Background and Purpose—Acute ischemic stroke patients are infrequently treated with rtPA, despite its proven effectiveness. Poor physician reimbursement for acute stroke care is one possible explanation for the low frequency of use. We describe the physician reimbursement for thrombolytic therapy for the stroke team physicians serving the Greater Cincinnati/Northern Kentucky region (GCNK), and the Alberta region.

Methods—GCNK: billing logs were accessed for the study period of 7/01–12/02, and cross-matched to stroke call logs. University of Calgary (UC): treatment records of a single physician were reviewed from 4/02–3/04. A telephone survey of Canadian provinces was conducted regarding billing practices.

Results—GCNK: During the study period, 151 patients received rtPA. For treated pts. the average time spent was 2.6 hours, and average reimbursement received was $472 (of those with insurance). The highest reimbursement was received by billing critical care codes. Reimbursement for critical care was similar to or lower than common office procedures for neurologists. UC: during the study period, 131 patients received rtPA. Average reimbursement for rtPA treated patients was $340 US, not including on-call payments. Survey across Canada revealed many provinces with weekend/after hour premium stipends and on-call stipends.

Conclusions—Physician reimbursement for the evaluation and treatment of acute stroke, when compared with other diagnoses commonly treated by neurologists, is relatively low in both the U.S. and Canada. Health policy decision-makers in the US and Canada should be made aware of the importance of providing a more balanced plan to provide medical care to stroke patients. (Stroke. 2005;36:682-687.)

Key Words: stroke, acute ischemic / stroke, ischemic tissue plasminogen activator / thrombolytic therapy

<table>
<thead>
<tr>
<th>Procedure Description</th>
<th>Average Physician Time Spent (min)</th>
<th>US: Medicare Allowed Amounts‡</th>
<th>Canada: Alberta Province Reimbursement‡</th>
<th>Dollar Amount Per 30 Minutes of Physician Time Spent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Critical care, 1st 30–74 min</td>
<td>60</td>
<td>$237.59</td>
<td>$65.59*§</td>
<td>$118.80 $65.59*§</td>
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<tr>
<td>Critical care, subsequent 30 min</td>
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<td>$106.11</td>
<td>$65.59*</td>
<td>$106.11 $65.59*</td>
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<td>Lumbar puncture</td>
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<td>$153.28</td>
<td>$37.67</td>
<td>$153.28 $37.67</td>
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<td>$200.31</td>
<td>$87.43</td>
<td>$400.62 $174.06</td>
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<tr>
<td>EMG needle 4 extremities (technical component excluded)</td>
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<td>$107.49</td>
<td>$82.90</td>
<td>$107.49 $82.90</td>
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<tr>
<td>EMG single nerve conduction (technical component excluded)</td>
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<td>$22.74</td>
<td>$34.60</td>
<td>$68.22 $103.58</td>
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<tr>
<td>EEG, awake/asleep (technical component excluded)</td>
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<td>$58.34</td>
<td>$23.83</td>
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<td>Consult comprehensive outpatient</td>
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<td>$215.27</td>
<td>$113.79*</td>
<td>$143.41 $75.86</td>
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<tr>
<td>Hospital consult, highest complexity</td>
<td>45</td>
<td>$189.99</td>
<td>$113.79*§</td>
<td>$126.66 $75.86</td>
</tr>
</tbody>
</table>

*After hours incentive compensation may also be applicable. †Medicare maximum amount does not equal actual reimbursement, which depends on the insurance status of the patient (private insurance, uninsured, etc), and Medicare only reimburses 80% of maximum amount. ‡Canadian/US dollar exchange rate ~0.76, but higher cost of living in US means the buying power of $1 in Canada is greater than the buying power of US $0.76. Note that the Canadian amounts reflect the 2004 Alberta Fee Schedule. §In Canada, critical care fees are in addition to consult fees after 30 minutes of care, whereas in the US you may only bill one or the other. EMG indicates electromyography.

