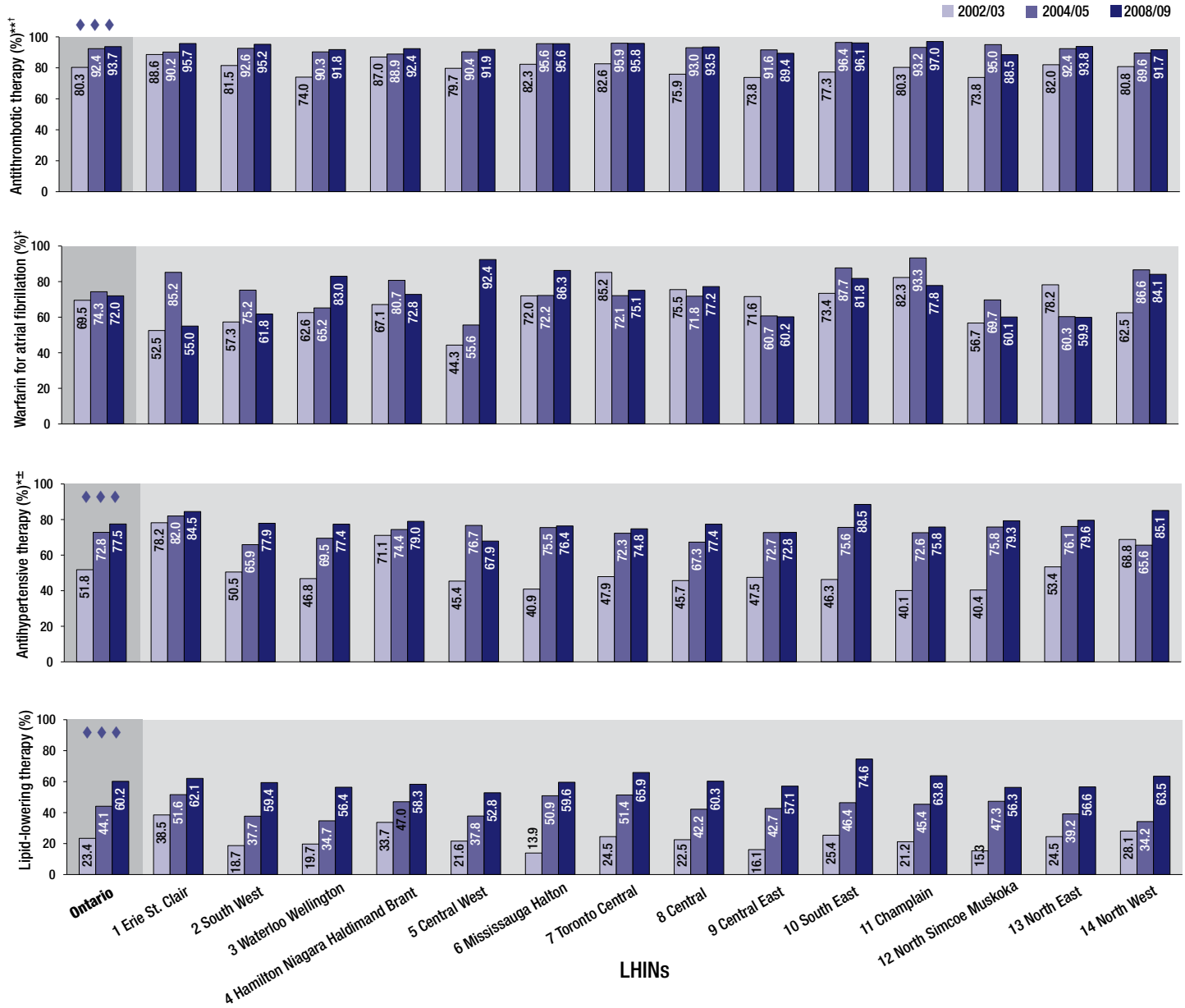
[‡] Patients with potential contraindications to warfarin were not excluded from the analyses.

^{‡‡} All antihypertensive agents are included in the present analyses. Previous reports assessed ACE inhibitor use only.

Exhibits and Findings

Exhibit 23 Proportion of patients with ischemic stroke or TIA who received drug therapy at discharge, by Ontario Local Health Integration Network (LHIN), 2002/03, 2004/05 and 2008/09

Patients with ischemic stroke or transient ischemic attack admitted to hospital



Significance levels used [p= p-value]:
 † p<0.05; †† p<0.01; ††† p<0.001 for comparisons across LHINs in 2008/09.
 ◆ p<0.05; ◆◆ p<0.001; ◆◆◆ p<0.0001 for comparisons between 2002/03, 2004/05 and 2008/09 (provincial rates only)

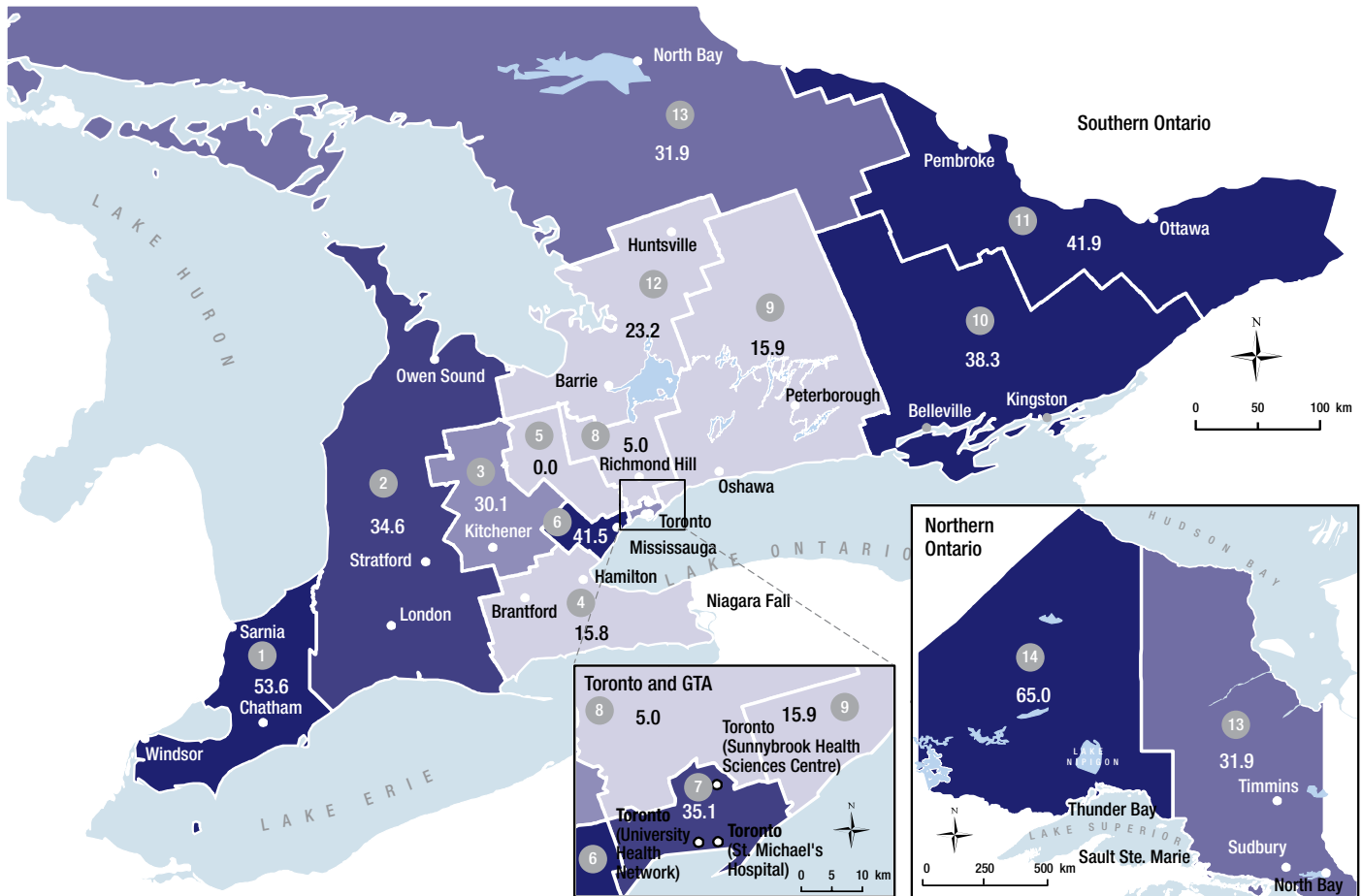
† Antithrombotic therapy includes ASA, combination ASA and dipyridamole, clopidogrel and warfarin.
 ‡ Patients with potential contraindications to warfarin were not excluded from the analyses.
 ‡ All antihypertensive agents are included in the present analyses. Previous reports assessed ACE inhibitor use only.

Findings

- In 2008/09, there were regional variations in prescribing rates for antithrombotic and antihypertensive therapy after discharge.

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, 2008 to March 31, 2009

Patients with stroke or transient ischemic attack admitted to hospital[‡]



Local Health Integration Networks (LHINs)

- 1 Erie St. Clair
- 8 Central
- 2 South West
- 9 Central East
- 3 Waterloo Wellington
- 10 South East
- 4 Hamilton Niagara Haldimand Brant
- 11 Champlain
- 5 Central West
- 12 North Simcoe Muskoka
- 6 Mississauga Halton
- 13 North East
- 7 Toronto Central
- 14 North West

Admission to stroke unit during any part of hospital stay, rate per 100 stroke patients, by LHIN, April 1, 2008 to March 31, 2009

Ontario rate (OR) = 29.3 per 100 stroke/TIA patients

LHIN rate per 100 stroke/TIA patients	LHIN rate compared to OR	Number of LHINs in each category
38.3 - 65.0	More than 20% above OR	5
34.6 - 35.1	10% to 20% above OR	2
30.1 - 31.9	Within 10% of OR	2
N/A	10% to 20% below OR	0
0.0 - 23.2	More than 20% below OR	5

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

[‡] Includes patients suspected of having a stroke or transient ischemic attack but for whom the diagnosis was uncertain.

[‡] North York General, Southlake and York Central hospitals were not considered to have a stroke unit at the time of abstraction.

GTA = Greater Toronto Area; N/A = not available.

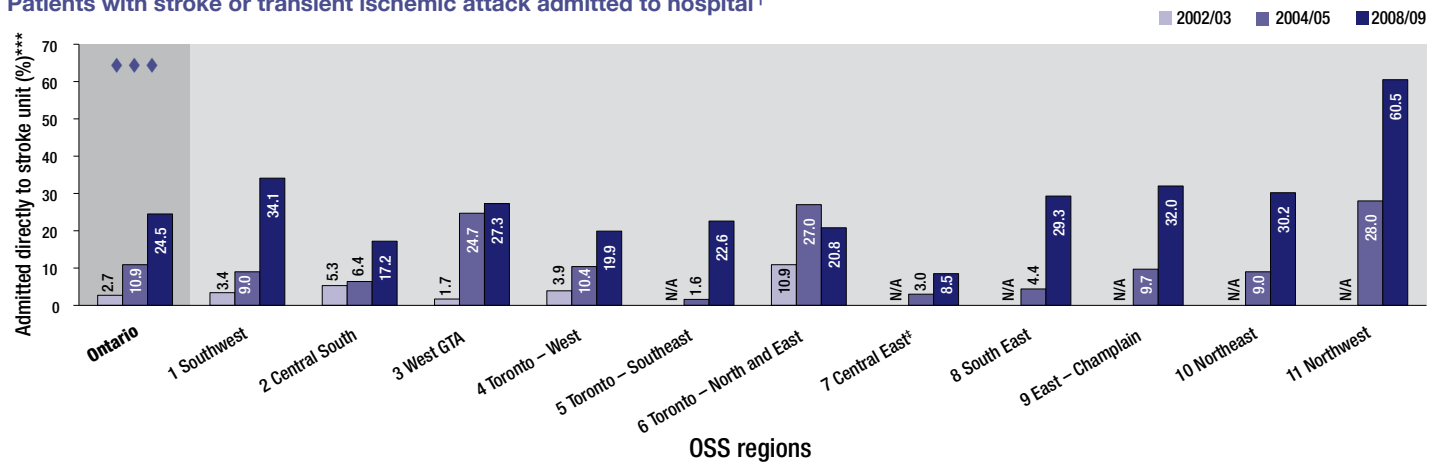
Findings

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

Exhibits and Findings

Exhibit 25 Proportion of stroke/TIA patients admitted directly to a stroke unit, by Ontario Stroke System (OSS) region, 2002/03, 2004/05 and 2008/09

Patients with stroke or transient ischemic attack admitted to hospital[†]



Significance levels used [p=p-value]:
 *p<0.05; **p<0.01; ***p<0.001 for comparisons across OSS regions in 2008/09.
 ◆p<0.05; ◆◆p<0.001; ◆◆◆p<0.0001 for comparisons between 2002/03, 2004/05 and 2008/09 (provincial rates only).

[†] Includes patients suspected of having a stroke or transient ischemic attack but in whom the diagnosis was uncertain
[‡] North York General, Southlake and York Central hospitals were not considered to have a stroke unit at the time of abstraction.

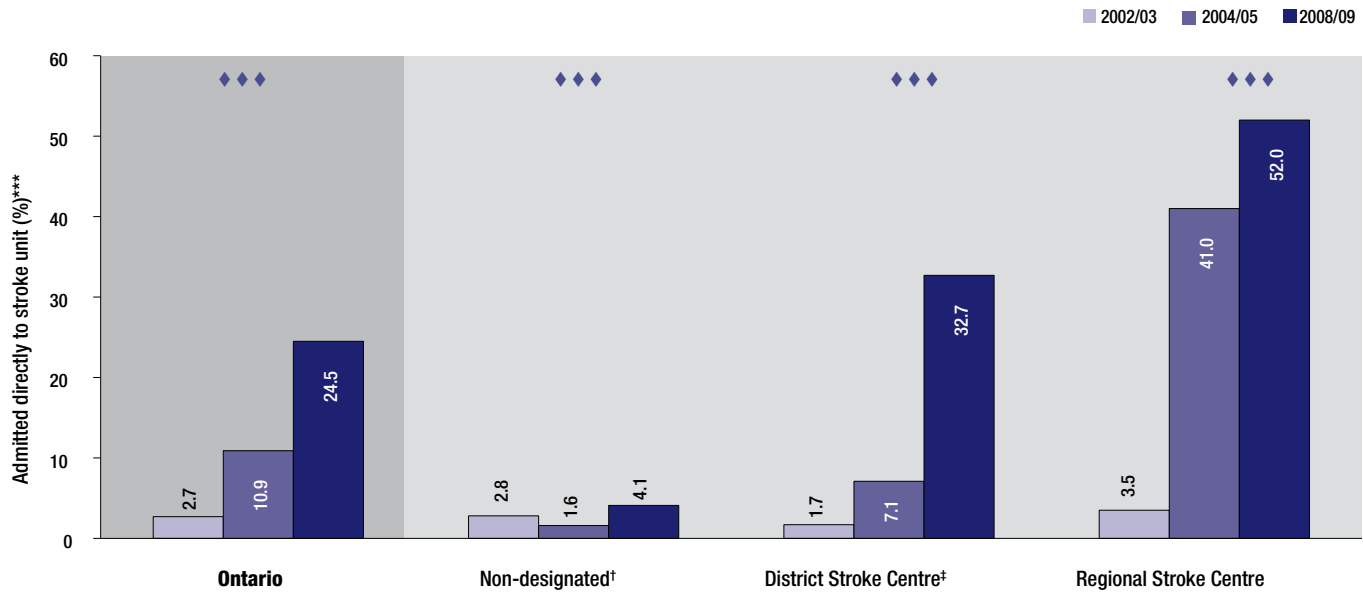
GTA = Greater Toronto Area; N/A = not available.

Findings

- In 2008/09, 24.5% of patients were admitted directly to a stroke unit, a significant increase from 10.9% in 2004/05 (p<0.0001).
- In 2008/09, there were significant variations in stroke unit admission rates by OSS region, from a low of 8.5% in the Central East region to a high of 60.5% in the Northwest region (p<0.0001).

Exhibit 26 Proportion of stroke/TIA patients admitted directly to a stroke unit, by Ontario Stroke System (OSS) designation, 2002/03, 2004/05 and 2008/09

Patients with stroke or transient ischemic attack admitted to hospital†



OSS designations

Significance levels used [p=p-value]:

*p<0.05; **p<0.01; ***p<0.001 for comparisons across OSS designations in 2008/09.

◆p<0.05; ◆◆p<0.001; ◆◆◆p<0.0001 for comparisons between 2002/03, 2004/05 and 2008/09 (rates for entire province and within designation).

† Includes patients suspected of having a stroke or transient ischemic attack but in whom the diagnosis was uncertain

‡ North York General, Southlake and York Central hospitals were not considered to have a stroke unit at the time of abstraction.

Non-designated: An acute care hospital that does not fit the definition of district or regional stroke centre.

District Stroke Centre: A facility with written stroke protocols (e.g., transport and triage, thrombolytic therapy, neuroimaging), clinicians with stroke expertise, and linkages to rehabilitation and secondary prevention.

Regional Stroke Centre: A facility that meets all the requirements of a district stroke centre, plus neurosurgical facilities and interventional radiology.

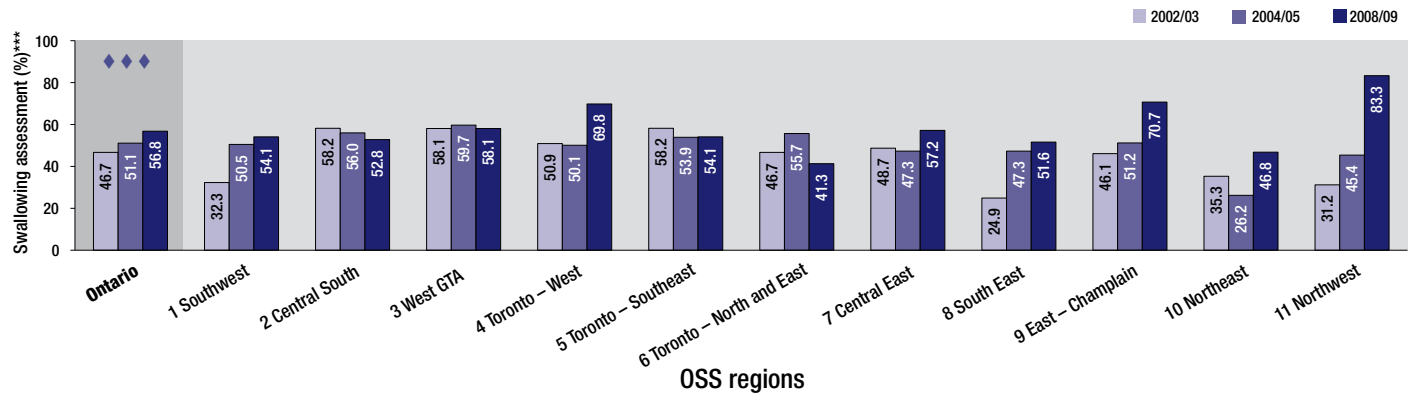
Findings

- Stroke unit admission rates increased at all facility types between 2004/05 and 2008/09.
- Stroke unit admission rates at non-designated hospitals remained very low (4.1%) in 2008/09.

