

Utilization of Ontario's Health System During the 2003 SARS Outbreak



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An ICES Investigative Report

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Executive Summary

Issue

During the spring of 2003, two waves of Severe Acute Respiratory Syndrome (SARS) occurred within the Greater Toronto Area (GTA), directly affecting the personal health of several hundred Ontario residents. Health care restrictions were imposed during the SARS outbreak, which could have indirectly impacted health care for conditions that were not SARS related. The objective of the study was to examine the impact of SARS restrictions on health system utilization by Ontario residents.

Study

Monthly trends in the utilization of various aspects of the health care system were studied, before and during the SARS outbreak. Utilization during the SARS outbreak was also compared to utilization during the same period one year earlier. The study examined the following areas of the health care system: inpatient and outpatient hospitalization, diagnostic testing, physician and emergency department visits, use of prescription medication, intensive care unit bed availability, and cardiac care.

Key Findings

The health care system's response to SARS, and the response of the public, did influence utilization of health services. In general, the most essential services were least affected, with the greatest impacts on elective services. There was a much greater impact on utilization in the Greater Toronto Area than outside the area. This indirect impact of SARS on utilization appears to have been larger in April of 2003 than May of 2003, indicating that the Ministry of Health and Long-Term Care (MOHLTC) directives during the second wave of SARS caused less collateral damage than those instituted during the first wave.

Implications

While imposing health care restrictions appears to have contained the spread of SARS, it also seems to have decreased health care utilization for non-SARS conditions, in some cases, significantly. In this study, it was not possible to assess whether this decrease in utilization directly affected population health. Thus, to aid decision-making in similar situations, ICES will be undertaking a more extensive study of the health implications of sudden health care restrictions on individual and population health.

Introduction

This study examines how the health system and public response to the Ontario SARS outbreak of 2003 affected utilization of non-SARS related health services. Utilization of various aspects of the health care system within and outside the GTA was compared before and during SARS. It was expected that GTA hospital restrictions would reduce the frequency of many hospital admissions and related procedures. However, if the health care system and the public responded rationally to SARS, it was expected that the response would vary depending on the severity of the conditions studied, with:

- Little or no impact on the management of acute, life-threatening conditions
- A relatively brief impact on important conditions or services for which a delay can have important long-term adverse consequences such as cancer surgery and therapeutic abortion;
- The greatest impact on elective procedures or visits for self-limiting conditions such as cholecystectomy and carpal tunnel release.

Background

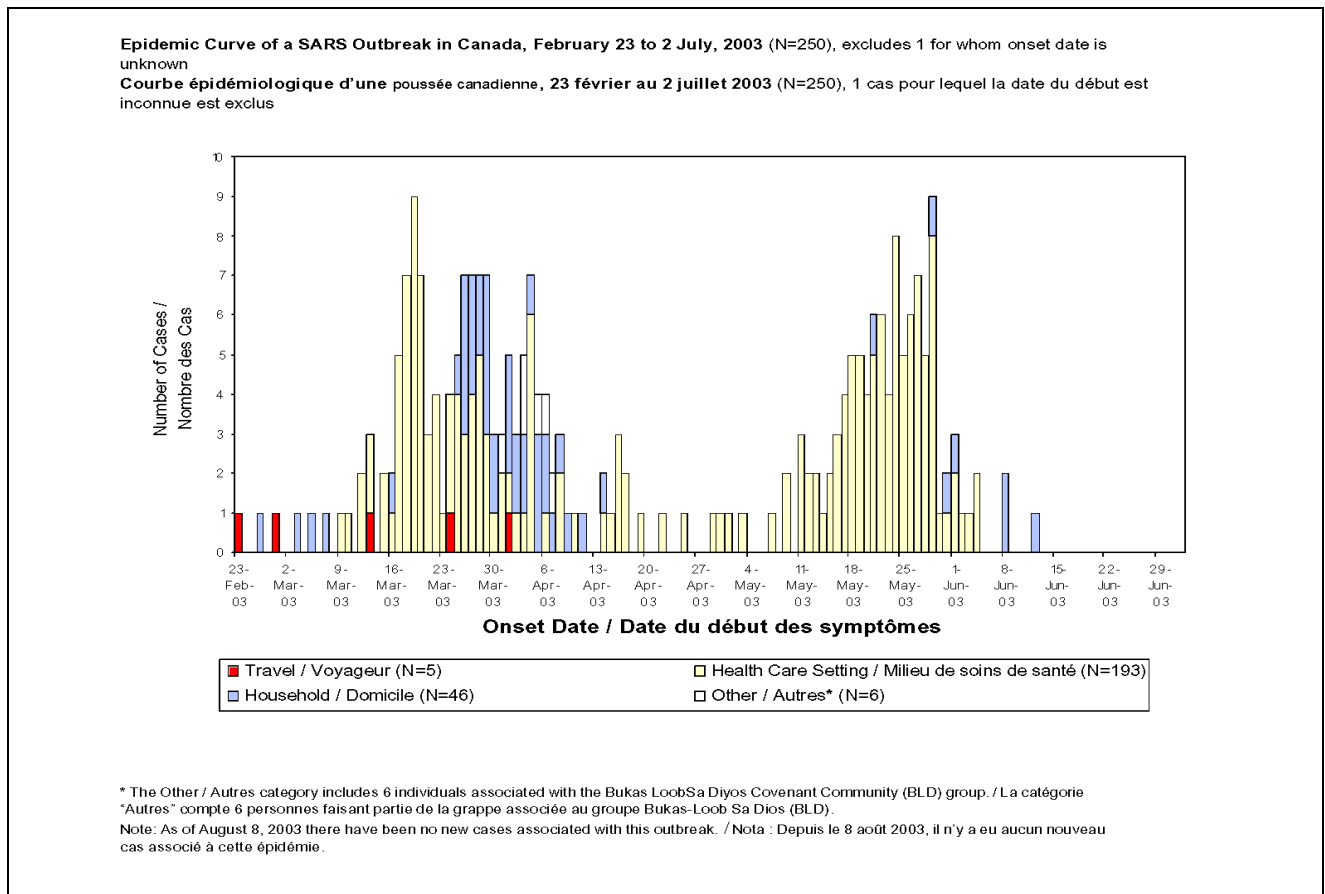
In late February 2003, a Canadian resident returned from Hong Kong with what later became known as Severe Acute Respiratory Syndrome (SARS). The spread of this disease within the Greater Toronto Area (GTA) during the next few months would directly impact the personal health and welfare of hundreds of Ontario residents. The outbreak was largely confined to hospitals, with health care workers accounting for more than half of all SARS cases, and occurred in two closely related but distinct waves known as SARS 1, March 14 to May 16, 2003, and SARS 2, May 27 to July 2, 2003 (Figure 1). As of August 2003, there had been 438 probable and suspect SARS cases in Canada, including 44 deaths. The majority of these individuals were from the GTA. Many more individuals were isolated for precautionary measures.