As part of ongoing acute stroke research protocols, any calls received by the stroke team pager (one number alerts central teaching hospitals. In the calendar year 1999, require intra-arterial thrombolytic therapy are transported to 1 of 3 the local primary care physician or neurologist. Only patients that patient for the first 24 hours, and then signs the patient over to team physician admits the patient to the local hospital and follows-up evaluates the patient onsite. If the patient receives rtPA, the stroke team physician (neurology or emergency medicine) travels to the local ED and potential candidate for thrombolytic therapy, the stroke team physi-
cian pages the stroke team immediately. If the patient is a When an acute stroke patient arrives in a local ED, the local ED physicians on the team take calls from all 17 hospitals in the region. They must be providing critical care and medical decision-making. This is different than hospitals that use the diagnosis-related group (DRG) coding system. The CPT codes bill for time spent with the patient in the medical record. If time spent is not documented, or if the patient was evaluated but the physician did not provide critical care, or if <30 minutes of critical care was provided, then standard consult codes were billed (CPT 99251 to 99255). Reimbursement received per patient was then calculated. The US health care reimbursement system is primarily a private system, combined with some governmental payers. Each private insurer is free to set its own reimbursement rates as it contracts with providers. The main governmental programs are Medicare, a program created for the elderly and those with certain disabling conditions, and Medicaid, a multifaceted program that provides coverage for those with lower incomes, families with dependent children, etc. There is also a significant minority of the US population who do not qualify for any of these programs, and for whom there is no reimbursement available.

Physician reimbursement is primarily billed using CPT codes, which is different than hospitals that use the diagnosis-related group (DRG) coding system. The CPT codes bill for time spent and specific procedures performed by physicians. The DRG codes are a flat fee to the hospital for a given diagnosis, intended to cover the costs incurred on average for this diagnosis.

For this comparison of physician reimbursement, the maximum Medicare-allowable rates (Table 1) per CPT code were used, because Medicare-eligible patients represented the largest single payer group, and because many private insurance reimbursement rates are similar to the Medicare rates.

commonly performed procedures for the physician members of their teams, including neurologists, emergency medicine physicians, and neuro-interventionists.

Materials and Methods
Greater Cincinnati/Northern Kentucky Stroke Team
The Greater Cincinnati/Northern Kentucky Stroke Team includes physicians (from neurology, emergency medicine, neurosurgery, and neuroradiology), basic scientists, research nurses, paramedics, and others. The neurologists and emergency medicine physicians cover acute stroke calls when not in clinic or on shift in the emergency department (ED). Described as the “stroke commando” model, the physicians on the team take calls from all 17 hospitals in the region. When an acute stroke patient arrives in a local ED, the local ED physician pages the stroke team immediately. If the patient is a potential candidate for thrombolytic therapy, the stroke team physician (neurology or emergency medicine) travels to the local ED and evaluates the patient onsite. If the patient receives rtPA, the stroke team physician admits the patient to the local hospital and follows-up that patient for the first 24 hours, and then signs the patient over to the local primary care physician or neurologist. Only patients that require intra-arterial thrombolytic therapy are transported to 1 of 3 central teaching hospitals. In the calendar year 1999, ~3.8% of all ischemic stroke patients in the population were treated with thrombolytics.

In general, whenever possible, the billing departments billed for critical care current procedural terminology (CPT) billing codes. These are divided into the first hour of critical care on a day (CPT 99291) and subsequent half-hours (CPT 99292). There may be several units of “subsequent half-hours” (CPT 99292) billed on a day of treatment if several hours are spent with the patient. According to “Current Procedural Terminology,” to bill critical care, the physician must be providing critical care and medical decision-making. This includes talking to family about critical decisions, as well as writing notes and orders. In addition, the physician must document time spent with the patient in the medical record. If time spent is not documented, or if the patient was evaluated but the physician did not provide critical care, or if <30 minutes of critical care was provided, then standard consult codes were billed (CPT 99251 to 99255). Reimbursement received per patient was then calculated.