Exhibits and Findings

Exhibit 27 Proportion of stroke patients who underwent dysphagia screening, by Ontario Stroke System (OSS) region, 2002/03, 2004/05 and 2008/09

Patients with stroke or uncertain diagnosis admitted to hospital†



Significance levels used [p=p-value]:
 *p<0.05; **p<0.01; ***p<0.001 for comparisons across OSS regions in 2008/09.
 ◆p<0.05; ◆◆p<0.001; ◆◆◆p<0.0001 for comparisons between 2002/03, 2004/05 and 2008/09 (provincial rates only).

† Transient ischemic attack patients were excluded from this analysis.

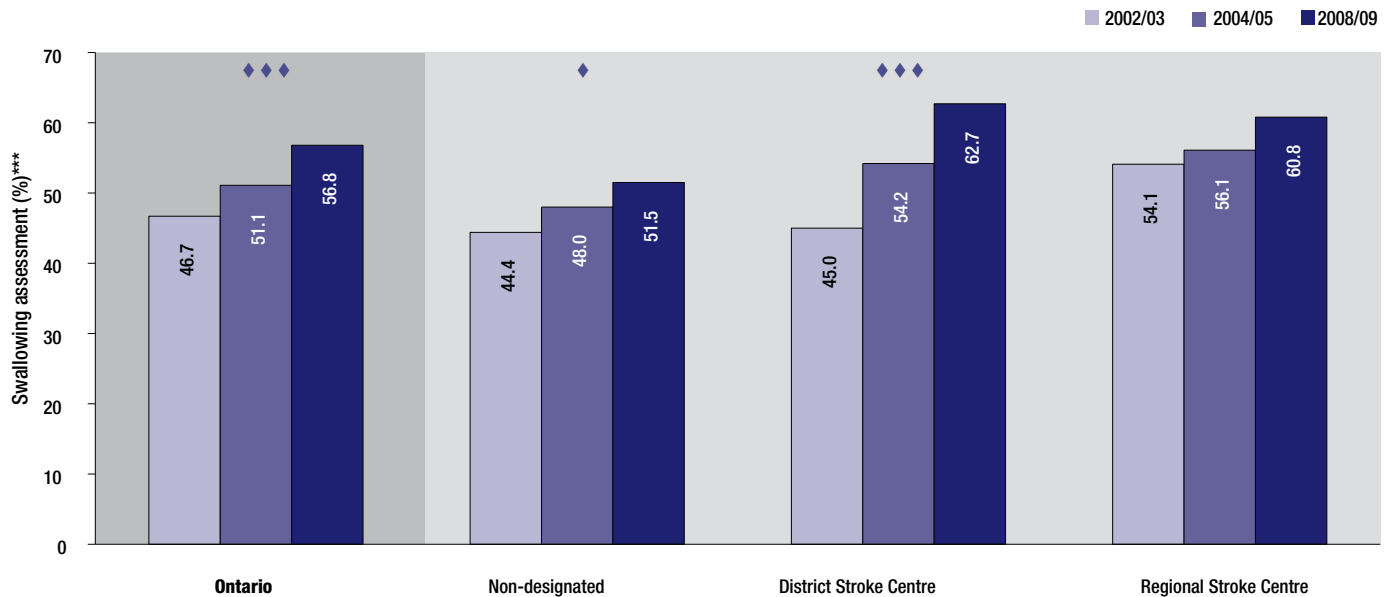
GTA = Greater Toronto Area.

Findings

- In 2008/09, 56.8% of patients admitted for stroke underwent screening for dysphagia (swallowing disorder), an increase from 51.1% in 2004/05 (p<0.01).
- In 2008/09, there were variations in dysphagia screening rates across OSS regions, ranging from 41.3% (North and East GTA) to 83.3% (Northwest).

Exhibit 28 Proportion of stroke patients who underwent dysphagia screening, by Ontario Stroke System (OSS) designation, 2002/03, 2004/05 and 2008/09

Patients with stroke or uncertain diagnosis admitted to hospital†



OSS designations

Significance levels used [p=p-value]:

*p<0.05; **p<0.01; ***p<0.001 for comparisons across OSS designations in 2008/09.
 ◆p<0.05; ◆◆p<0.001; ◆◆◆p<0.0001 for comparisons between 2002/03, 2004/05 and 2008/09 (rates for entire province and within designation).

† Transient ischemic attack patients were excluded from this analysis.

Non-designated: An acute care hospital that does not fit the definition of district or regional stroke centre.

District Stroke Centre: A facility with written stroke protocols (e.g., transport and triage, thrombolytic therapy, neuroimaging), clinicians with stroke expertise, and linkages to rehabilitation and secondary prevention.

Regional Stroke Centre: A facility that meets all the requirements of a district stroke centre, plus neurosurgical facilities and interventional radiology.

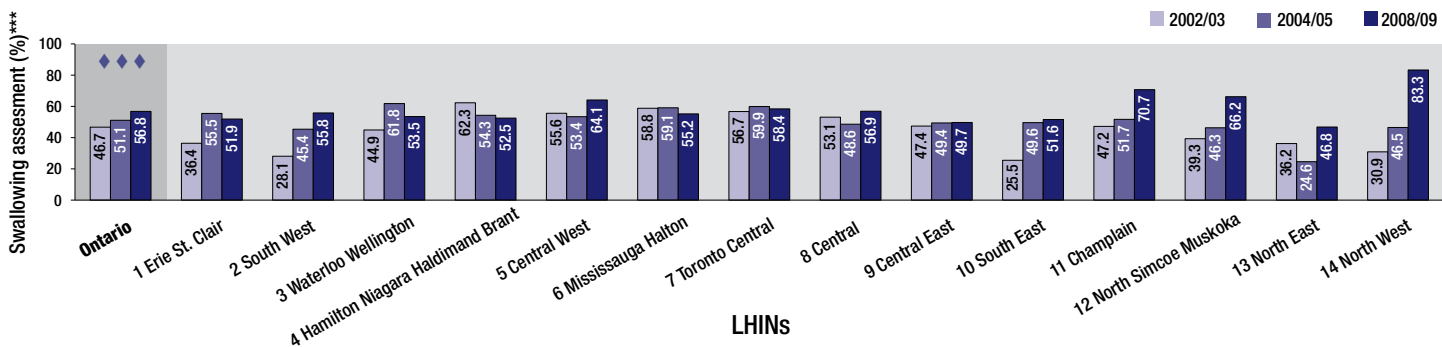
Findings

- In 2008/09, dysphagia screening rates were highest at regional and district stroke centres (approximately 60% of patients), followed by non-designated hospitals (51.5%).
- There were increases in rates of dysphagia screening between 2004/05 and 2008/09 for all hospital types.

Exhibits and Findings

Exhibit 29 Proportion of stroke patients who underwent dysphagia screening, by Ontario Local Health Integration Network (LHIN), 2002/03, 2004/05 and 2008/09

Patients with stroke or uncertain diagnosis admitted to hospital[†]



Significance levels used [p=p-value]:
 *p<0.05; **p<0.01; ***p<0.001 for comparisons across LHINs in 2008/09.
 ◆p<0.05; ◆◆p<0.001; ◆◆◆p<0.0001 for comparisons between 2002/03, 2004/05 and 2008/09 (provincial rates only).

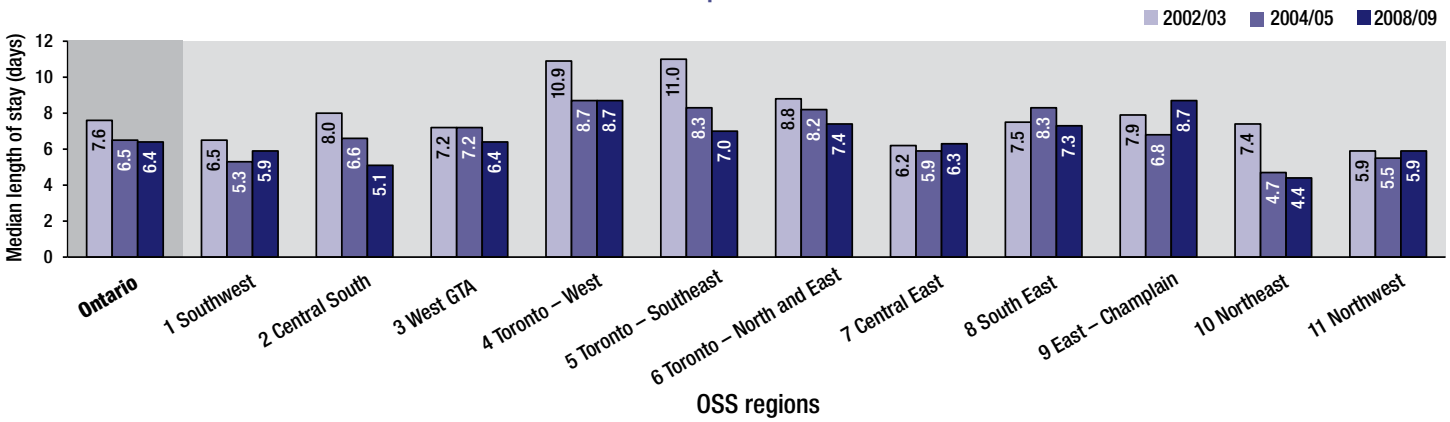
[†] Transient ischemic attack patients were excluded from this analysis.

Findings

- In 2008/09, there were variations in dysphagia screening rates across LHINs, ranging from 46.8% (North East LHIN) to 83.3% (North West LHIN) (p<0.0001).

Exhibit 30 Median length of hospital stay for stroke/TIA, by Ontario Stroke System (OSS) region, 2002/03, 2004/05 and 2008/09

Patients with stroke or transient ischemic attack admitted to hospital*



* Includes patients suspected of having a stroke or transient ischemic attack but in whom the diagnosis was uncertain.

GTA = Greater Toronto Area.

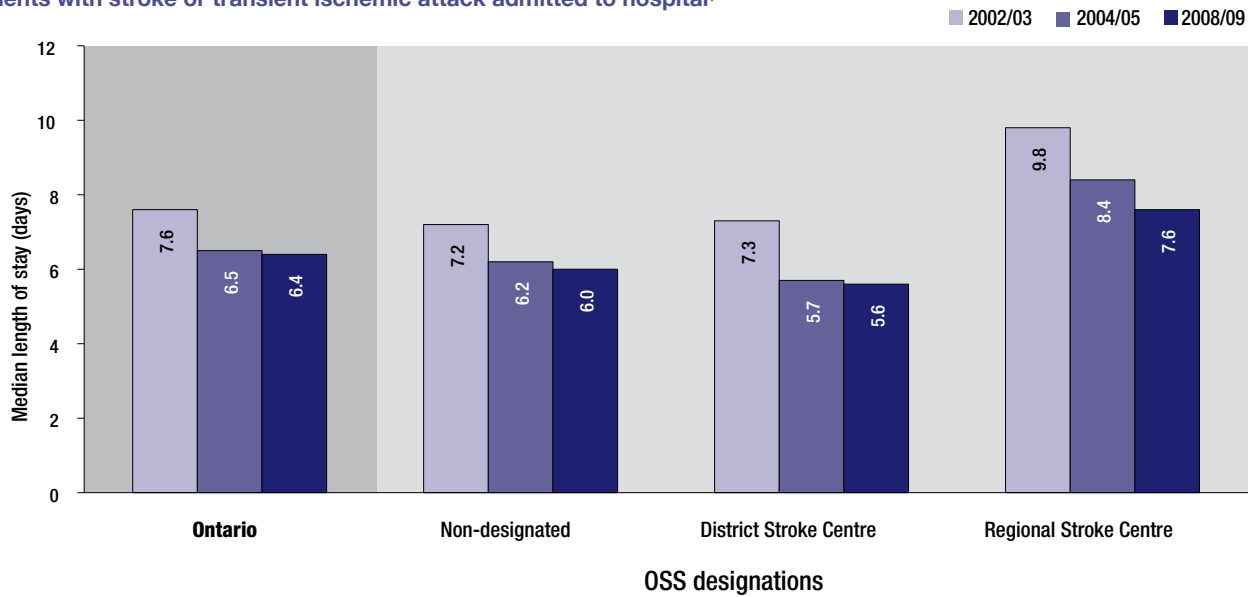
Findings

- In 2008/09, the median length of hospital stay for patients with stroke or transient ischemic attack was 6.4 days, with no significant change from 2004/05.
- There were variations in the median length of stay by OSS region.

Exhibits and Findings

Exhibit 31 Median length of hospital stay for stroke/TIA, by Ontario Stroke System (OSS) designation, 2002/03, 2004/05 and 2008/09

Patients with stroke or transient ischemic attack admitted to hospital†



† Includes patients suspected of having a stroke or transient ischemic attack but in whom the diagnosis was uncertain

Non-designated: An acute care hospital that does not fit the definition of district or regional stroke centre.

District Stroke Centre: A facility with written stroke protocols (e.g., transport and triage, thrombolytic therapy, neuroimaging), clinicians with stroke expertise, and linkages to rehabilitation and secondary prevention.

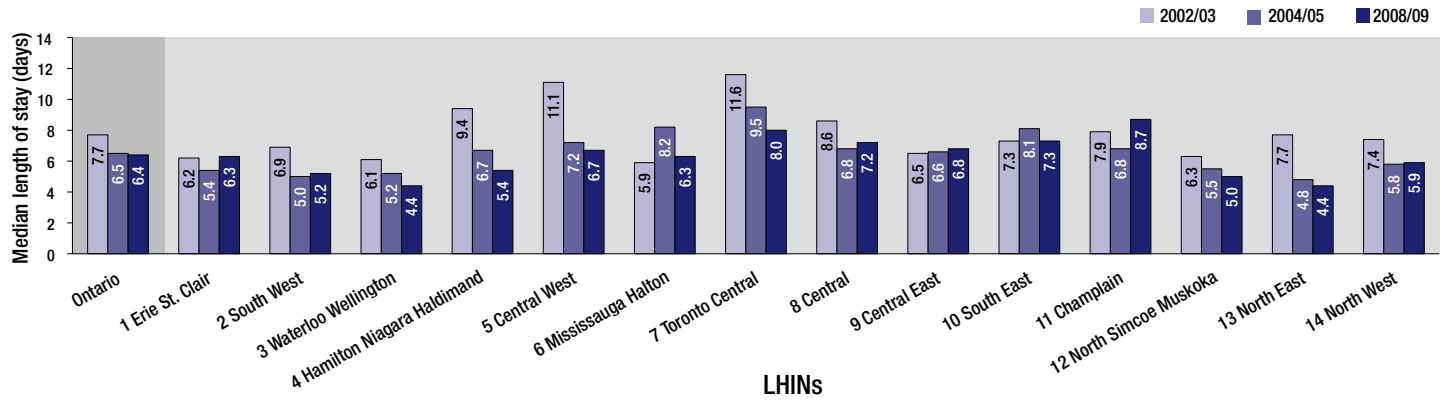
Regional Stroke Centre: A facility that meets all the requirements of a district stroke centre, plus neurosurgical facilities and interventional radiology.

Findings

- In all years, 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, likely explained by differences in case mix.

Exhibit 32 Median length of hospital stay for stroke/TIA, by Ontario Local Health Integration Network (LHIN), 2002/03, 2004/05 and 2008/09

Patients with stroke or transient ischemic attack admitted to hospital†



† Includes patients suspected of having a stroke or transient ischemic attack but in whom the diagnosis was uncertain.

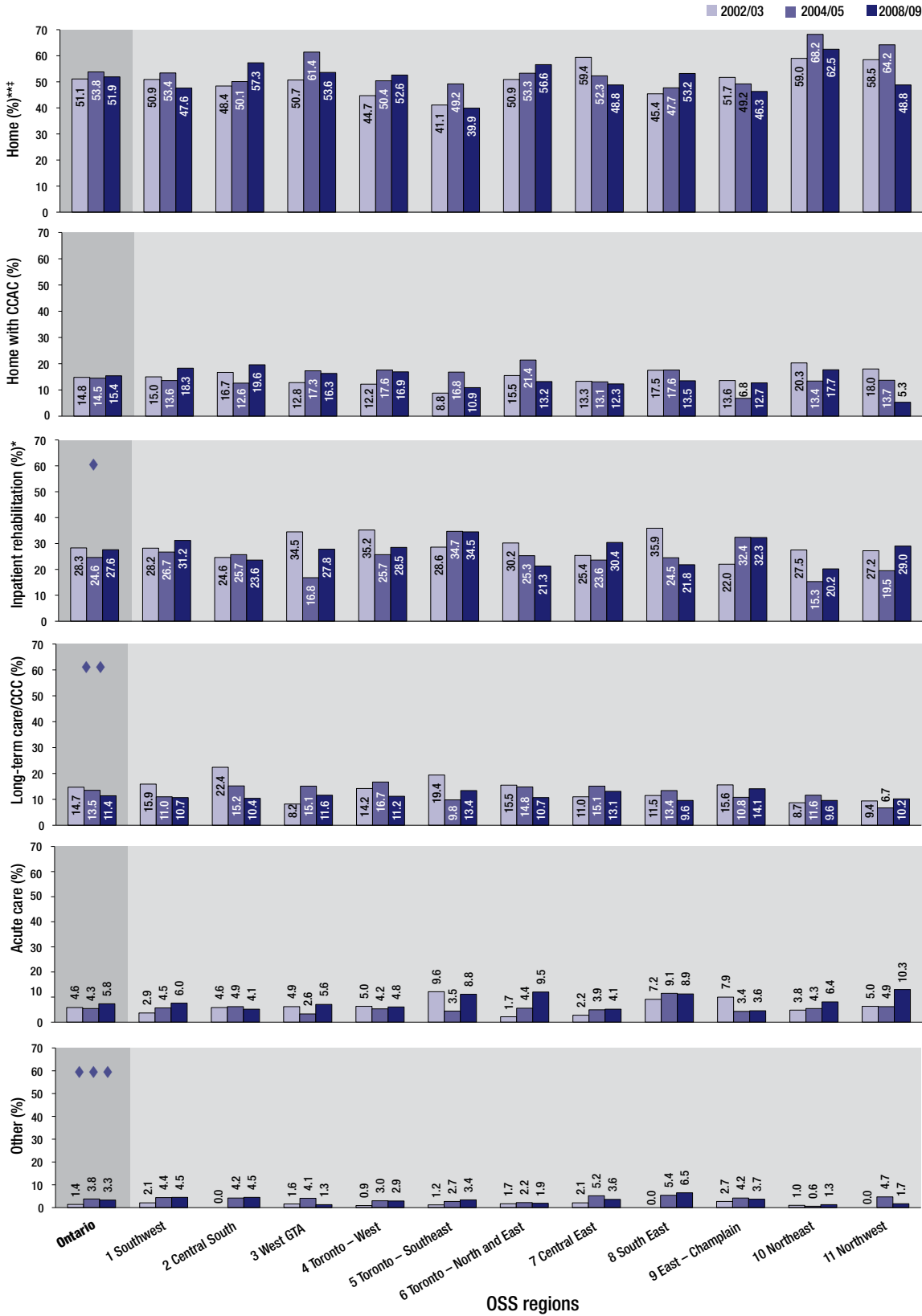
Findings

- There were variations in median length of hospital stay for patients with stroke or transient ischemic attack across LHINs.