Fears that the SARS outbreak could worsen within hospitals or spread into the community led to the declaration of a Provincial Health Emergency on March 26, 2003, and the imposition of wide-ranging restrictions on health services. All of the GTA's acute-care hospitals were subject to directives to reduce ambulatory and inpatient medical and surgical activity to urgent cases only, severely restrict visitors, expand respiratory isolation (negative pressure) rooms, and mandate the use of protective garments in high-risk areas. A number of significant dates related to this emergency have been provided in Table 1.

Unprotected SARS transmission took place at three hospitals, Scarborough Grace, York Central, and North York General, which were essentially closed with no new admissions, no surgery, no emergency department activity, and no on-site clinics or specialty services such as oncology for periods lasting from a few weeks to several months. In some cases, although only the ICU was closed, other services such as regional trauma units or emergency departments also severely curtailed activities. This affected surrounding hospitals' ability to manage the overflow, particularly in Emergency Departments. In several cases, the inter-hospital transfer of an unrecognized SARS patient allowed the outbreak to spread to a new site, which led to major restrictions on inter-hospital transfers. Given the large number of tertiary care centres within the GTA, this meant reduced access to highly specialized services, such as cardiac catheterization and MRI, specialized programs such as oncology, neurovascular diseases and trauma, and difficult access to referral for off-site specialty care, within the GTA and in surrounding communities that depend on the GTA for highly specialized care.

In April 2003, family physicians in Ontario were provided guidelines on how to keep potential SARS patients out of doctors' offices, how to safely treat potential cases that do enter the office, and how to protect physician and staff from infection. It is suspected that care provided by physicians in the community may have been indirectly curtailed due to patient screening, decreased efficiency related to working in cumbersome infection control garb and staff absences due to quarantine. Publicity and patient screening methods, such as signs, pre-recorded telephone messages, and questionnaires may also have raised patient fears of seeking care in hospitals or doctors' offices. These factors may have reduced the utilization of community-based health care services, even when available.