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For this comparison of physician reimbursement, the maximum Medicare-allowable rates (Table 1) per CPT code were used, because Medicare-eligible patients represented the largest single payer group, and because many private insurance reimbursement rates are similar to the Medicare rates.
The Medicare-allowed amounts are public information published on the Medicare carriers’ web sites. Note that these charges are not the reimbursements, because Medicare only reimburses 80% of the maximum amount and the remainder of the amount is billed to a co-insurance or the patient. The average time spent for each procedure was an estimation based on the Cincinnati physicians’ average clinical practice.

University of Calgary Stroke Team
In contrast, the University of Calgary Stroke Team is organized around a single tertiary care site serving all of southern Alberta (population ~1.5 million).13 Organization and training of the paramedic services has allowed routing of stroke patients with disabling symptoms and a defined time of onset within 6 hours to Foothills Hospital. Small community hospitals without access to computed tomography within 100 km of Calgary route patients directly to Foothills hospital by land ambulance, and a small proportion of patients are air-lifted by helicopter or fixed wing aircraft from distances >100 km. A full-time, all-the-time stroke team responds to a single-number acute stroke pager. The team consists of 5 staff neurologists, a full-time nurse practitioner, a full-time transcranial Doppler nurse, stroke fellows, neurology residents, and medical students. One of 4 interventionists is available at any time for intra-arterial therapies. Patients are admitted to the stroke unit and cared for by the stroke service neurologist.

Payment for physician services is governed by a universal agreement between the province of Alberta and the Alberta Medical Association representing all physicians in the province. The provincial government is the single insurer for the residents of Alberta. All residents of Alberta pay a health premium on a quarterly basis. This premium amounts to ~13% of health expenditures by the province. The remainder is financed through general revenues (eg, income tax). In general, what is billed is what is paid. A small number of patients who are members of the Royal Canadian Mounted Police or the military have their health care costs covered by the federal government.

The current Alberta fee schedule was accessed to estimate the dollar amount paid for each service rendered. For the 2-year period, April 1, 2002 through March 31, 2004, the detailed billing records of sequential patients treated with rtPA by 1 of the staff neurologists (M.D.H.) were reviewed. An average amount per patient was calculated.

To estimate fees remunerated to interventional radiologists, the authors reviewed intra-arterial thrombolysis cases from the calendar year 2003. During this period, 29 patients were treated. Total fees were calculated, including supplemental after-hours and weekend fees and the average amount per case calculated.

Finally, in 2002, the authors conducted an informal telephone survey of stroke neurologists across Canada requesting information on billing practices in as many of the 10 provinces as possible. Comparisons made between the US and Canada for reimbursement amounts in 2002 are made assuming that $1 Canadian equals $0.65 US, which was the approximate exchange rate in the year 2002. Note that since that time, the US dollar has declined in value such that the exchange rate is now $1 Canadian equals $0.76 US, which is the exchange rate used in Table 1.

Results
Greater Cincinnati/Northern Kentucky Stroke Team Results
During the 18-month study period, there were 959 calls to the stroke team. Of those, 151 patients received treatment with rtPA under a stroke team physician’s direction. Ninety-three patients received intravenous rtPA alone,8 51 received the combination of intravenous and intra-arterial rtPA,14 and 7 patients received intra-arterial therapy alone.15

The 6 neurology physicians on the team treated 120 patients with rtPA during the study period. However, complete billing paperwork was only turned in to the billing department for 84 patients. Of the 84 patients with paperwork, 9 patients had no reimbursement available (2 patients were cared for by physicians with credentialing issues, and 7 patients had no insurance). The 36 patients without complete billing paperwork are not included in the analyses and include patients treated in the context of an acute treatment trial, paperwork that was lost by physicians, or incomplete documentation rendering the case “unbillable.” The most common reasons for a case to be “unbillable” includes missing date of service, missing signature of treating physician, and missing or incomplete patient identifiers. Cross-matching of the stroke call log to the IDX billing database accounted for all the patients listed as treated with rtPA in the log.