Exhibits and Findings

Exhibit 33 Discharge destination of stroke/TIA patients, by Ontario Stroke System (OSS) region, 2002/03, 2004/05 and 2008/09

Patients with stroke or transient ischemic attack admitted to hospital†



Findings

- In 2008/09, 51.9% of patients admitted with stroke or transient ischemic attack (TIA) were discharged home, 15.4% were discharged home with home care services, 27.6% were transferred to inpatient rehabilitation and 11.4% to long-term care.
- Compared to 2004/05, there was a significant increase in the proportion of patients discharged to inpatient rehabilitation and a significant decrease in the proportion discharged to long-term care
- There were variations in discharge destination by OSS region.

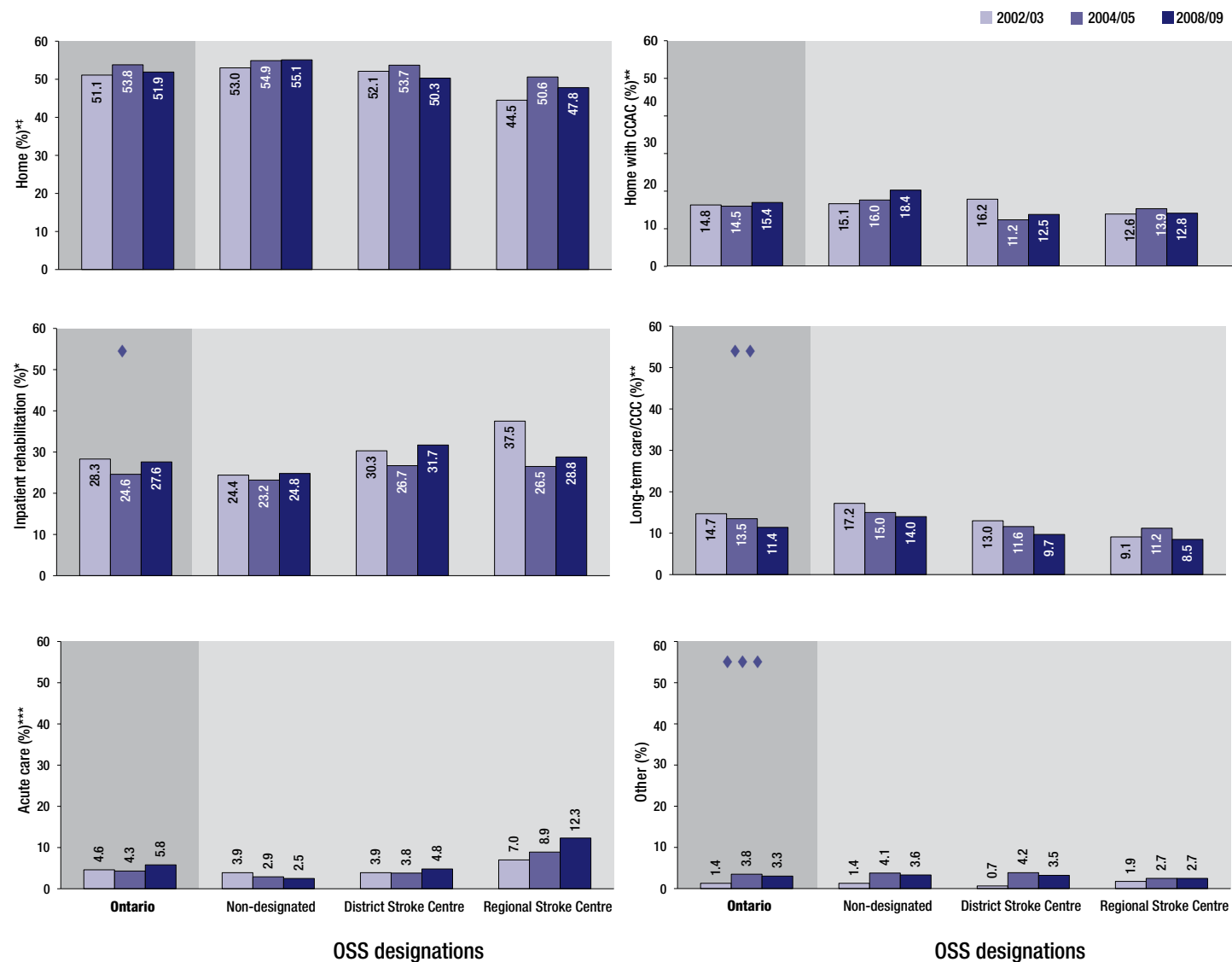
Significance levels used [p=p-value]: *p<0.05; **p<0.01; ***p<0.001 for comparisons across OSS regions in 2008/09.
 ◆p<0.05; ◆◆p<0.001; ◆◆◆p<0.0001 for comparisons between 2002/03, 2004/05 and 2008/09 (provincial rates only).

† Includes patients suspected of having a stroke or transient ischemic attack but in whom the diagnosis was uncertain
 ‡ Includes patients discharged home with outpatient rehabilitation and those at home with CCAC.

GTA = Greater Toronto Area; CCAC = Community Care Access Centre home care; CCC = Complex Continuing Care

Exhibit 34 Discharge destination of stroke/TIA patients, by Ontario Stroke System (OSS) designation, 2002/03, 2004/05 and 2008/09

Patients with stroke or transient ischemic attack admitted to hospital†



Significance levels used [p=p-value]:
 *p<0.05; **p<0.01; ***p<0.001 for comparisons across OSS designations in 2008/09.
 ◆p<0.05; ◆◆p<0.001; ◆◆◆p<0.0001 for comparisons between 2002/03, 2004/05 and 2008/09 (rates for entire province and within designation).

† Includes patients suspected of having a stroke or transient ischemic attack but in whom the diagnosis was uncertain.

‡ Includes patients discharged home with outpatient rehabilitation and those at home with CCAC.

CCAC = Community Care Access Centre home care; CCC = Complex Continuing Care

Non-designated: An acute care hospital that does not fit the definition of district or regional stroke centre.

District Stroke Centre: A facility with written stroke protocols (e.g., transport and triage, thrombolytic therapy, neuroimaging), clinicians with stroke expertise, and linkages to rehabilitation and secondary prevention.

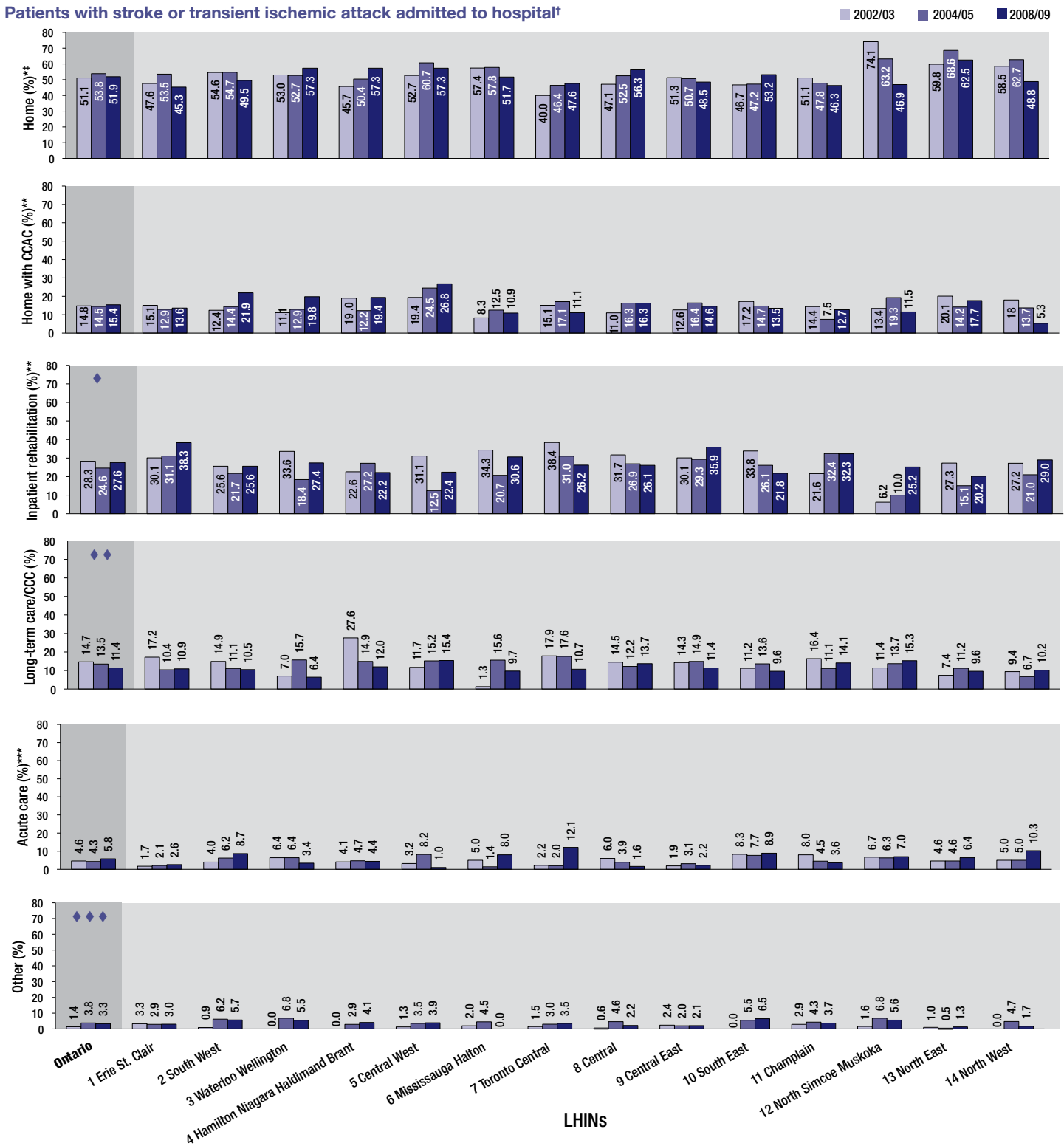
Regional Stroke Centre: A facility that meets all the requirements of a district stroke centre, plus neurosurgical facilities and interventional radiology.

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 and less likely to be transferred to long-term care institutions.

Exhibits and Findings

Exhibit 35 Discharge destination of stroke/TIA patients, by Ontario Local Health Integration Network (LHIN), 2002/03, 2004/05 and 2008/09



Significance levels used [p=p-value]:
 *p<0.05; **p<0.01; ***p<0.001 for comparisons across LHINs in 2008/09.
 ◆p<0.05; ◆◆p<0.001; ◆◆◆p<0.0001 for comparisons between 2002/03, 2004/05 and 2008/09 (provincial rates only).

† Includes patients suspected of having a stroke or transient ischemic attack but in whom the diagnosis was uncertain.
 ‡ Includes patients discharged home with outpatient rehabilitation and those at home with CCAC.

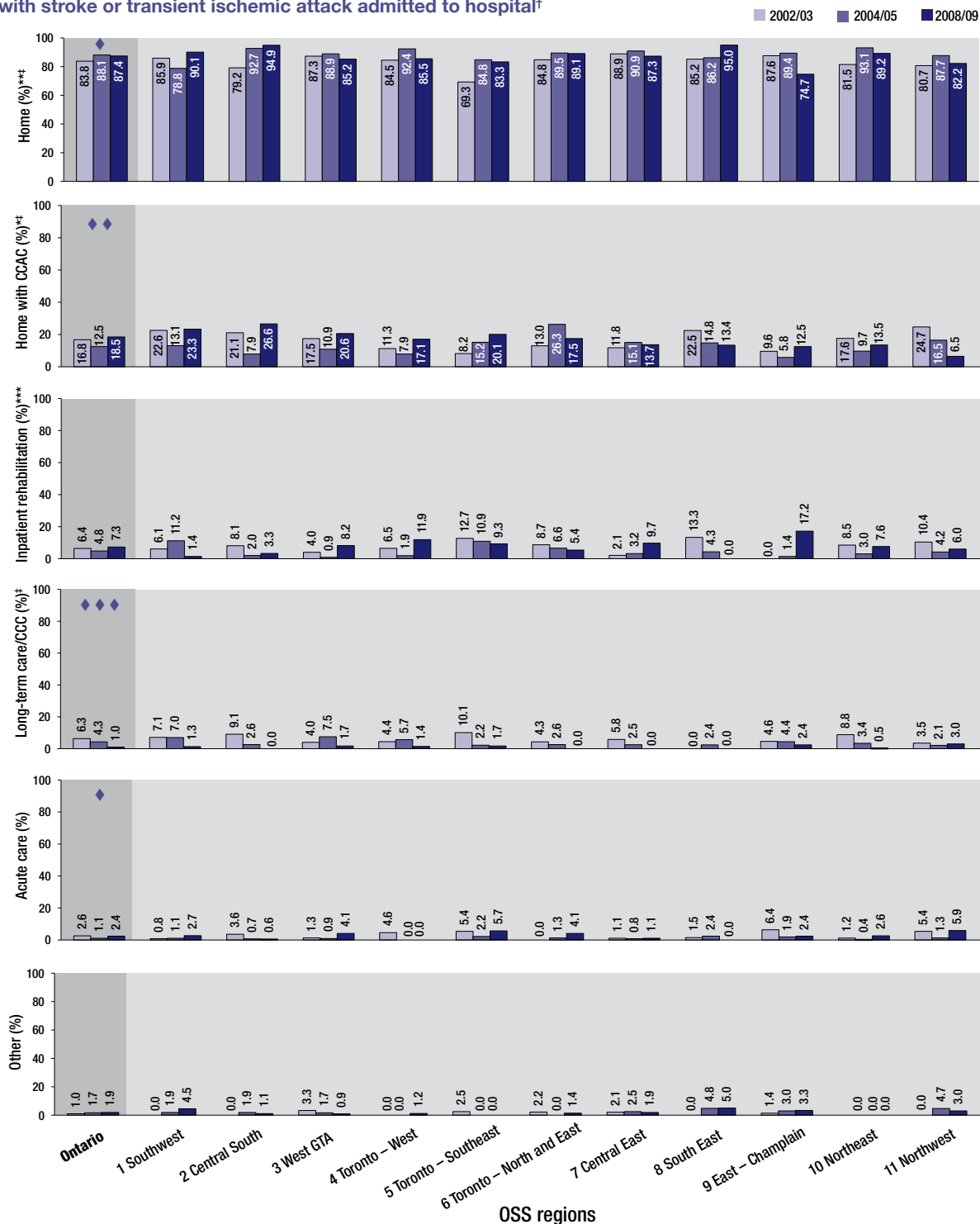
CCAC = Community Care Access Centre home care; CCC = Complex Continuing Care

Findings

- There were variations across LHINs in discharge destination after hospitalization for stroke or transient ischemic attack.

Exhibit 36a Discharge destination of stroke/TIA patients with Rankin score 0–2, by Ontario Stroke System (OSS) region, 2002/03 (n=14,190), 2004/05 (n=12,403) and 2008/09 (n=11,814)

Patients with stroke or transient ischemic attack admitted to hospital[†]



Significance levels used [p=p-value]:

*p<0.05; **p<0.01; ***p<0.001 for comparisons across OSS regions in 2008/09.

◆p<0.05; ◆◆p<0.001; ◆◆◆p<0.0001 for comparisons between 2002/03, 2004/05 and 2008/09 (provincial rates only).

[†] Includes patients suspected of having a stroke or transient ischemic attack but in whom the diagnosis was uncertain

[‡] Includes patients discharged home with outpatient rehabilitation and those at home with CCAC.