Figure 1. Epidemic curve of SARS in Canada[†]



[†]Source: [SARS Outbreak: February 23 to July 2, 2003](http://www.hc-sc.gc.ca/pphb-dgsp/sars-sras/pdf-ec/ec_20030808.pdf), Health Canada, November 17, 2003; http://www.hc-sc.gc.ca/pphb-dgsp/sars-sras/pdf-ec/ec_20030808.pdf

Table 1. Chronology of selected SARS events and MOHLTC directives*

Date	Event/Ministry Directive
February 23, 2003	Elderly woman returns to Toronto with SARS
March 14, 2003	MOHLTC press conference about cluster of atypical pneumonia cases
March 23, 2003	Scarborough Grace Hospital closes
March 26, 2003	Ontario Premier declares SARS a provincial emergency
March 27, 2003	Restrictions begin in all GTA and Simcoe County hospitals
March 28, 2003	York Central Hospital closes
March 31, 2003	Admission and access restrictions extended to all Ontario hospitals
April 3, 2003	All surgical services reinstated in all hospitals outside the GTA
April 3, 2003	Guidelines for family doctors issued
April 20, 2003	All hospitals asked to update CritiCall database every 12 hours
April 21, 2003	Family doctors provided with protective equipment
Late April 2003	GTA hospitals begin to ease infection control precautions
May 17, 2003	Ontario Premier lifts provincial emergency
May 22, 2003	New hospital-based cluster of 5 SARS cases reported to World Health Organization
May 23, 2003	North York General Hospital closed
June 2003	Last probable cases of SARS are identified
July 2003	No Ontario residents under SARS-related quarantine

*Sources:

- 1) Learning from SARS. Renewal of Public Health in Canada. A report of the National Advisory Committee on SARS and Public Health. *Health Canada* 2003.
- 2) Phil Jackson, Director, SARS Expert Panel Secretariat, Ontario Ministry of Health and Long-Term Care, personal communication.

How the Research was Done

Data Sources

- Ontario Hospital Insurance Plan
- Canadian Institute for Health Information Discharge Abstract Database
- National Ambulatory Care Reporting System
- Ontario Drug Benefit program
- Ontario CritiCall program
- Cardiac Care Network of Ontario

Key Measures

Various areas of the health care system were examined for changes in service delivery during SARS:

- Inpatient Procedures
- Outpatient Procedures
- Outpatient Diagnostic Tests
- Physician Visits
- Emergency Department Visits
- Prescription Medication Use
- Intensive Care Bed Availability*
- Cardiac Care**

Analyses

Within each of the identified health care areas, a number of health utilization measures were used as indicators of health system delivery (Table 2). Each service was categorized according to its urgency:

1 = life threatening;

2 = non-life threatening but a delay may cause severe adverse long-term consequences;

3 = non-life threatening with little or no known severe adverse long-term consequences associated with a brief delay.

Urgency ratings were not assigned to totals for health system areas (e.g. Total Physician Visits), Diagnostic Tests, or Intensive Care Bed Availability, as the reason for the service was unknown.

For each indicator, the average daily activity each month was examined within and outside the GTA, for the year preceding SARS and the period of the SARS crisis, essentially April and May of 2003. A GTA versus non-GTA comparison was chosen because SARS-related hospital restrictions were generally limited to the GTA. Although restrictions were placed on some hospitals outside of the GTA for a short period, only the GTA hospitals were affected for the entire SARS crisis.

To assess the impact of SARS on health system utilization, relative to the preceding year, monthly averages for April and May of 2003 were compared to the values for April and May of 2002. Changes from April 2002 to April 2003, and May 2002 to May 2003, were then assessed in light of the expected changes due to regular and random fluctuation.

Additional information about the data sources and methods used in this study is included in Appendix A.

* Data provided by the Ontario CritiCall Program

** Data provided by the Ontario Cardiac Care Network

Limitations

These results show that SARS did affect health service utilization but the analysis has a number of limitations. A major limitation of this study is that it involved a small selected group of relatively crude measures of health care delivery at a system level. The study could not detect relatively infrequent, but important, adverse effects of SARS on the delivery of care to individuals. As well, many aspects of health care delivery were not addressed in this report.

Except for cardiac care, the possible impact of SARS on waiting lists for health care services was not evaluated. It is possible that some patients who would normally have been referred for a service (e.g. cardiac angiography, radiotherapy for cancer) may not have been referred during SARS (either because of patient anxiety about contacting the health care system or lack of capacity). This phenomenon could not be measured.

Subjective, but important, measures such as patient satisfaction, inconvenience, patient anxiety while on waiting lists, and quality of life have not been addressed. Although some procedures may be considered elective (e.g. hip and knee arthroplasty), many patients in Ontario are already waiting many months for procedures that have a large beneficial impact on quality of life, so the impact of further delay should not be underestimated.

While this study evaluated trends in utilization over time, it did not address the appropriateness of the care provided, or the impact of the changes in delivery of care upon mortality or disease recurrence. Because it was not possible to evaluate outcomes, no comment can be made on the possible impact of SARS on the coordinated delivery of care, such as that which would be required to effectively manage a patient with a ruptured abdominal aortic aneurysm.