The average reimbursement received for the neurology stroke physicians is summarized in Table 2. In general, the highest reimbursement was received by billing critical care codes. For rtPA–treated patients, the physicians billed an average of 2.6 hours of critical care per patient. It should be noted that critical care codes were often billed to patients who were evaluated for rtPA, but no thrombolysis was given. For patients not treated with rtPA, the physicians billed an average of 1.2 hours per patient.

For all patients with reimbursement who were evaluated, the average reimbursement was US $347.94. When the 9 patients with no reimbursement available were added back into the analysis, the total reimbursement received per patient evaluated by the neurology stroke physicians decreased to US $318.07.

The 3 emergency medicine stroke physicians on the stroke team treated 31 patients during the 18-month study period. Billing records for the calendar year of 2002 show billing for 21 patients. The only billing codes used by the emergency medicine billing department were critical care codes, and these yielded an average of US $172 per patient.

---

**TABLE 2. Average Reimbursement Received for Acute Stroke Care For Neurology Stroke Physicians in Greater Cincinnati/Northern Kentucky Region, July 2001 to December 2002**

<table>
<thead>
<tr>
<th></th>
<th>Average Reimbursement Received</th>
</tr>
</thead>
<tbody>
<tr>
<td>rtPA Treated Patients</td>
<td></td>
</tr>
<tr>
<td>Patients billed critical care codes</td>
<td>75</td>
</tr>
<tr>
<td>(average 2.6 h spent/pt)</td>
<td></td>
</tr>
<tr>
<td>1st 30–74-min unit</td>
<td>73</td>
</tr>
<tr>
<td>Subsequent 30-min units</td>
<td>187</td>
</tr>
<tr>
<td>Patients billed consult codes</td>
<td>2</td>
</tr>
<tr>
<td>No rtPA Given to Patients</td>
<td></td>
</tr>
<tr>
<td>Patients billed critical care codes</td>
<td>74</td>
</tr>
<tr>
<td>(average 1.2 h spent/pt)</td>
<td></td>
</tr>
<tr>
<td>1st 30–74-min unit</td>
<td>61</td>
</tr>
<tr>
<td>Subsequent 30-min units</td>
<td>38</td>
</tr>
<tr>
<td>Patients billed consult codes</td>
<td>13</td>
</tr>
<tr>
<td>Average reimbursement for all patients</td>
<td>149</td>
</tr>
</tbody>
</table>

pt indicates patient.
The 3 neuro-interventionists on the stroke team performed 42 angiograms with thrombolysis on acute stroke patients at the University Hospital. The additional 18 cases of intra-arterial thrombolysis during the study period were performed at 1 of 2 other teaching hospitals in the city; billing records were not available for these hospitals. For those 42 angiograms, an average of US $1484 was reimbursed to the physician performing the procedure, which includes reimbursement for the angiogram itself and the thrombolysis. Thrombolysis CPT codes 37201 (transcatheter thrombolysis), 75896 (supervision and interpretation in thrombolysis case), and 75898 (follow-up angiogram in thrombolysis case) accounted for $31% of the average reimbursement per patient. If care took place outside of regular hours, supplementary fees were billed as appropriate. The average reimbursement per rtPA patient billed was $523.11 Canadian (US $340.02), which includes fees for service and after-hours supplemental fees, but not the on-call per diem. Time data detailing the average time spent per patient were not available in the database. During the same period, stroke neurologists in the Calgary region were paid an additional $289.75 Canadian (US $188.34) per day until March 2002 and thereafter $357.03 Canadian (US $232.07) as specialist on-call payment. Review of intra-arterial thrombolysis cases yielded an average reimbursement of $1454.77 Canadian (US $945.60) per case over 29 cases. These latter fees included after-hours supplements and fees.