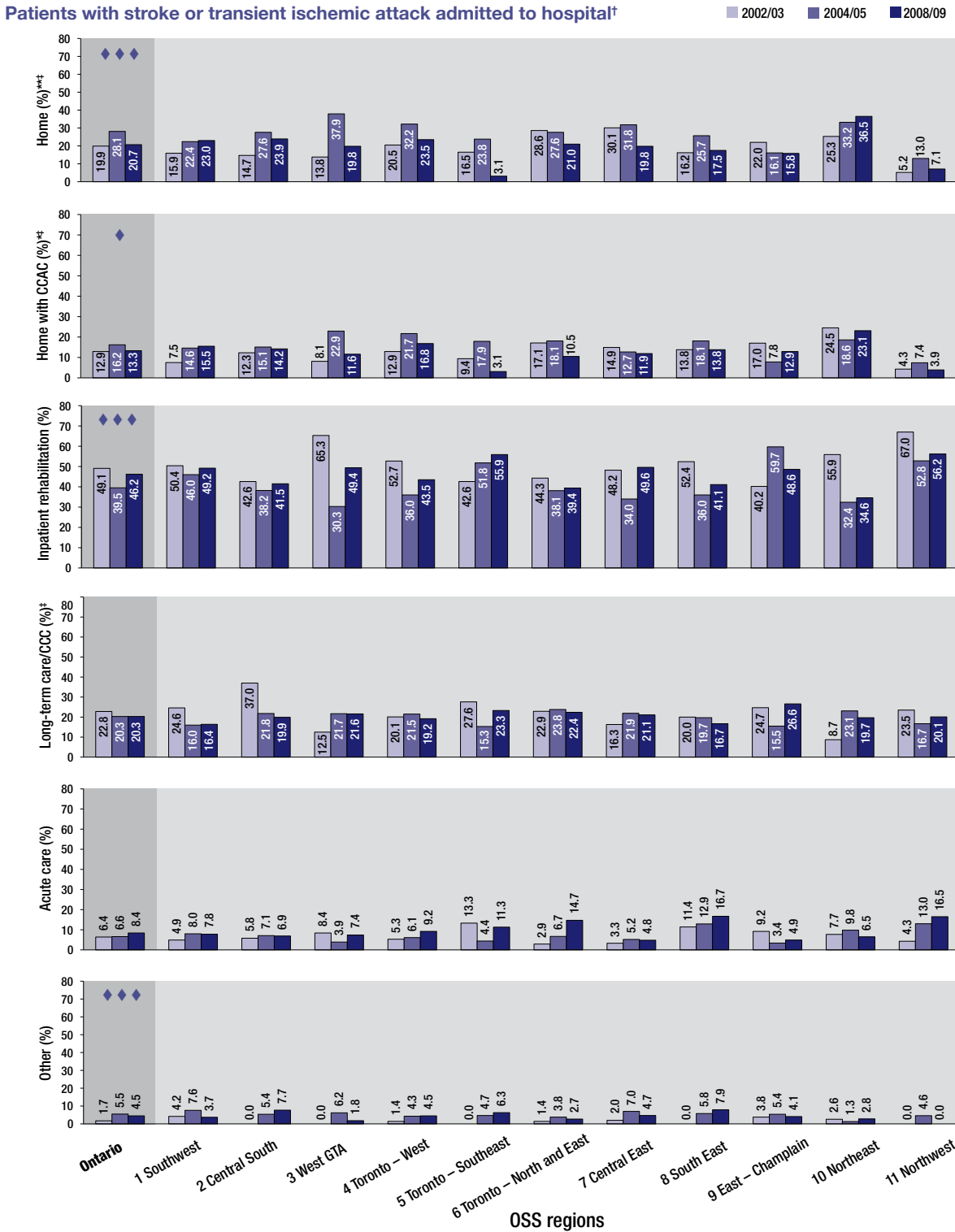
GTA = Greater Toronto Area; CCAC = Community Care Access Centre home care; CCC = Complex Continuing Care

Findings

- Among stroke patients with no or minimal disability at discharge (Rankin score 0–2), the majority (87.4%) were discharged home in 2008/09. There were significant variations in discharge destination across OSS regions.

Exhibits and Findings

Exhibit 36b Discharge destination of stroke/TIA patients with Rankin score 3–5, by Ontario Stroke System (OSS) region, 2002/03 (n=8,392), 2004/05 (n=8,573) and 2008/09 (n=7,330)



Findings

- Among stroke patients with moderate to severe disability at discharge (Rankin score 3–5), the majority (46.2%) were discharged to inpatient rehabilitation in 2008/09. This was a significant increase compared to 39.5% in 2004/05. There were significant variations in discharge destinations across OSS regions.

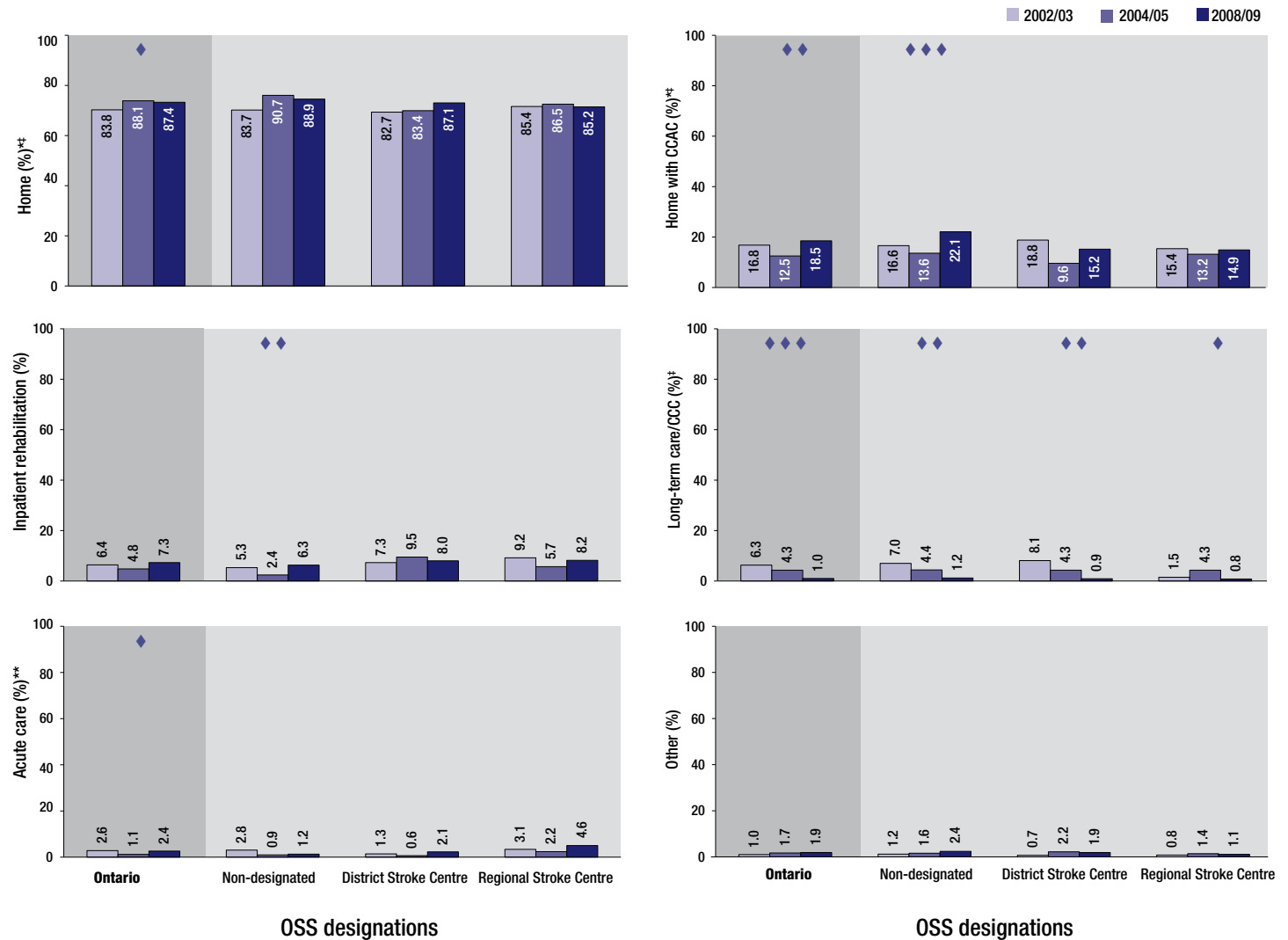
Significance levels used [p=p-value]:
 *p<0.05; **p<0.01;
 ***p<0.001 for comparisons across OSS regions in 2008/09.
 ◆ p<0.05; ◆◆ p<0.001;
 ◆◆◆ p<0.0001 for comparisons between 2002/03, 2004/05 and 2008/09 (provincial rates only).

† Includes patients suspected of having a stroke or transient ischemic attack but in whom the diagnosis was uncertain
 ‡ Includes patients discharged home with outpatient rehabilitation and those at home with CCAC.

GTA = Greater Toronto Area; CCAC = Community Care Access Centre home care; CCC = Complex Continuing Care.

Exhibit 37a Discharge destination of stroke/TIA patients with Rankin score 0–2, by Ontario Stroke System (OSS) designation, 2002/03 (n=14,190), 2004/05 (n=12,403), and 2008/09 (n=11,814)

Patients with stroke or transient ischemic attack admitted to hospital†



Significance levels used [p=p-value]:
 *p<0.05; **p<0.01; ***p<0.001 for comparisons across OSS designations in 2008/09.
 ◆p<0.05; ◆◆p<0.001; ◆◆◆p<0.0001 for comparisons between 2002/03, 2004/05 and 2008/09 (rates for entire province and within designation).

† Includes patients suspected of having a stroke or transient ischemic attack but in whom the diagnosis was uncertain
 ‡ Includes patients discharged home with outpatient rehabilitation and those at home with CCAC.
 CCAC = Community Care Access Centre home care; CCC = Complex Continuing Care

Non-designated: An acute care hospital that does not fit the definition of district or regional stroke centre.

District Stroke Centre: A facility with written stroke protocols (e.g., transport and triage, thrombolytic therapy, neuroimaging), clinicians with stroke expertise, and linkages to rehabilitation and secondary prevention

Regional Stroke Centre: A facility that meets all the requirements of a district stroke centre, plus neurosurgical facilities and interventional radiology.

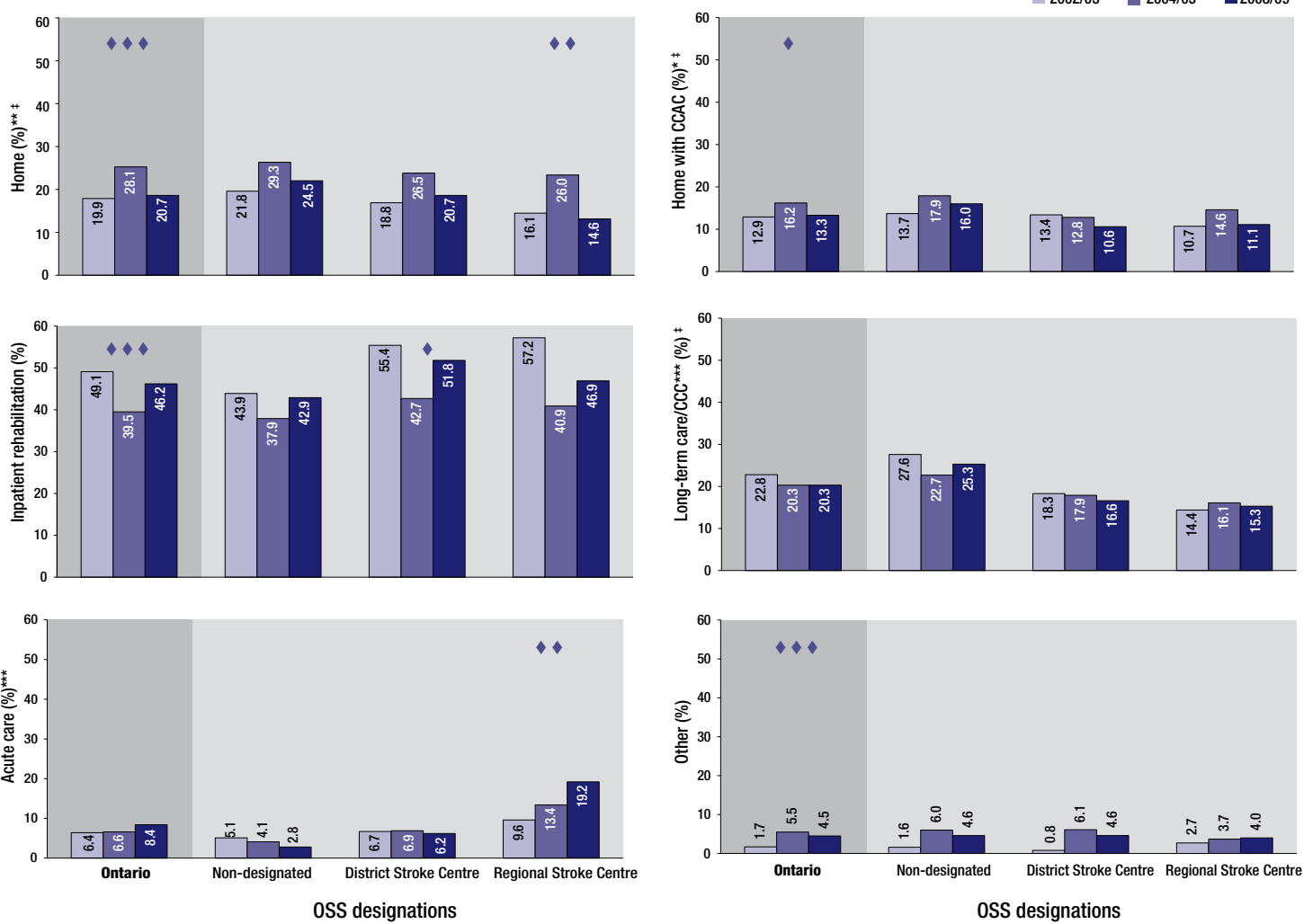
Findings

- In 2008/09, 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.

Exhibits and Findings

Exhibit 37b Discharge destination of stroke/TIA patients with Rankin score 3–5, by Ontario Stroke System (OSS) designation, 2002/03 (n=8,392), 2004/05 (n=8,573) and 2008/09 (n=7,330)

Patients with stroke or transient ischemic attack admitted to hospital†



Significance levels used [p=p-value]:
 *p<0.05; **p<0.01; ***p<0.001 for comparisons across OSS designations in 2008/09.
 ◆p<0.05; ◆◆p<0.001; ◆◆◆p<0.0001 for comparisons between 2002/03, 2004/05 and 2008/09 (rates for entire province and within designation).

† Includes patients suspected of having a stroke or transient ischemic attack but in whom the diagnosis was uncertain
 † Includes patients discharged home with outpatient rehabilitation and those at home with CCAC.
 CCAC = Community Care Access Centre home care; CCC = Complex Continuing Care

Non-designated: An acute care hospital that does not fit the definition of district or regional stroke centre.

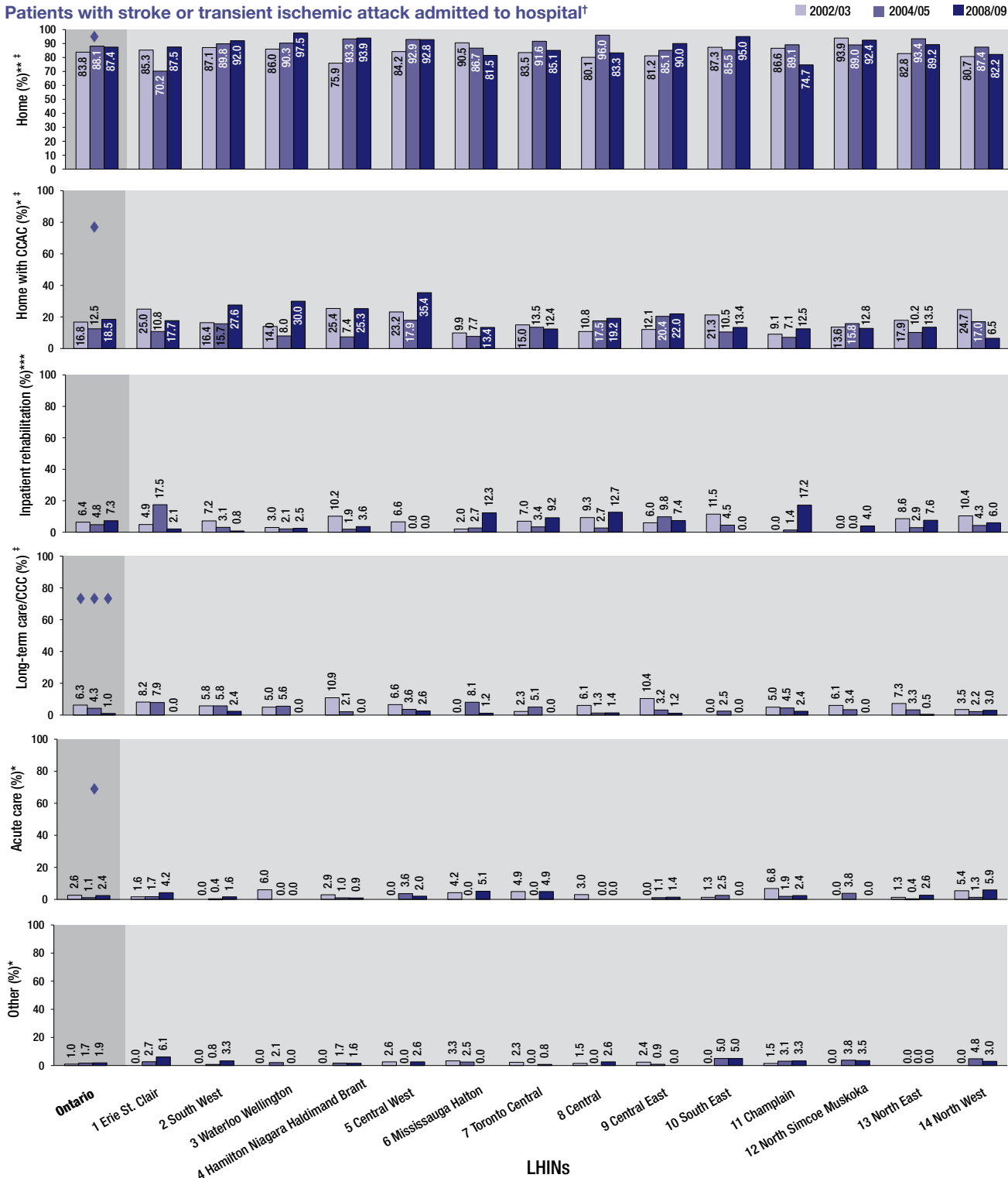
District Stroke Centre: A facility with written stroke protocols (e.g., transport and triage, thrombolytic therapy, neuroimaging), clinicians with stroke expertise, and linkages to rehabilitation and secondary prevention.

Regional Stroke Centre: A facility that meets all the requirements of a district stroke centre, plus neurosurgical facilities and interventional radiology.

Findings

- In 2008/09, patients with moderate to severe disability (Rankin score 3–5) were most likely to be discharged to inpatient rehabilitation (46.2%); this was true across all hospital types
- Compared to 2004/05, there was an increase in the proportion of such patients discharged to inpatient rehabilitation from all hospital types.

Exhibit 38a Discharge destination of stroke/TIA patients with Rankin score 0–2, by Ontario Local Health Integration Network (LHIN), 2002/03 (n=14,190), 2004/05 (n=12,403) and 2008/09 (n=11,814)



Significance levels used [p=p-value]:
 *p<0.05; **p<0.01; ***p<0.001 for comparisons across LHINs in 2008/09.
 ♦p<0.05; ♦♦p<0.001; ♦♦♦p<0.0001 for comparisons between 2002/03, 2004/05 and 2008/09 (provincial rates only).
 † Includes patients suspected of having a stroke or transient ischemic attack but in whom the diagnosis was uncertain.
 ‡ Includes patients discharged home with outpatient rehabilitation and those home with CCAC.