The methods involved a relatively simple analysis looking for substantial changes over time. Subtle or more complex changes, related to temporal variation, may have gone unnoticed or unaccounted for. As well, there is considerable temporal variability within the health care system that is unrelated to SARS. The frequency of some services, such as medication use, appeared to change steadily before SARS, so that differences between the spring of 2002 and 2003 might reflect or be masked by trends unrelated to SARS. All of these limitations must be considered when interpreting the data and point to the need for further study to more accurately measure the impact that SARS had on the health care system.

Table 2. List of indicators studied to assess the Ontario health system's response to SARS

Health System Indicators	Urgency
1. Inpatient Procedures	
1.1. Elective abdominal aortic surgery	3
1.2. Cholecystectomy	3
1.3. Hip or knee replacement	3
1.4. Transurethral resection of prostate	3
1.5. Carotid endarterectomy	2
1.6. Colectomy	2
1.7. Thoracotomy	2
1.8. Total prostatectomy	2
1.9. Lumpectomy or mastectomy	2
1.10. Physician initiation of mechanical ventilation	1
2. Outpatient Procedures	
2.1. Vasectomy	3
2.2. Myringotomy	3
2.3. Carpal tunnel release	3
2.4. Cataract surgery	3
2.5. Therapeutic abortion	2
2.6. Breast biopsy	2
2.7. Injection or infusion of chemotherapy	2
3. Outpatient Diagnostic Tests	
3.1. Magnetic resonance imaging (MRI)	NA
3.2. Computed tomography (CT) scan	NA
3.3. Colonoscopy	NA
3.4. Cystoscopy	NA
3.5. Transthoracic echocardiography	NA
4. Physician Visits	
4.1. Total visits	NA
4.2. Pre-natal care	2
4.3. Well-baby care	2
4.4. Infant immunization	2
5. Emergency Department Visits	
5.1. Total visits	NA
5.2. Extremity strain or sprain	3
5.3. Cuts	2
5.4. Superficial injuries	3
5.5. Upper or lower respiratory infection or rhinitis	2
5.6. Otitis media	2
5.7. Back or neck pain	3
6. Prescription Medication Use	
6.1. All Ontario Drug Benefit claims	2
6.2. Antibiotic claims	2
6.3. Statin claims	3
6.4. Non-steroidal anti-Inflammatory claims	2
6.5. Angiotensin converting enzyme inhibitor (ACEI) & angiotensin receptor blocker (ARB) claims	3
6.6. Anti-psychotic medication claims	1
6.7. Anti-epileptic medication claims	1
7. Intensive Care Bed Availability	
7.1. Number of available ICU beds	NA
7.2. Number of available ICU beds in the GTA by hospital size	NA
8. Cardiac Care**	
8.1. Number of surgery cases waiting, completed, and cancelled	2
8.2. Number of percutaneous coronary intervention (PCI) cases waiting, completed, and cancelled	2
8.3. Number of catheterizations (CATH) cases waiting, completed, and cancelled	2

*1 = life threatening; 2 = non-life threatening but a delay may cause severe adverse long-term consequences; 3 = non-life threatening with little or no known severe adverse long-term consequences associated with a brief delay; NA = not applicable

** Some cardiac care is very urgent whereas some care is relatively non-urgent. Thus, an urgency score of 2 was assigned overall.

Findings and Discussion

The findings of this study clearly demonstrate that the health care system's response to SARS, and that of the public, did affect utilization, although the impact was not uniform. In general, the most essential services appear to have been least affected while the greatest effects appear to have been on the elective services. As well, the impact in April 2003 appears to have been greater than in May 2003, suggesting that the MOHLTC directives during SARS 2 caused less collateral damage than those instituted during SARS 1.

Service levels in April and May 2003 compared to the same months a year earlier have been summarized in Table 3. Monthly trends are summarized in the following section of Exhibits. Based on Table 3 (see page 10) and the exhibits, the following generalizations seem appropriate for the eight areas of the health care system that were studied.

1. Inpatient Procedures

All of the least urgent services (Exhibits 1.1–1.4) declined in the GTA during April 2003, and some major decreases were observed outside of the GTA (Exhibits 1.2 and 1.4). Some decreases in cancer services during the SARS outbreak were also identified (Exhibits 1.5–1.9) but these declines were not consistent within the GTA or within a specific month (April or May). Unexpected however, was the major decrease within the GTA for the Initiation of Mechanical Ventilation (Exhibit 1.10). It is suspected that this was at least partially due to a decrease in major surgery that requires this type of care, such as coronary artery bypass surgery. Limited availability of hospitalization admission data at the time of our analyses hindered the ability to further assess the impact of SARS on the hospital sector, especially with respect to overnight hospital admissions for various non-surgical conditions.