### University of Calgary Results

The Alberta fee schedule is structured in 4 levels. First, physicians are remunerated a consultation fee on a per patient basis. In-hospital consultations for neurologists are considered the same as outpatient consultations. Second, after-hours emergency work is supplemented with additional fees at 2 tiers depending on the time of day. Similarly, weekend or statutory holiday consultations are supplemented (Table 3). Third, for acute ischemic stroke patients treated with rtPA, critical care billing fees apply on a per-15-minute basis, beginning after the first 30 minutes. The same is not true if rtPA is not administered. Fourth, a specialist on-call program is in effect such that neurologists and other specialists are paid a stipend on an hourly basis for being available. This amount is due over and above fees billed for consultation plus after-hours supplement. Thus, the typical stroke patient treated with rtPA will be billed and received as:

\[
\text{(consult fee) + (critical care according to time spent after the first 30 minutes) + (after-hours fee)} = \text{reimbursement received}
\]

During the study period, the fee schedule increased slightly. Reported dollar amounts represent raw figures unadjusted for inflation. Figure in Table 1 represents the 2004 Alberta fee schedule.

During the 2-year period, 131 patients were treated with rtPA in Calgary. This represents \( \approx 8\% \) of the ischemic stroke population. Of these, 56 (43\%) were treated by one of the staff. Of these, 10 involved either combined intravenous followed by intra-arterial rtPA or intra-arterial rtPA alone. Two patient care episodes were not billed because of a clerical error. Of the remaining 54 patients, a consult fee only was billed to 3. Of the remaining 51, a consult fee plus critical care time was billed varying according to the time spent with the patient. If care took place outside of regular hours, supplementary fees were billed as appropriate. The average reimbursement per rtPA patient billed was $523.11 Canadian (US $340.02), which includes fees for service and after-hours supplemental fees, but not the on-call per diem. Time data detailing the average time spent per patient were not available in the database. During the same period, stroke neurologists in the Calgary region were paid an additional $289.75 Canadian (US $188.34) per day until March 2002 and thereafter $357.03 Canadian (US $232.07) as specialist on-call payment. Review of intra-arterial thrombolysis cases yielded an average reimbursement of $1454.77 Canadian (US $945.60) per case over 29 cases. These latter fees included after-hours supplements and fees.

### Discussion

In this analysis, the authors found that the physician reimbursement for the evaluation and treatment of acute stroke, when compared with other diagnoses commonly treated by neurologists, was relatively low in both the US and Canada. A comparison to other commonly performed services by neurologists can be found in Table 1. Historically, in both countries, procedures tend to be better remunerated than medical consultation and pharmacotherapy. Procedures such...
as injecting botulinum toxin in the outpatient setting receive similar reimbursement (or better, for time spent) as taking care of a critically ill stroke patient, which has a higher level of acuity, severity, and potential medico-legal risk, and requires additional time for the physician to travel to the hospital at a moment’s notice. This disparity in reimbursement is further underscored by comparisons to other medical specialties. For instance, in the US, a dermatologist can remove anywhere from 1 to 14 warts and is reimbursed $83.00 for the procedure, which is similar to a half-hour of critical care.

In Canada, physician reimbursement for acute stroke care is supplemented by additional payments for after-hours care and stipends for being on-call. Extra reimbursement for off-hours work, or for taking calls, is not unique to Alberta; schedules similar to the specialist on-call system are present in British Columbia, Manitoba, and Ontario. This type of remuneration is currently nonexistent in the Cincinnati region, and very uncommon in the US. Some highly specialized surgeons in parts of the US have negotiated on-call stipends with hospitals, but this practice has not yet spread to neurologists for acute stroke care. Despite this extra supplementation, however, Canadian neurologists still have financial barriers to routinely treating acute stroke patients with thrombolysis.