Findings

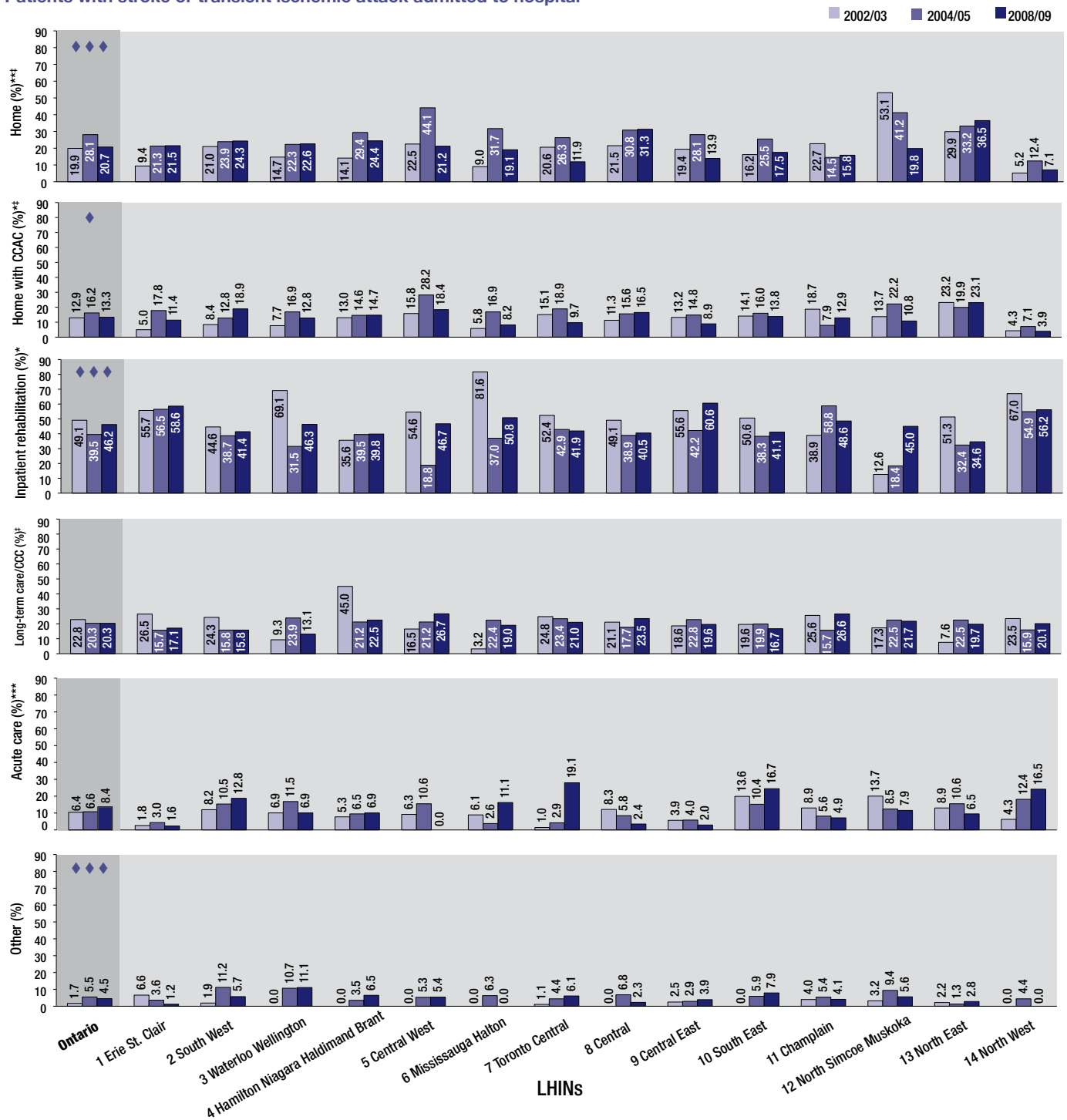
- There were regional variations in discharge destination among patients with minimal or no disability at discharge (Rankin score 0–2).

CCAC = Community Care Access Centre home care; CCC = Complex Continuing Care

Exhibits and Findings

Exhibit 38b Discharge destination of stroke/TIA patients with Rankin score 3–5, by Ontario Local Health Integration Network (LHIN), 2002/03 (n=8,392), 2004/05 (n=8,573) and 2008/09 (n=7,330)

Patients with stroke or transient ischemic attack admitted to hospital†



Significance levels used [p=p-value]:
 *p<0.05; **p<0.01; ***p<0.001 for comparisons across LHINs in 2008/09.
 ◆p<0.05; ◆◆p<0.001; ◆◆◆p<0.0001 for comparisons between 2002/03, 2004/05 and 2008/09 (provincial rates only).

† Includes patients suspected of having a stroke or transient ischemic attack but in whom the diagnosis was uncertain.
 ‡ Includes patients discharged home with outpatient rehabilitation and those home with CCAC.

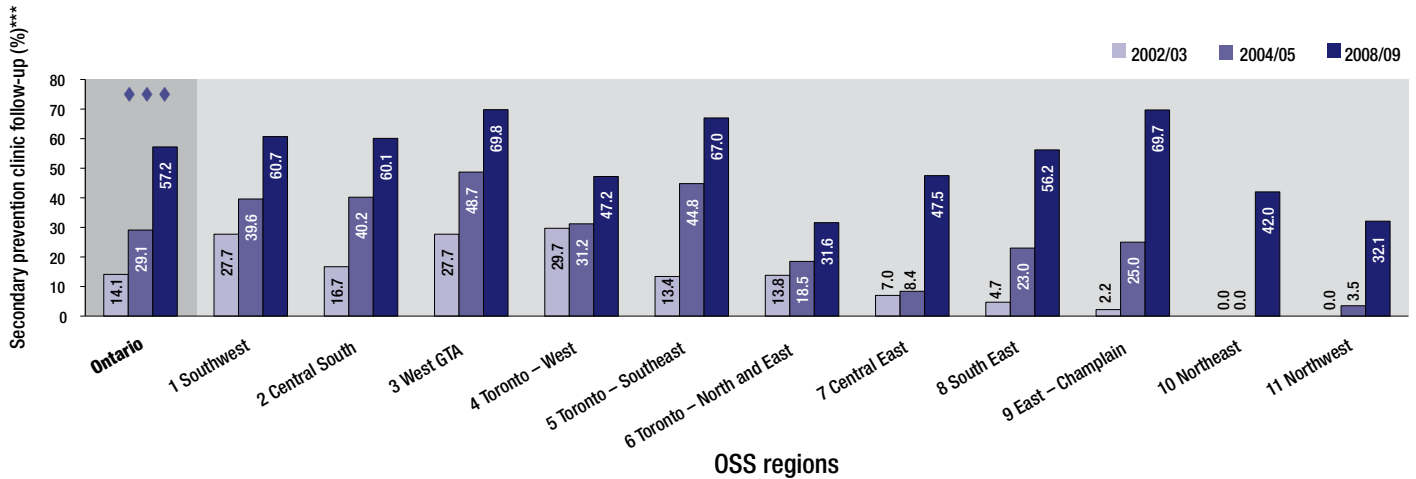
CCAC = Community Care Access Centre home care; CCC = Complex Continuing Care

Findings

- In 2008/09, there were variations by LHIN in the proportion of stroke patients with moderate to severe disability (Rankin score 3–5) discharged to home, inpatient rehabilitation or long-term care.
- There were increases in rates of discharge to inpatient rehabilitation in 2008/09 compared to 2004/05 in almost all regions.

Exhibit 39 Proportion of stroke/TIA patients referred to a secondary prevention clinic, by Ontario Stroke System (OSS) region, 2002/03, 2004/05 and 2008/09

Patients with stroke or transient ischemic attack discharged alive from the ED and not admitted to hospital



Significance levels used [p=p-value]:
 *p<0.05; **p<0.01; ***p<0.001 for comparisons across OSS regions in 2008/09.
 ◆p<0.05; ◆◆p<0.001; ◆◆◆p<0.0001 for comparisons between 2002/03, 2004/05 and 2008/09 (provincial rates only).

ED = emergency department; GTA = Greater Toronto Area.

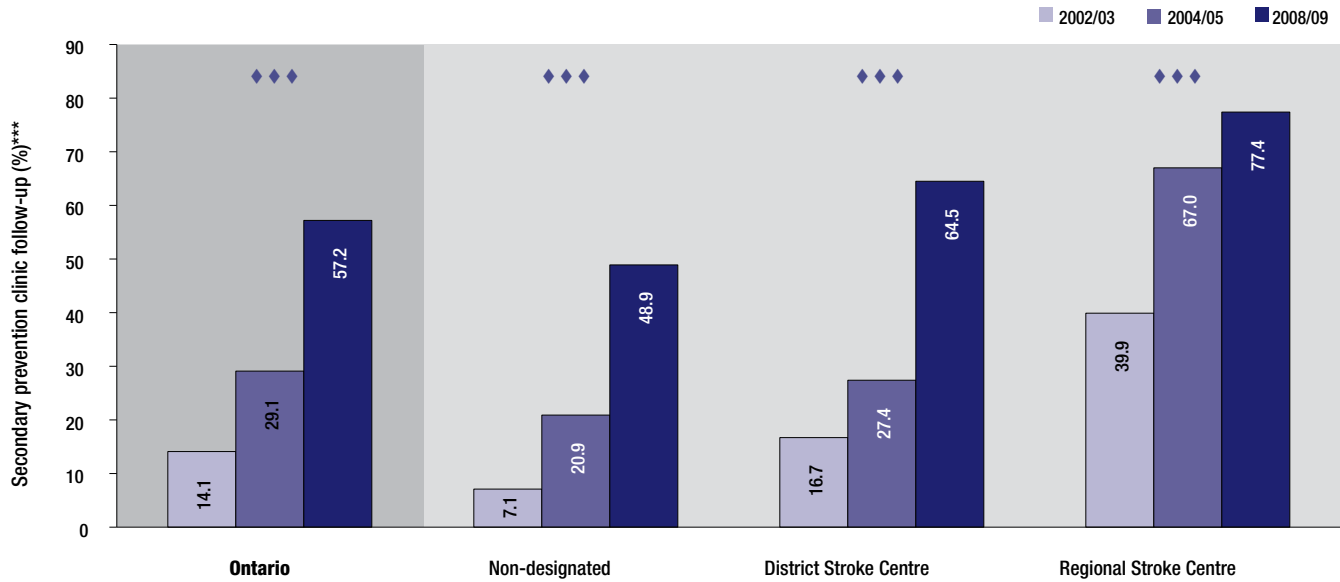
Findings

- There were marked increases over time in the proportion of patients referred to stroke secondary prevention clinics.
- In 2008/09, there were variations in rates of stroke secondary prevention clinic referrals across OSS regions.

Exhibits and Findings

Exhibit 40 Proportion of stroke/TIA patients referred to a secondary prevention clinic, by Ontario Stroke System (OSS) designation, 2002/03, 2004/05 and 2008/09

Patients with stroke or transient ischemic attack discharged alive from the ED and not admitted to hospital



OSS designations

Significance levels used [p=p-value]:
 *p<0.05; **p<0.01; ***p<0.001 for comparisons across OSS designations in 2008/09.
 ◆p<0.05; ◆◆p<0.001; ◆◆◆p<0.0001 for comparisons between 2002/03, 2004/05 and 2008/09 (rates for entire province and within designation).

Non-designated: An acute care hospital that does not fit the definition of district or regional stroke centre.

District Stroke Centre: A facility with written stroke protocols (e.g., transport and triage, thrombolytic therapy, neuroimaging), clinicians with stroke expertise, and linkages to rehabilitation and secondary prevention.

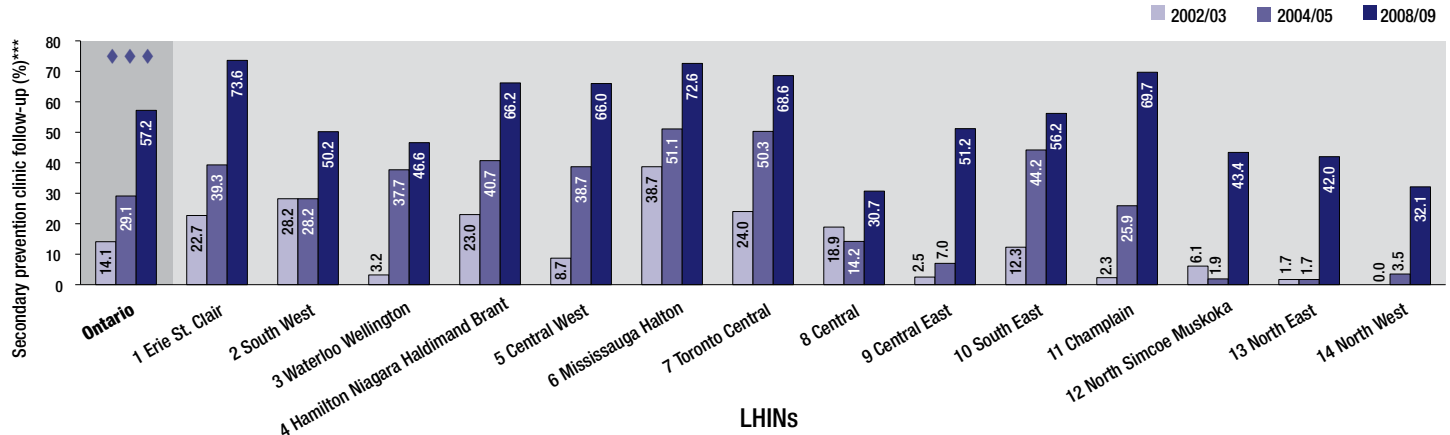
Regional Stroke Centre: A facility that meets all the requirements of a district stroke centre, plus neurosurgical facilities and interventional radiology.

Findings

- For all hospital types, there was an increase over time in the proportion of patients referred to stroke secondary prevention clinics.
- The largest increase in referral rates between 2004/05 and 2008/09 was seen at non-designated hospitals.
- Referrals to stroke secondary prevention clinics were highest at regional stroke centres compared to other types of hospitals, with referral rates in 2008/09 of 77.4% at regional stroke centres, 64.5% at district stroke centres and 48.9% at non-designated hospitals.

Exhibit 41 Proportion of stroke/TIA patients referred to a secondary prevention clinic, by Ontario Local Health Integration Network (LHIN), 2002/03, 2004/05 and 2008/09

Patients with stroke or transient ischemic attack discharged alive from the ED and not admitted to hospital



Significance levels used [p=p-value]:
 *p<0.05; **p<0.01; ***p<0.001 for comparisons across LHINs in 2008/09.
 ◆ p<0.05; ◆◆ p<0.001; ◆◆◆ p<0.0001 for comparisons between 2002/03, 2004/05 and 2008/09 (provincial rates only).

ED = emergency department.

LHINs

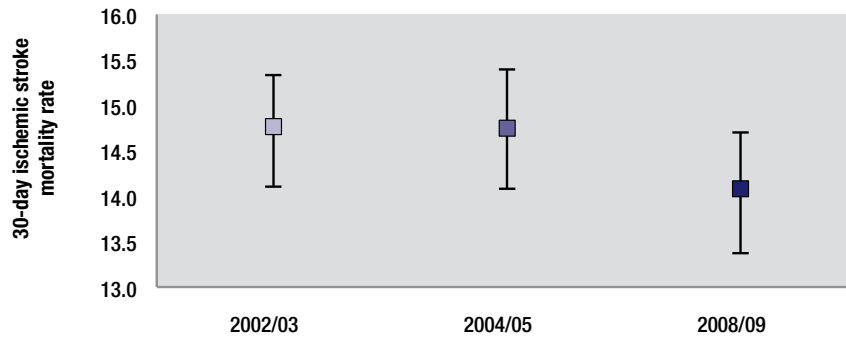
Findings

- There were regional variations in rates of referrals to stroke secondary prevention clinics.
- Referrals to secondary prevention clinics increased between 2004/05 and 2008/09 in all regions.

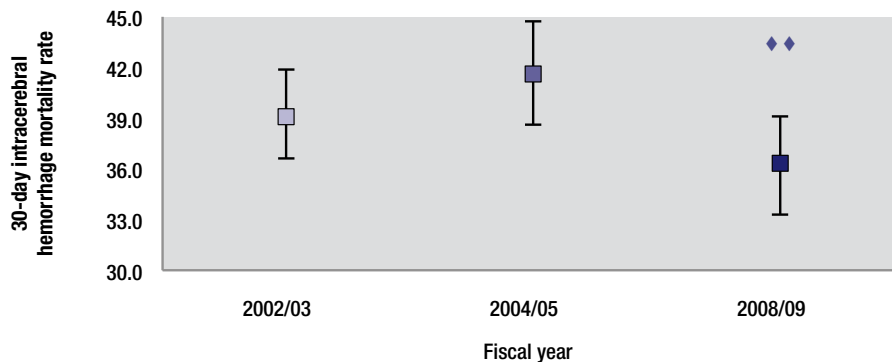
Exhibits and Findings

Exhibit 42 Age- and sex-adjusted 30-day mortality rates for ischemic stroke and intracranial hemorrhage in Ontario, 2002/03, 2004/05 and 2008/09

Patients with ischemic stroke seen in the ED or admitted to hospital†



Patients with intracranial hemorrhage seen in the ED or admitted to hospital‡



Significance levels used [p=p-value]:
 *p<0.05; **p<0.01; ***p<0.001 for comparisons across LHINs in 2008/09.
 ◆p<0.05; ◆◆p<0.001; ◆◆◆p<0.0001 for comparisons between years, 2003/04, 2004/05 and 2008/09.

† Age- and sex-standardized 30-day mortality rates (standardized to the age and sex distribution of the ischemic stroke cohort of all years combined).
 ‡ Age- and sex-standardized 30-day mortality rates (standardized to the age and sex distribution of the ICH stroke cohort of all years combined).

Note: The age-sex standardized rate for the province was calculated by applying the year's rate to each age-sex group of the Ontario stroke population for the three years combined.

Data sources: Canadian Institute for Health Information, Discharge Abstract Database (CIHI-DAD), and National Ambulatory Care Reporting System (CIHI-NACRS); Ontario Ministry of Health and Long-Term Care, Registered Persons Database (RPDB); 2002/03, 2004/05 and 2008/09.