2. Outpatient Procedures

Not surprisingly, the least urgent procedures declined dramatically during April 2003 within the GTA but also outside the GTA (Exhibits 2.1–2.4). This was expected given the MOHLTC directive to halt all elective surgery, and these services appear to have rebounded to previous levels in May 2003. The more essential procedures also appear to have been impacted by SARS during April and May 2003, primarily within the GTA (Exhibits 2.5–2.6). Much less of an impact was seen on the most essential outpatient procedure studied, chemotherapy, but there still appears to have been a considerable decline in the GTA during May 2003, with a smaller decline the same month outside the GTA (Exhibit 2.7).

3. Outpatient Diagnostic Tests

Outpatient diagnostic testing appears to have suffered some of the most dramatic changes during SARS, especially within the GTA during April 2003 (Exhibits 3.1–3.5). Again, this can be linked to MOHLTC directives, which were in place for a much longer period within the GTA than over the rest of the province.

4. Physician Visits

There was a decline in overall physician visits within the GTA, primarily in April 2003, but also in May 2003 (Exhibit 4.1). Declines in physician visits for the specific indicators studied were not as great (Exhibits 4.2–4.4). During April 2003, there were some decreases within the GTA for visits to provide well-baby care and immunization of children less than 3 years of age (Exhibits 4.2 and 4.3). These declines, which were not evident in May 2003, are likely due to the precautions imposed on the physician offices during the SARS outbreak. While this decline appears small in relative terms, it represents a substantial number of visits.

5. Emergency Department Visits

There were major decreases in emergency department use during SARS, both within and outside the GTA (Exhibit 5.1). These decreases were found for many of the conditions studied and were expected for many of the less urgent conditions, such as strains, superficial injuries, and back pain (Exhibits 5.2, 5.4 and 5.7).

6. Prescription Drug Use

Overall, claims to the Ontario Drug Benefit Plan have steadily increased over the past 18 months (Exhibit 6.1). This trend was observed within and outside of the GTA for most of the medications studied, including statins, angiotensin converting enzyme inhibitors (ACEI) and angiotensin receptor blockers (ARB), anti-psychotics, and anti-epileptics (Exhibits 6.2–6.7). This upward trend makes interpretation of the findings more difficult. However, it appears SARS had little effect on drug use, but more sophisticated time series analysis is required to be certain.

7. Availability of Intensive Care Unit Beds

CritiCall data showed that the number of available and staffed Intensive Care Unit (ICU) beds in the GTA began to rise dramatically within the GTA in April of 2003 and continued to increase until July 2003. Similar increases were not found outside the GTA (Exhibit 7.1). This marked increase in apparent availability of critical care beds during and after the SARS outbreak occurred in large and small GTA hospitals (Exhibit 7.2) and does not correspond with anecdotal reports from the field of a shortage of critical care capacity during SARS.

Additional analyses of these data revealed that the mean number of beds available per week approached zero during the week of March 23, 2003 (Appendix B), but the number of beds quickly recovered to pre-SARS levels and then doubled during the week of April 20, 2003. This doubling of beds coincided with a MOHLTC directive for hospitals to increase the frequency of reporting from once to twice per day. There were also large hospital-specific fluctuations in the data (sometimes up to 15 to 20 beds over one day), with some hospitals having reported a negative number of beds some days if critical care patients were being cared for in the emergency department. This raises some concerns about the data being reported by hospitals in the CritiCall network, and no conclusions about the impact of SARS on critical care bed capacity were drawn.

8. Cardiac Care

There were major changes in cardiac care during the SARS outbreak (Exhibits 8.1–8.4). Many of these changes occurred within the GTA during April 2003, but changes also were seen in May 2003. The mean number of bypass surgeries, percutaneous coronary interventions (PCI), and catheterizations (CATH) completed each month in the GTA decreased substantially in April 2003, accompanied by large increases in cancellations (Exhibits 8.1–8.3). The impact on the mean number of patients waiting for care was inconsistent and difficult to interpret due to prior fluctuations in PCI and CATH and a general increase in the number of cases on the bypass surgery waiting list over the past year.

Given the reduced number of completions and increased cancellations, it was expected that there would be large increases in the number of patients waiting for cardiac care in April of 2003, but this was not the case. This suggests that there may have been a decrease in referrals for these procedures or a change in the threshold for intervention during the SARS outbreak. Unfortunately, data on waiting times did not allow a GTA versus non-GTA comparison.