In the Greater Cincinnati area, reimbursement to emergency physicians is even lower than that received by neurologists. This may be in part because of differences in billing practices, in that the ED billing staff never used any other CPT codes besides the critical care codes. Comparisons to the Calgary situation are not available because emergency physicians do not provide acute stroke thrombolytic treatment. Following the historical model of greater procedural reimbursement, neuro-interventionists were better rewarded. It should be noted, however, that in Cincinnati, the reimbursement for angiograms with thrombolysis is the same regardless of the amount of time spent, and intra-arterial thrombolysis cases often last >2 hours. This was not true in Calgary, where after-hours and supplemental fees apply equally to neuro-interventionists as they do to neurologists.

The authors note that the reimbursement received to the Greater Cincinnati/Northern Kentucky stroke team may be higher than many US physicians receive for caring for acute stroke patients. Anecdotally, the authors have learned that many US physicians are not billing for critical care, or they are not billing if thrombolysis is not given. Although the current reimbursement rates are not adequate, centers caring for stroke patients in the US should attempt to maximize the physician reimbursement within the current system. This should include billing critical care CPT codes when appropriate. Physicians in both Canada and US should pay close attention to documentation and include dates, patient identifiers, time spent with the patient, and signatures on all documentation of acute care. In addition, physicians caring for acute stroke should consider lobbying hospitals to reimburse on-call time, as is underway in the Greater Cincinnati region and widespread in Canada.

Physician reimbursement is only one small part of the overall picture. In Alberta, as in other parts of Canada, hospitals are funded from general provincial revenues. Most provinces in Canada have adopted a regional funding envelope where each region’s budget pays for acute care, rehabilitation, and long-term care. This means that therapies like rtPA for stroke that are proven to reduce the number of patients who require rehabilitation and long-term care are strongly positive for the region’s bottom-line budget. Although the initial costs of acute stroke thrombolysis for any given patient are higher, the overall cost to the system on a population basis is probably lower, providing an economic incentive for treatment.

In the United States, hospital reimbursement for stroke (the stroke DRG in the US) is notoriously low; $5793.50 is the national Medicare reimbursement to hospitals for the DRG 14, which covers “Intracranial Hemorrhage or Cerebral Infarction,” and the DRG does not increase if rtPA is given or if complications arise. Therefore, if rtPA is given, even though it saves money for society in general, it loses money for the hospital. This, in turn, makes it difficult to motivate system-wide changes in treating acute stroke patients in the US.

Clearly, physician medical decision-making is more about appropriate medical care and altruism than financial gain. However, as the financial pressures on physicians continue to mount, physicians are having to prioritize their time and commitments more and more. Based purely on financial data, the current systems in the US and Canada would drive physicians toward usual office practice and procedures and away from acute care of stroke. In making acute treatment decisions, the current systems would drive decision-making regarding treatment away from intravenous and toward intra-arterial therapy.

At a minimum, office practice and acute care should be equally reimbursed. Ideally, acute care would be reimbursed at a higher rate to account for the higher acuity, severity, and medico-legal risk acute stroke patients represent. The financial barriers currently in place for physicians and hospitals are, in effect, discouraging adequate and appropriate care for stroke, a major killer and disabler of the public. Health policy decision-makers in the US and Canada should be made aware of the importance of providing a more balanced plan to provide medical care to stroke patients, and physicians need to take a more active role in this process so that they may continue to provide quality care to their patients.

References


A Description of Canadian and United States Physician Reimbursement for Thrombolytic Therapy Administration in Acute Ischemic Stroke

Dawn Kleindorfer, Michael D. Hill, Daniel Woo, Thomas Tomskick, Arthur Pancioli, Brett Kissela, Andrew M. Demchuk, David Losiewicz, Edward Jauch, Alexander Schneider, Andrew Ringer, Daniel Kanter and Joseph P. Broderick

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