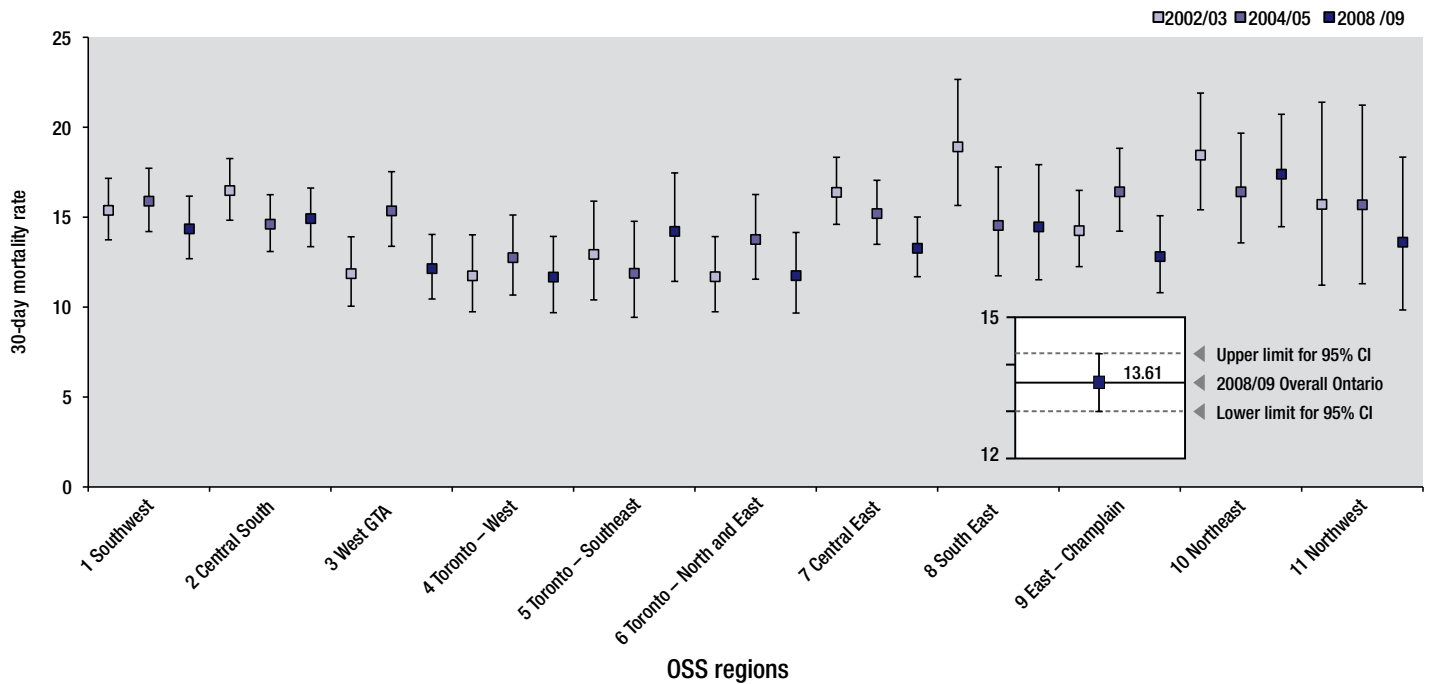
CI = confidence interval; ICH = intracranial hemorrhage.

Findings

- In 2008/09, the adjusted provincial 30-day mortality rate for ischemic stroke was 14.0%, not a statistically significant change from 2004/05.
- In 2008/09, the adjusted provincial 30-day mortality rate for hemorrhagic stroke was 36.1%, a statistically significant decrease (<0.001) from 2004/05.

Exhibit 43 Age- and sex-adjusted 30-day mortality rate for ischemic stroke, by Ontario Stroke System (OSS) region, 2002/03, 2004/05 and 2008/09

Patients with ischemic stroke seen in the ED or admitted to hospital



Notes:

- (1) The age-sex standardized rate for an OSS region was calculated by applying the region-specific rate for each age-sex group to the Ontario stroke population. This was done separately for each year. Therefore, all regional rates were calculated as if they had the provincial age-sex stroke distribution.
- (2) Rates within regions cannot be compared across years. Statistical significance was examined for 2008/09 only.

Data sources: Canadian Institute for Health Information, Discharge Abstract Database (CIHI-DAD), and National Ambulatory Care Reporting System (CIHI-NACRS); Ontario Ministry of Health and Long-Term Care, Registered Persons Database (RPDB); 2002/03, 2004/05 and 2008/09.

ED = emergency department; GTA = Greater Toronto Area; CI = confidence interval.

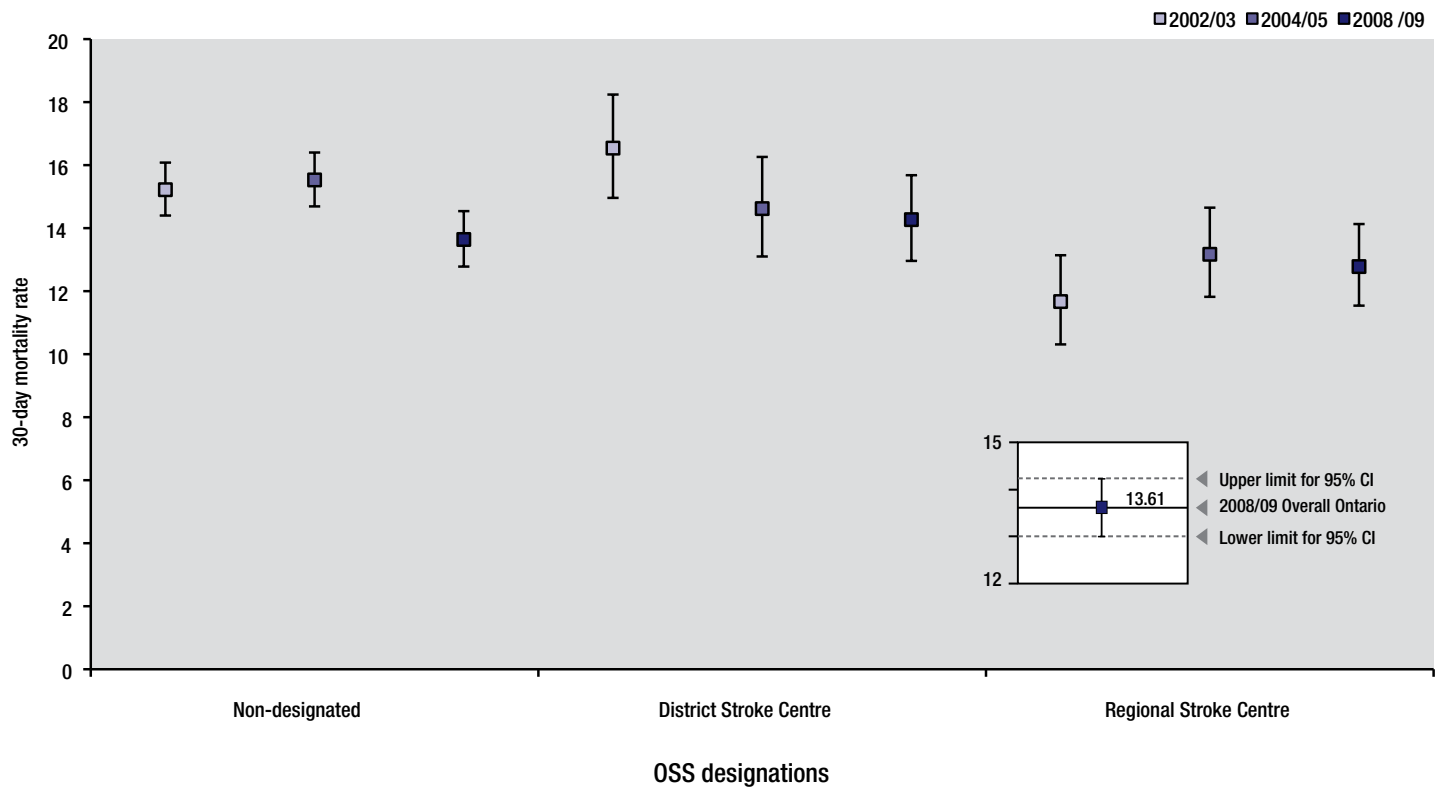
Findings

- In 2008/09, the overall provincial 30-day mortality rate for ischemic stroke was 13.6%. There were no statistically significant differences in mortality rates across LHINs, with the exception of the Northeast where the 2008/09 mortality rate was slightly higher than the overall Ontario rate.

Exhibits and Findings

Exhibit 44 Age- and sex-adjusted 30-day mortality rate for ischemic stroke, by Ontario Stroke System (OSS) designation, 2002/03, 2004/05 and 2008/09

Patients with ischemic stroke seen in the ED or admitted to hospital



Notes:

- (1) The age-sex standardized rate for an OSS designation was calculated by applying the designation-specific rate for each age-sex group to the Ontario stroke population. This was done separately for each year. Therefore, all OSS designation rates were calculated as if they had the provincial age-sex stroke distribution.
- (2) Rates within designations cannot be compared across years. Statistical significance was examined for 2008/09 only.

Data sources: Canadian Institute for Health Information, Discharge Abstract Database (CIHI-DAD), and National Ambulatory Care Reporting System (CIHI-NACRS); Ontario Ministry of Health and Long-Term Care, Registered Persons Database (RPDB); 2002/03, 2004/05 and 2008/09.

ED = emergency department; GTA = Greater Toronto Area; CI = confidence interval.

Non-designated: An acute care hospital that does not fit the definition of district or regional stroke centre.

District Stroke Centre: A facility with written stroke protocols (e.g., transport and triage, thrombolytic therapy, neuroimaging), clinicians with stroke expertise, and linkages to rehabilitation and secondary prevention.

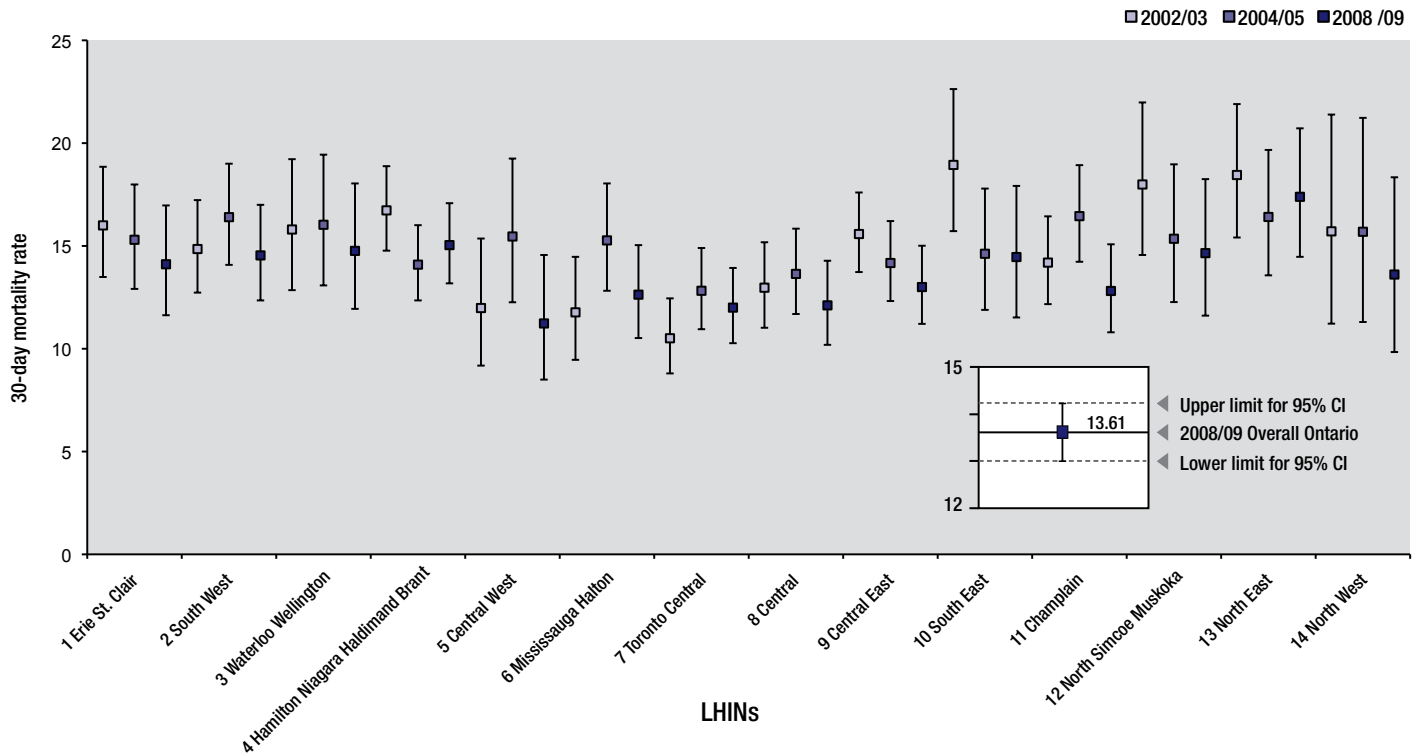
Regional Stroke Centre: A facility that meets all the requirements of a district stroke centre, plus neurosurgical facilities and interventional radiology.

Findings

- In 2008/09, the provincial 30-day mortality rate for ischemic stroke was 13.6%. There were no statistically significant differences in mortality rates across hospital types compared to the overall Ontario rate.

Exhibit 45 Age-and sex-adjusted 30-day mortality rate for ischemic stroke, by Ontario Local Health Integration Network (LHIN), 2002/03, 2004/05 and 2008/09

Patients with ischemic stroke seen in the ED or admitted to hospital



Notes:

- (1) The age-sex standardized rate for a LHIN was calculated by applying the LHIN-specific rate for each age-sex group to the Ontario stroke population. This was done separately for each year. Therefore, all LHIN rates were calculated as if they had the provincial age-sex stroke distribution.
- (2) Rates within LHINs cannot be compared across years. Statistical significance was examined for 2008/09 only.

Data sources: Canadian Institute for Health Information, Discharge Abstract Database (CIHI-DAD), and National Ambulatory Care Reporting System (CIHI-NACRS); Ontario Ministry of Health and Long-Term Care, Registered Persons Database (RPDB); 2002/03, 2004/05 and 2008/09.

ED = emergency department; GTA = Greater Toronto Area; CI = confidence interval.

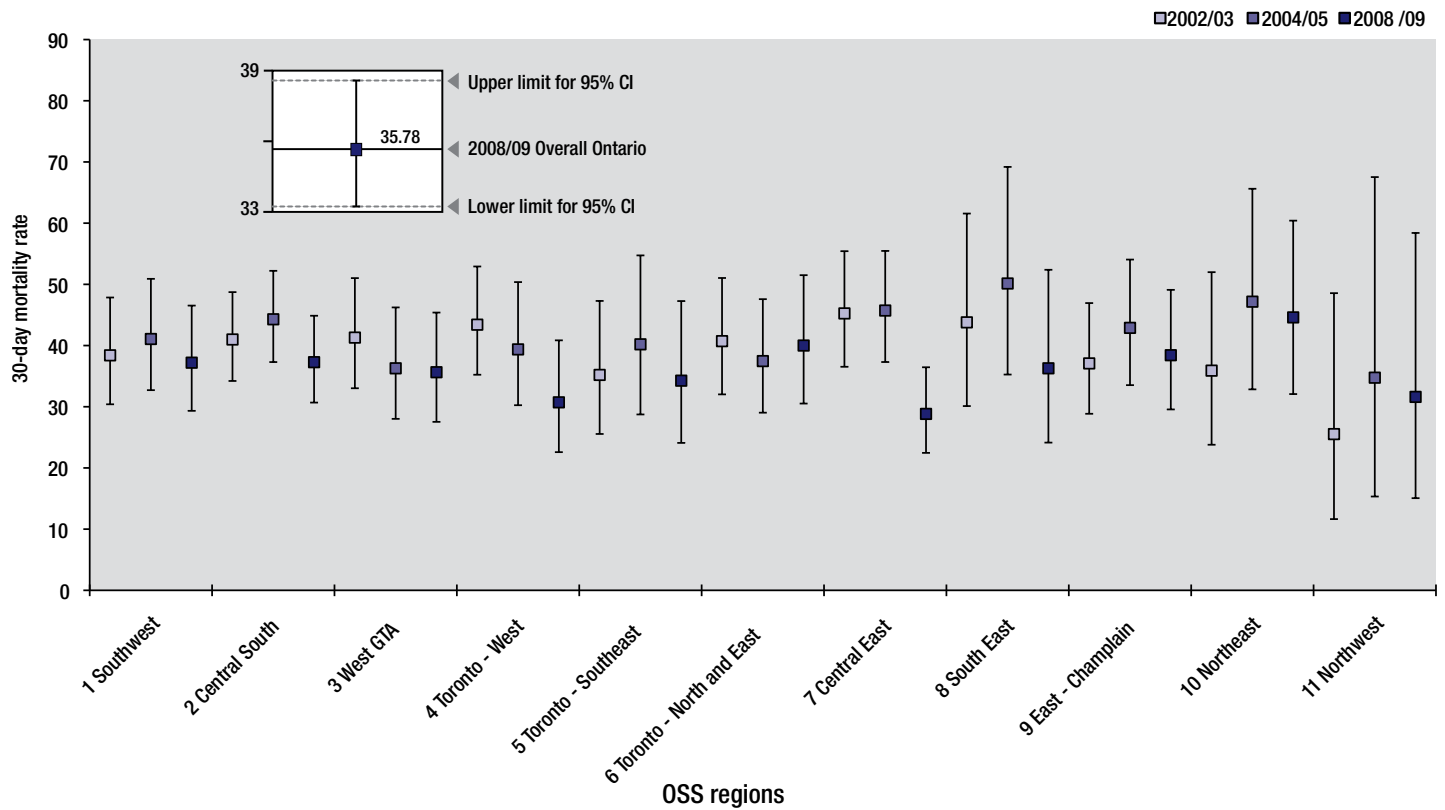
Findings

- In 2008/09, the provincial 30-day mortality rate for ischemic stroke was 13.6%. There were no statistically significant differences in mortality rates across LHINs, with the exception of the Northeast where the 2008/09 adjusted mortality rate was slightly higher than the overall Ontario rate.

Exhibits and Findings

Exhibit 46 Age- and sex-adjusted 30-day mortality rate for intracranial hemorrhagic stroke, by Ontario Stroke System (OSS) region, 2002/03, 2004/05 and 2008/09

Patients with intracranial hemorrhage seen in the ED or admitted to hospital



Notes:

- (1) The age-sex standardized rate for an OSS region was calculated by applying the region-specific rate for each age-sex group to the Ontario stroke population. This was done separately for each year. Therefore, all region rates were calculated as if they had the provincial age-sex stroke distribution.
- (2) Rates within regions cannot be compared across years. Statistical significance was examined for 2008/09 only.