Table 3. Comparison of health care service provision in April and May of 2003 to April and May of 2002 within and outside of the GTA

Health Care Service	Average Daily Number of Services Provided per Month*														Average Expected Variation	
	GTA							Non-GTA								
	Apr-02	May-02	Apr-03	May-03	% Change (Apr)	% Change (May)	Expected Variation **	Apr-02	May-02	Apr-03	May-03	% Change (Apr)	% Change (May)	Expected Variation		
Inpatient Procedures																
Elective abdominal aortic surgery	2	2	1	2	-24%	0%	16%	3	3	3	3	11%	3%	14%	15%	
Cholecystectomy	30	30	14	28	-54%	-7%	8%	45	42	36	39	-19%	-6%	9%	8%	
Hip/knee replacement	22	22	10	21	-55%	-7%	14%	27	27	26	27	-5%	0%	13%	14%	
Transurethral resection of prostate	10	8	5	9	-54%	10%	13%	13	11	10	11	-23%	-1%	10%	12%	
Carotid endarterectomy	1	1	1	1	-37%	6%	20%	2	3	2	2	19%	-21%	21%	20%	
Colectomy	5	6	5	5	-6%	-23%	13%	9	10	8	9	-7%	-9%	9%	11%	
Thoracotomy	3	3	3	3	12%	8%	18%	4	4	4	3	-1%	-30%	17%	17%	
Total prostatectomy	4	3	3	4	-8%	23%	15%	4	3	3	3	-6%	-6%	12%	14%	
Lumpectomy or mastectomy	30	28	23	27	-25%	-6%	9%	28	30	27	27	-2%	-13%	6%	8%	
Initiation of mechanical ventilation	47	47	39	43	-17%	-8%	4%	51	48	46	45	-10%	-5%	5%	5%	
Outpatient Procedures																
Vasectomy	18	15	1	15	-93%	0%	14%	32	27	15	23	-55%	-15%	15%	15%	
Myringotomy	22	20	6	17	-71%	-16%	18%	34	33	26	30	-24%	-10%	15%	17%	
Carpal tunnel release	9	9	4	11	-57%	18%	16%	23	22	22	27	-5%	25%	14%	15%	
Cataract extraction	84	81	25	82	-70%	1%	13%	138	140	123	141	-11%	1%	11%	12%	
Therapeutic abortion	16	14	10	11	-39%	-21%	12%	28	29	27	25	-2%	-13%	8%	10%	
Breast biopsy	11	13	8	10	-27%	-24%	9%	11	12	10	11	-11%	-3%	12%	11%	
Injection or infusion of chemotherapy	127	134	119	112	-6%	-16%	8%	110	109	113	102	2%	-6%	6%	7%	
Outpatient Diagnostic Tests																
MRI	221	224	109	219	-51%	-2%	7%	244	249	218	268	-11%	7%	6%	6%	
CT Scan	786	820	517	797	-34%	-3%	4%	1,054	1,063	1,002	1,109	-5%	4%	3%	4%	
Colonoscopy	413	417	230	380	-44%	-9%	9%	448	455	388	459	-13%	1%	8%	8%	
Cytoscopy	190	181	80	182	-58%	1%	9%	279	260	232	278	-17%	7%	8%	8%	
Transthoracic echocardiography	638	652	490	618	-23%	-5%	7%	587	585	517	566	-12%	-3%	8%	8%	

* Averages have been rounded to the nearest whole number. However, the percentage change in April and May is based on original, non-rounded data.

** Expected Variation was calculated as the Standard Deviation (SD) divided by the mean, expressed as a percentage. It is calculated using the SD and Mean of the Daily Averages from January 2002 through February 2003. See Appendix A for more details.

Physician Visits															
Total visits	148,454	141,847	124,052	130,950	-16%	-8%	6%	163,991	157,756	153,942	151,340	-6%	-4%	6%	6%
Prenatal care	1,756	1,734	1,809	1,714	3%	-1%	4%	1,790	1,751	1,845	1,725	3%	-1%	5%	5%
Well-baby care	1,260	1,207	1,159	1,242	-8%	3%	5%	1,227	1,171	1,190	1,178	-3%	1%	5%	5%
Immunization (2 and Under)	875	831	798	854	-9%	3%	6%	634	590	644	624	1%	6%	8%	7%
Emergency Department Visits															
Total visits	3,784	3,830	2,828	3,119	-25%	-19%	4%	7,495	7,700	6,285	7,001	-16%	-9%	4%	4%
Extremity strain/sprain	173	198	99	129	-43%	-35%	10%	442	504	217	285	-51%	-43%	11%	10%
Cuts	81	86	52	69	-35%	-20%	21%	168	194	95	125	-43%	-35%	30%	26%
Superficial injuries	104	111	67	82	-35%	-27%	11%	251	301	118	151	-53%	-50%	23%	17%
URI/LRI/rhinitis	168	143	137	115	-19%	-20%	26%	708	649	393	334	-45%	-49%	23%	25%
Otitis media	51	42	22	24	-58%	-42%	24%	207	189	79	80	-62%	-58%	24%	24%
Back/neck pain	76	77	40	53	-47%	-31%	4%	193	212	91	109	-53%	-49%	6%	5%
Medication															
Total claims	51,090	50,804	55,862	55,720	9%	10%	6%	72,988	72,532	82,922	80,770	14%	11%	6%	6%
Antibiotics	1,892	1,809	1,717	1,686	-9%	-7%	10%	2,590	2,430	2,517	2,384	-3%	-2%	10%	10%
Statins	2,629	2,622	3,165	3,132	20%	19%	9%	3,195	3,219	4,015	3,948	26%	23%	10%	9%
NSAIDs	2,606	2,553	2,521	2,601	-3%	2%	4%	3,537	3,503	3,648	3,648	3%	4%	5%	4%
ACEI + ARB	3,977	3,975	4,571	4,533	15%	14%	8%	5,538	5,528	6,554	6,391	18%	16%	8%	8%
Anti-psychotics	1,038	1,081	1,359	1,367	31%	26%	11%	1,632	1,661	2,135	2,068	31%	25%	10%	11%
Anti-epileptics	376	384	444	444	18%	16%	9%	611	612	738	719	21%	17%	7%	8%
Available ICU Beds															
Total beds	7	6	10	12	34%	82%	24%	67	58	68	60	1%	3%	14%	19%
Cardiac Care															
Surgery vases waiting	158	157	182	165	15%	5%	6%	100	94	125	131	25%	39%	12%	9%
Surgery cases completed	127	123	77	112	-40%	-9%	9%	95	96	85	93	-10%	-3%	8%	8%
Surgery cases cancelled	13	20	46	22	254%	9%	18%	14	18	18	16	22%	-12%	18%	18%
PCI cases waiting	83	94	68	60	-18%	-36%	8%	42	42	40	39	-6%	-8%	7%	7%
PCI cases completed	151	151	89	140	-41%	-7%	7%	118	117	118	124	0%	6%	5%	6%
PCI cases cancelled	2	1	26	8	1067%	1550%	77%	2	2	6	2	158%	-27%	44%	61%
CATH cases waiting	129	134	164	169	27%	27%	16%	153	159	187	175	22%	10%	7%	11%
CATH cases completed	270	289	131	259	-51%	-10%	8%	182	189	156	186	-14%	-2%	7%	7%
CATH cases cancelled	6	6	57	14	873%	118%	24%	6	4	19	9	225%	95%	59%	41%

Data sources: Ontario Health Insurance Plan, Ontario Drug Benefit Plan, CriteCall Network, Cardiac Care Network of Ontario

Exhibits

The following charts show how utilization of health care changed in Ontario during the SARS outbreak. The plots are grouped according to the areas of the health care system studied (Table 2) and show the average daily number of services provided per month within and outside of the GTA.*