Data sources: Canadian Institute for Health Information, Discharge Abstract Database (CIHI-DAD), and National Ambulatory Care Reporting System (CIHI-NACRS); Ontario Ministry of Health and Long-Term Care, Registered Persons Database (RPDB); 2002/03, 2004/05 and 2008/09.

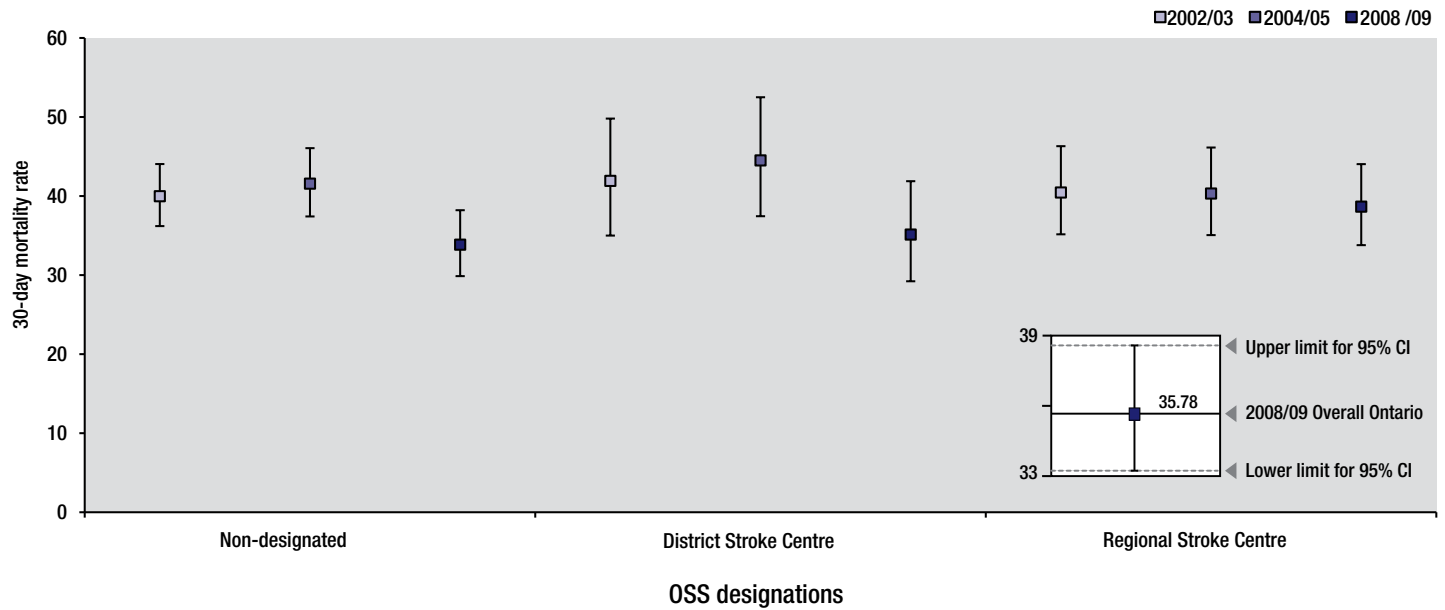
ED = emergency department; GTA = Greater Toronto Area; CI = confidence interval.

Findings

- In 2008/09, the overall provincial 30-day mortality rate for hemorrhagic stroke was 35.8%, and there were no statistically significant variations in mortality rates across OSS regions compared to the Ontario rate.

Exhibit 47 Age- and sex-adjusted 30-day mortality rate for intracranial hemorrhagic stroke by Ontario Stroke System (OSS) designation, 2002/03, 2004/05 and 2008/09

Patients with intracranial hemorrhage seen in the ED or admitted to hospital



Notes:

(1) The age-sex standardized rate for an OSS designation was calculated by applying the designation-specific rate for each age-sex group to the Ontario stroke population. This was done separately for each year. Therefore, all designation rates were calculated as if they had the provincial age-sex stroke distribution.
 (2) Rates within designations cannot be compared across years. Statistical significance was examined for 2008/09 only.

Data sources: Canadian Institute for Health Information, Discharge Abstract Database (CIHI-DAD), and National Ambulatory Care Reporting System (CIHI-NACRS); Ontario Ministry of Health and Long-Term Care, Registered Persons Database (RPDB); 2002/03, 2004/05 and 2008/09.

ED = emergency department; GTA = Greater Toronto Area; CI = confidence interval.

Non-designated: An acute care hospital that does not fit the definition of district or regional stroke centre.

District Stroke Centre: A facility with written stroke protocols (e.g., transport and triage, thrombolytic therapy, neuroimaging), clinicians with stroke expertise, and linkages to rehabilitation and secondary prevention.

Regional Stroke Centre: A facility that meets all the requirements of a district stroke centre, plus neurosurgical facilities and interventional radiology.

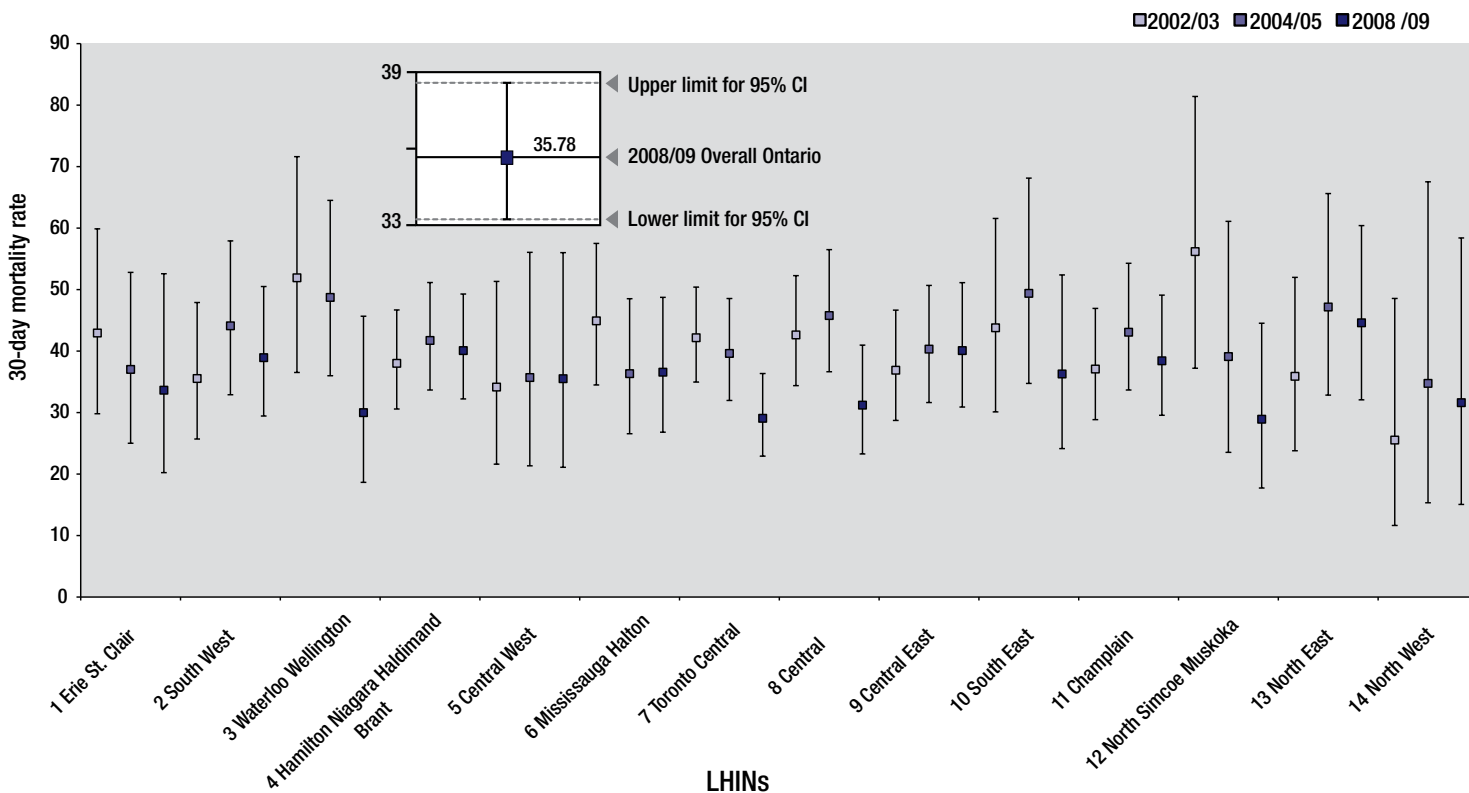
Findings

- In 2008/09, the overall provincial 30-day mortality rate for intracranial hemorrhagic stroke was 35.8%, and there were no significant variations in mortality rates across hospital types compared to the Ontario rate.

Exhibits and Findings

Exhibit 48 Age- and sex-adjusted 30-day mortality rate for intracranial hemorrhagic stroke, by Ontario Local Health Integration Network (LHIN), 2002/03, 2004/05 and 2008/09

Patients with intracranial hemorrhage seen in the ED or admitted to hospital



Notes:
 (1) The age-sex standardized rate for a LHIN was calculated by applying the LHIN-specific rate for each age-sex group to the Ontario stroke population. This was done separately for each year. Therefore, all LHIN rates were calculated as if they had the provincial age-sex stroke distribution.
 (2) Rates within LHINs cannot be compared across years. Statistical significance was examined for 2008/09 only.

Data sources: Canadian Institute for Health Information, Discharge Abstract Database (CIHI-DAD), and National Ambulatory Care Reporting System (CIHI-NACRS); Ontario Ministry of Health and Long-Term Care, Registered Persons Database (RPDB); 2002/03, 2004/05 and 2008/09.

ED = emergency department; GTA = Greater Toronto Area; CI = confidence interval.

Findings

- In 2008/09, the overall provincial 30-day mortality rate for hemorrhagic stroke was 35.8%, and there were no significant variations in mortality rates across LHINs compared to the Ontario rate.

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7. Rothwell PM, Eliasziw M, Gutnikov SA, Fox AJ, Taylor DW, Mayberg MR, et al. Analysis of pooled data from the randomized controlled trials of endarterectomy for symptomatic carotid stenosis. *Lancet* 2003; 361(9352):107–16.
8. Joint Stroke Strategy Working Group. *Towards an Integrated Stroke Strategy for Ontario. Report of the Joint Stroke Strategy Working Group*. [Toronto]: Ontario Ministry of Health and Long-Term Care and the Heart and Stroke Foundation of Ontario; 2000. Accessed on November 23, 2010, at http://www.health.gov.on.ca/english/public/pub/ministry_reports/stroke/stokereport.pdf.

Appendix A. Ontario Stroke Audit 2008/09 Indicator List

Section	Indicator Statements
Baseline Characteristics	Prevalence of stroke across the province by stroke type, region and Local Health Integration Network
	Proportion of patients who seek medical attention within 2.5 hours of stroke symptom onset
Thrombolysis	All eligible patients who arrive at hospital within 2.5 hours of symptom onset should receive tPA 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 a CT brain scan completed within 25 minutes of ED arrival
Emergency and Inpatient Care	All stroke patients should have a CT/MRI scan 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 after stroke

Appendix B. Institutional Resources for Stroke¹ in Ontario, November 2009

Legend

Regional Stroke Centre
Enhanced District Stroke Centre
District Stroke Centre
Non-designated Hospital

LHIN/Institution (Site)	Location	OSS Region	Stroke Unit	CT Scanner	MRI Scanner	Telestroke Centre ²	Stroke Prevention Clinic ³
1. ERIE ST. CLAIR							
Bluewater Health (Petrolia)	Petrolia	Southwest					
Bluewater Health (Sarnia General)	Sarnia	Southwest		X	X		X
Chatham Kent Health Alliance (Chatham)	Chatham	Southwest	X	X	X		X
Chatham Kent Health Alliance (Sydenham)	Wallaceburg	Southwest					
Hotel-Dieu Grace Hospital (St. Joseph's)	Windsor	Southwest	X	X	X		X
Leamington District Memorial Hospital	Leamington	Southwest		X			
Windsor Regional Hospital (Western)	Windsor	Southwest		X	X		
2. SOUTH WEST							
Alexandra Hospital	Ingersoll	Southwest					
Alexandra Marine and General Hospital	Goderich	Southwest					
Clinton Public Hospital	Clinton	Southwest					
Four Counties Health Services Corporation	Newbury	Southwest					
Grey Bruce Health Services (Lion's Head)	Lion's Head	Southwest					
Grey Bruce Health Services (Markdale)	Markdale	Southwest					
Grey Bruce Health Services (Meaford)	Meaford	Southwest					
Grey Bruce Health Services (Owen Sound)	Owen Sound	Southwest		X	X		X
Grey Bruce Health Services (Southampton)	Southampton	Southwest					
Grey Bruce Health Services (Warton)	Warton	Southwest					
Hanover and District Hospital	Hanover	Southwest					
Listowel Memorial Hospital	Listowel	Southwest					
London Health Sciences Centre (University)	London	Southwest	X	X	X		X
London Health Sciences Centre (Victoria)	London	Southwest		X	X		
Seaforth Community Hospital	Seaforth	Southwest					
South Bruce Grey Health Centre (Chesley)	Chesley	Southwest					
South Bruce Grey Health Centre (Durham)	Durham	Southwest					
South Bruce Grey Health Centre (Kincardine)	Kincardine	Southwest					
South Bruce Grey Health Centre (Walkerton)	Walkerton	Southwest		X			
South Huron Hospital	Exeter	Southwest					

Appendix B

LHIN/Institution (Site)	Location	OSS Region	Stroke Unit	CT Scanner	MRI Scanner	Telestroke Centre ²	Stroke Prevention Clinic ³
St. Joseph's Health Care (London)	London	Southwest		X	X		
St. Mary's Memorial Hospital	St. Marys	Southwest					
St. Thomas-Elgin General Hospital	St. Thomas	Southwest		X			
Stratford General Hospital	Stratford	Southwest		X			X
Strathroy Middlesex General Hospital	Strathroy	Southwest		X			
Tillsonburg District Memorial Hospital	Tillsonburg	Southwest		X			
Wingham and District Hospital	Wingham	Southwest					
Woodstock General Hospital	Woodstock	Southwest		X			
3. WATERLOO WELLINGTON							
Cambridge Memorial Hospital	Cambridge	Central South		X			
Grand River Hospital Corporation (Waterloo)	Kitchener	Central South	X	X	X		X
Groves Memorial Community Hospital	Fergus	Central South					
Guelph General Hospital	Guelph	Central South		X	X		
North Wellington Health Care (Mount Forest)	Mount Forest	Central South					
North Wellington Health Care (Palmerston)	Palmerston	Central South					
St. Mary's General Hospital	Kitchener	Central South		X			
4. HAMILTON NIAGARA HALDIMAND BRANT							
Brant Community Health Care System (Brantford General)	Brantford	Central South		X	X	X⁴	X
Haldimand War Memorial Hospital	Dunnville	Central South					
Hamilton Health Sciences Corp. (General)	Hamilton	Central South	X	X	X		X
Hamilton Health Sciences Corp. (Henderson)	Hamilton	Central South		X	X		
Hamilton Health Sciences Corp. (McMaster)	Hamilton	Central South		X	X		
Joseph Brant Memorial Hospital	Burlington	Central South		X	X		
Niagara Health System (Douglas Memorial)	Fort Erie	Central South					
Niagara Health System (Greater Niagara)	Niagara Falls	Central South		X	X	X	X
Niagara Health System (Port Colborne)	Port Colborne	Central South					

LHIN/Institution (Site)	Location	OSS Region	Stroke Unit	CT Scanner	MRI Scanner	Telestroke Centre ²	Stroke Prevention Clinic ³
Niagara Health System (St. Catharines General)	St. Catharines	Central South		X	X		
Niagara Health System (Welland County)	Welland	Central South		X			
Norfolk General Hospital	Simcoe	Central South		X			X
St. Joseph's Health Care System (Hamilton)	Hamilton	Central South		X	X		X
West Haldimand General Hospital	Hagersville	Central South					
West Lincoln Memorial Hospital	Grimsby	Central South					
5. CENTRAL WEST							
Headwaters Health Care Centre (Dufferin)	Orangeville	West GTA		X			
William Osler Health Centre (Brampton)	Brampton	West GTA		X	X		X
William Osler Health Centre (Etobicoke)	Etobicoke	West GTA		X			
6. MISSISSAUGA HALTON							
Halton Healthcare Services Corp. (Georgetown)	Georgetown	West GTA		X			
Halton Healthcare Services Corp. (Milton)	Milton	West GTA		X			
Halton Healthcare Services Corp. (Oakville)	Oakville	West GTA		X	X		
The Credit Valley Hospital	Mississauga	West GTA		X	X		
Trillium Health Centre (Mississauga)	Mississauga	West GTA	X	X	X		X
7. TORONTO CENTRAL							
Mount Sinai Hospital	Toronto	Toronto West		X	X		
St. Joseph's Health Centre	Toronto	Toronto West		X	X		
St. Michael's Hospital	Toronto	Toronto – Southeast	X	X	X		
Sunnybrook and Women's College Health Sciences Centre	Toronto	Toronto – North & East	X	X	X		X
The Toronto East General Hospital	Toronto	Toronto – Southeast		X	X		X
University Health Network (General)	Toronto	Toronto West		X	X		
University Health Network (Western)	Toronto	Toronto West	X	X	X		X
8. CENTRAL							
Humber River Regional Hospital (Humber Memorial – Church)	Weston	Toronto West	X	X			

Appendix B

LHIN/Institution (Site)	Location	OSS Region	Stroke Unit	CT Scanner	MRI Scanner	Telestroke Centre ²	Stroke Prevention Clinic ³
Humber River Regional Hospital (York-Finch)	Downsview	Toronto West	X	X	X		
North York General Hospital	Toronto	Toronto – North & East	X	X	X		
Southlake Regional Health Centre	Newmarket	Central East	X	X	X		
Stevenson Memorial Hospital (Alliston)	Alliston (New Tecumseth Township)	Central East		X			
York Central Hospital	Richmond Hill	Central East	X	X	X		X⁵
9. CENTRAL EAST							
Campbellford Memorial Hospital	Campbellford	Central East					
Haliburton Highlands Health Services Corporation (Haliburton)	Haliburton	Central East					
Lakeridge Health Corporation (Bowmanville)	Clarington	Central East		X			
Lakeridge Health Corporation (Oshawa)	Oshawa	Central East	X	X	X	X	X
Lakeridge Health Corporation (Port Perry)	Port Perry	Central East					X
Markham Stouffville Hospital (Markham)	Markham	Central East		X	X		
Markham Stouffville Hospital (Uxbridge)	Uxbridge	Central East		X	X		
Northumberland Hills Hospital	Cobourg	Central East		X			
Peterborough Regional Health Centre	Peterborough	Central East	X	X	X	X	
Ross Memorial Hospital	Lindsay	Central East		X			
Rouge Valley Health System (Ajax)	Ajax	Toronto – Southeast		X			
Rouge Valley Health System (Centenary)	Scarborough	Toronto – Southeast		X	X		
The Scarborough Hospital (Grace)	Scarborough	Toronto – North & East		X			
The Scarborough Hospital (Scarborough General)	Scarborough	Toronto – North & East	X	X	X		
10. SOUTH EAST							
Brockville General Hospital	Brockville	South East		X			X
Kingston General Hospital	Kingston	South East	X	X	X		X
Lennox and Addington County General Hospital	Napanee	South East					
Perth and Smiths Falls District (Perth Site)	Perth	South East					X
Perth and Smiths Falls District (Smith Falls)	Smiths Falls	South East					X
Quinte Healthcare Corporation (Belleville)	Belleville	South East	X	X			X
Quinte Healthcare Corporation (Bancroft)	Bancroft	South East					X
Quinte Healthcare Corporation (Picton)	Picton	South East					X
Quinte Healthcare Corporation (Trenton)	Trenton	South East		X			X

LHIN/Institution (Site)	Location	OSS Region	Stroke Unit	CT Scanner	MRI Scanner	Telestroke Centre ²	Stroke Prevention Clinic ³
11. CHAMPLAIN							
Almonte General Hospital	Almonte	East – Champlain					
Cornwall Community Hospital (Second Street)	Cornwall	East – Champlain		X			
Deep River and District Hospital	Deep River	East – Champlain					
Glengarry Memorial Hospital	Alexandria	East – Champlain					
Hawkesbury and District General Hospital	Hawkesbury	East – Champlain		X			X
Hôpital Montfort	Ottawa	East – Champlain		X	X		
Pembroke Regional Hospital Inc.	Pembroke	East – Champlain	X	X		X	
Queensway-Carleton Hospital	Ottawa	East – Champlain		X	X		
Renfrew Victoria Hospital	Renfrew	East – Champlain		X			
St. Francis Memorial Hospital	Barry's Bay	East – Champlain					
The Arnprior and District Memorial Hospital	Arnprior	East – Champlain					
The Ottawa Hospital (Civic)	Ottawa	East – Champlain		X	X		
The Ottawa Hospital (General)	Ottawa	East – Champlain	X	X	X		X
Winchester District Memorial Hospital	Winchester	East – Champlain		X			
12. NORTH SIMCOE MUSKOKA							
Collingwood General and Marine Hospital	Collingwood	Central East		X			
Huron District Hospital	Midland	Central East		X			
Muskoka Algonquin Healthcare (Huntsville)	Huntsville	Central East		X			
Muskoka Algonquin Healthcare (Bracebridge)	Bracebridge	Central East		X			
Orillia Soldiers' Memorial Hospital	Orillia	Central East		X	X		
The Royal Victoria Hospital of Barrie	Barrie	Central East	X	X	X		X
13. NORTH EAST							
Englehart and District Hospital	Englehart	Northeast					
Hôpital régional de Sudbury Regional Hospital	Sudbury	Northeast	X	X	X	X	X
Kirkland and District Hospital	Kirkland Lake	Northeast					
Lady Dunn Health Centre	Wawa	Northeast					

Appendix B

LHIN/Institution (Site)	Location	OSS Region	Stroke Unit	CT Scanner	MRI Scanner	Telestroke Centre ²	Stroke Prevention Clinic ³
Manitoulin Health Centre (Little Current)	Little Current	Northeast					
Manitoulin Health Centre (Mindemoya)	Mindemoya	Northeast					
Mattawa General Hospital	Mattawa	Northeast					
North Bay General Hospital (Civic/St. Joseph's)	North Bay	Northeast	X	X		X	X
Notre Dame Hospital	Hearst	Northeast					
Sault Area Hospital (Sault Ste. Marie)	Sault Ste. Marie	Northeast	X	X	X	X	X
Sensenbrenner Hospital	Kapuskasing	Northeast					
St. Joseph's General Hospital	Elliot Lake	Northeast					
Temiskaming Hospital	New Liskeard	Northeast		X			
Timmins and District General Hospital	Timmins	Northeast		X	X	X	X
West Nipissing General Hospital	Sturgeon Falls	Northeast					
West Parry Sound Health Centre	Parry Sound	Northeast		X			
14. NORTH WEST							
Atikokan General Hospital	Atikokan	Northwest					
Dryden Regional Health Centre	Dryden	Northwest		X			
Lake-of-the-Woods District Hospital	Kenora	Northwest		X		X	X
Nipigon District Memorial Hospital	Nipigon	Northwest					
Riverside Health Care Facilities (La Verendrye)	Fort Frances	Northwest		X			X
Sioux Lookout Meno-Ya-Win Health Centre (District)	Sioux Lookout	Northwest					X
The Red Lake Margaret Cochenour Memorial Hospital	Red Lake	Northwest					
Thunder Bay Regional Health Sciences Centre	Thunder Bay	Northwest	X	X	X		X

¹ Based on provincial hospital resources as of November 2009.

² A funded Ontario Telemedicine Network site.

³ A Ministry of Health and Long-Term Care-designated secondary prevention clinic.

⁴ Brant Community Health Care System (Brantford General) has a Telestroke system but does not participate in the provincial program.

⁵ Stroke prevention clinic onsite but not funded by Ontario Ministry of Health and Long-Term Care.

Regional stroke centre: A facility that meets all the requirements of a district stroke centre, plus neurosurgical facilities and interventional radiology.

Enhanced district stroke centre: A facility established to provide leadership integration in the regions of Ontario where the designation of a regional stroke centre cannot be met. 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.

District stroke centre: A facility with written stroke protocols (e.g., transport and triage, thrombolytic therapy, neuroimaging), clinicians with stroke expertise, and linkages to rehabilitation and secondary prevention.

Non-designated: An acute care hospital that does not fit the definition of district or regional stroke centre.

Ontario hospital peer group:

Small community hospitals: Facilities that generally provide fewer 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 facilities; members of the Council of Academic Hospitals of Ontario.

Large community hospitals: All other hospitals.

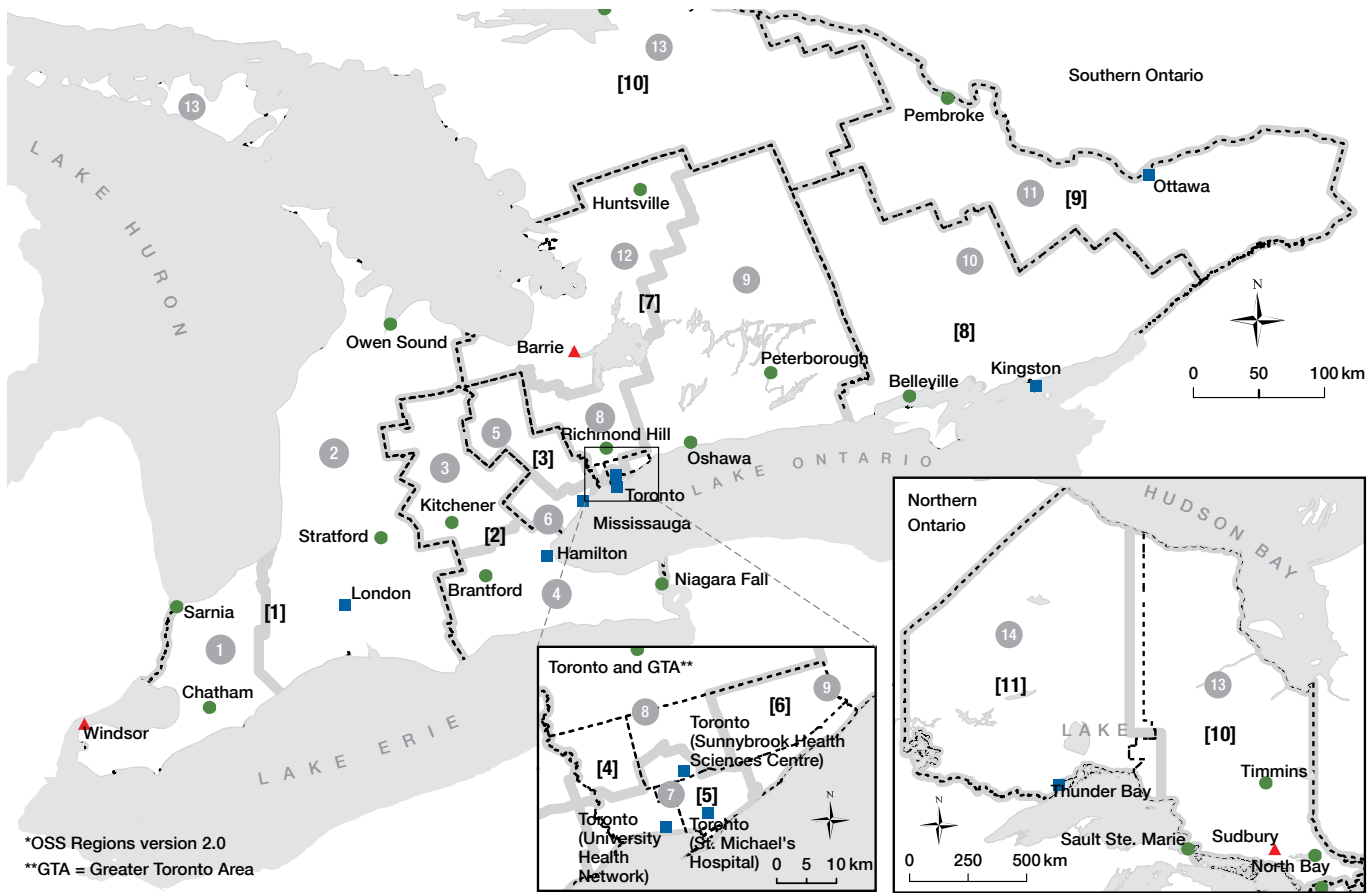
Appendix C. Glossary of Terms

Term/Acronym	Definition
Academic hospital	University-affiliated facility; member of the Council of Academic Hospitals of Ontario
Acute stroke unit	Specialized, geographically-located hospital unit with dedicated stroke team and stroke resources
AF	Atrial fibrillation
Alternative level of care (ALC)	A patient who is designated “ALC” is one who has finished the acute care phase of his/her treatment but remains in an acute bed. This classification is invoked when the patient's physician gives an order to change the level of care from acute care and requests a transfer for the patient.
Annual stroke patient volume	Indicates the annual number of hospital separations (inpatient and emergency) for stroke or transient ischemic attack.
Charlson score	A comorbidity index score where higher scores indicate more comorbid illness.
Canadian Neurological Scale (CNS) score	Canadian Neurological Scale, designed to assess neurological function in conscious stroke patients. The scale ranges from 0 to 11.5, with a higher score indicating less impairment. A CNS score of 8 or less indicates severe stroke.
CSN	Canadian Stroke Network
CSS	Canadian Stroke Strategy (or System)
CT	Computed tomography
District stroke centre	A facility 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.
ED	Emergency department
Enhanced district stroke centre	A facility established to provide leadership and integration in the regions of Ontario where the designation of a regional stroke centre cannot be met. 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.
GTA	Greater Toronto Area
ICH	Intracerebral hemorrhage
Large community hospital	A hospital that does not qualify as a small hospital, academic hospital, or district or regional stroke centre
Local Health Integration Network (LHIN)	One of 14 not-for-profit corporations established in Ontario by the MOHLTC, each with specific geographic boundaries. Each LHIN is responsible for planning, integrating and funding local health services.

Appendix C

LSN	Last seen normal; time prior to onset of stroke symptoms
MOHLTC	Ontario Ministry of Health and Long-Term Care
MRI	Magnetic resonance imaging
Non-designated hospital	An acute care hospital that does not fit the definition of a district or regional stroke centre
OHA	Ontario Hospital Association
OSS	Ontario Stroke Strategy (or System)
Rankin score	A measure of functional status after stroke with a range from 0 (no disability) to 6 (death)
Regional stroke centre	A facility that has all the requirements of a district stroke centre, plus neurosurgical facilities and interventional radiology.
Small community hospital	A facility that generally provides fewer than 3,500 weighted cases, has a referral population of less than 20,000 people and is the only hospital in the community, as defined by the Joint Policy and Planning Committee.
Stroke unit	Specialized, geographically-located hospital unit with a dedicated stroke team and stroke resources.
TIA	Transient ischemic attack, or “mini-stroke”
tPA	Tissue plasminogen activator
UTD	Unable to determine; based on available data in the patient’s medical records, or on clinical presentation and/or findings

Appendix D. LHIN Boundaries, OSS Regions* and OSS Stroke Centre Classifications



*OSS Regions version 2.0
 **GTA = Greater Toronto Area

Local Health Integration Networks (LHINs)

- | | |
|------------------------------------|-------------------------|
| 1 Erie St. Clair | 8 Central |
| 2 South West | 9 Central East |
| 3 Waterloo Wellington | 10 South East |
| 4 Hamilton Niagara Haldimand Brant | 11 Champlain |
| 5 Central West | 12 North Simcoe Muskoka |
| 6 Mississauga Halton | 13 North East |
| 7 Toronto Central | 14 North West |
- LHIN boundary

OSS Region

- | | | |
|-------------------|------------------------|--------------------|
| [1] Southwest | [5] South East Toronto | [9] Champlain |
| [2] Central South | [6] North and East GTA | [10] Northeast |
| [3] West GTA | [7] Central East | [11] Northwest |
| [4] Toronto West | [8] Southeast | ----- OSS boundary |

OSS Stroke Centre Classification

- Regional Stroke Centre
- District Stroke Centre
- ▲ Enhanced District Stroke Centre

Appendix E. Exhibit Sample Size

Exhibits 3, 4, 5, 6, 7, 8, 15, 16 and 17

All stroke, transient ischemic attack and patients with uncertain diagnosis

Frequency	Overall	002/03	2004/05	2008/09
Weighted	71,785	25,392	23,800	22,593
Sample	12,166	3,322	4,913	3,931

Exhibits 9, 10 and 11

Table: Neuroimaging within 25 minutes

Patients with stroke, transient ischemic attack and uncertain diagnosis who arrived within 2.5 hours of symptom onset (and thus were potentially eligible to receive thrombolysis)

Frequency	Overall	002/03	2004/05	2008/09
Weighted	23,075	8,000	7,714	7,361
Sample	4,007	1,081	1,628	1,298

Table: Thrombolysis

Patients with ischemic stroke only

Frequency	Overall	002/03	2004/05	2008/09
Weighted	34,193	11,978	10,959	11,256
Sample	5,645	1,539	2,182	1,924

Table: Thrombolysis among those arriving within 2.5 hours of symptom onset

Patients with ischemic stroke who arrived within 2.5 hours of symptom onset (and thus were potentially eligible for thrombolysis)

Frequency	Overall	002/03	2004/05	2008/09
Weighted	8,799	2,978	2,831	2,990
Sample	1,469	397	562	510

Exhibits 12, 13 and 14

Patients with ischemic stroke who received intravenous thrombolysis with tPA

Frequency	Overall	002/03	2004/05	2008/09
Weighted	1,619	375	400	844
Sample	260	42	75	143

Exhibit 18, 19 and 20

Patients with ischemic stroke or transient ischemic attack

Frequency	Overall	002/03	2004/05	2008/09
Weighted	57,690	20,721	19,004	17,965
Sample	9,769	2,726	3,920	3,123

Exhibits 21, 22 and 23

Tables: Antithrombotic therapy, antihypertensive therapy and lipid-lowering therapy Patients with ischemic stroke or transient ischemic attack who were discharged alive from the emergency department or hospital

Frequency	Overall	002/03	2004/05	2008/09
Weighted	53,658	19,343	17,768	16,547
Sample	9,114	2,548	3,683	2,883

Table: Warfarin for atrial fibrillation

Patients with ischemic stroke or transient ischemic attack with atrial fibrillation who were discharged alive from the emergency department or hospital

Frequency	Overall	002/03	2004/05	2008/09
Weighted	6,987	2,389	2,264	2,334
Sample	1,181	316	458	407

Exhibits 24, 25, 26, 30, 31 and 32

All patients with stroke, transient ischemic attack or uncertain diagnosis admitted to hospital

Frequency	Overall	002/03	2004/05	2008/09
Weighted	46,945	16,269	15,525	15,151
Sample	7,975	2,174	3,180	2,621

Exhibits 27, 28 and 29

All patients with stroke or uncertain diagnosis admitted to hospital (TIA patients excluded)

Frequency	Overall	002/03	2004/05	2008/09
Weighted	39,331	13,417	12,835	13,079
Sample	6,533	1,732	2,563	2,238

Exhibits 33, 34 and 35

All patients with stroke, transient ischemic attack or uncertain diagnosis admitted to hospital and discharged alive

Frequency	Overall	002/03	2004/05	2008/09
Weighted	40,179	13,931	13,291	12,957
Sample	6,860	1,872	2,742	2,246

Exhibits 36a, 37a and 38a

All patients with stroke, transient ischemic attack or uncertain diagnosis admitted to hospital and discharged alive with a modified Rankin score of 0 to 2

Frequency	Overall	002/03	2004/05	2008/09
Weighted	18,241	6,714	5,618	5,909
Sample	3,189	953	1,194	1,042

Exhibits 36b, 37b and 38b

All patients with stroke, transient ischemic attack or uncertain diagnosis admitted to hospital and discharged alive with a modified Rankin score of 3 to 5

Frequency	Overall	002/03	2004/05	2008/09
Weighted	21,360	7,149	7,514	6,697
Sample	3,566	910	1,513	1,143

Exhibits 39, 40 and 41

All patients with stroke, transient ischemic attack or uncertain diagnosis not admitted to hospital and discharged alive from the emergency department

Frequency	Overall	002/03	2004/05	2008/09
Weighted	24,425	8,956	8,163	7,306
Sample	4,125	1,128	1,710	1,287



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