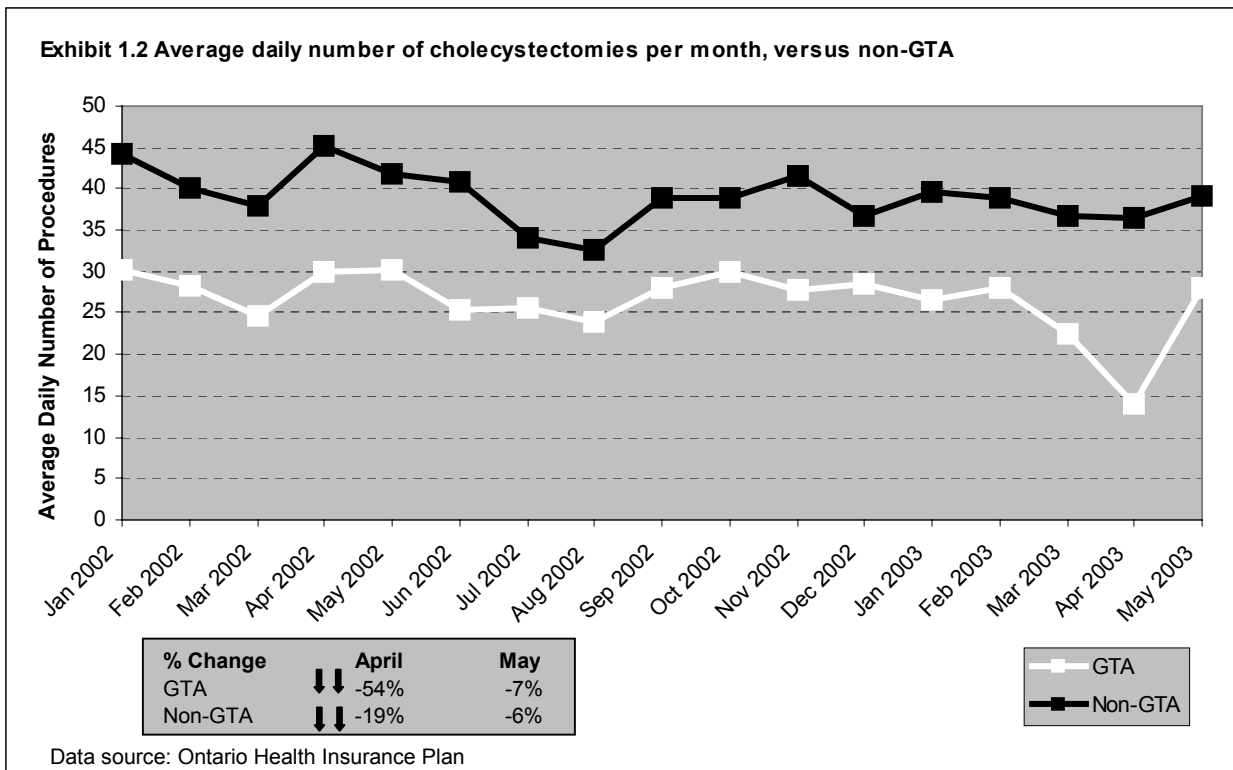
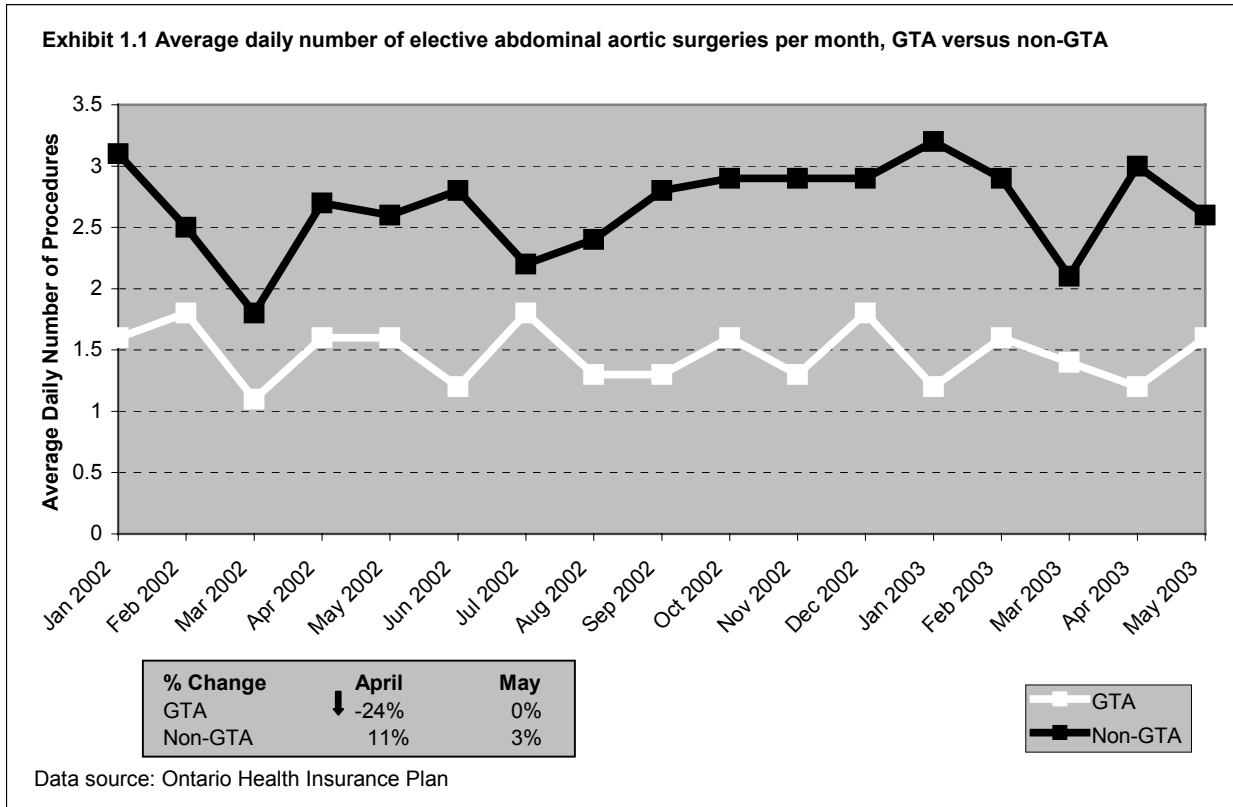
Changes during the SARS outbreak (April and May 2003), compared to the same month a year earlier, also are shown. An increase or decrease is identified by one upward or downward arrow, and upward or downward double arrows identify a major increase or decrease.

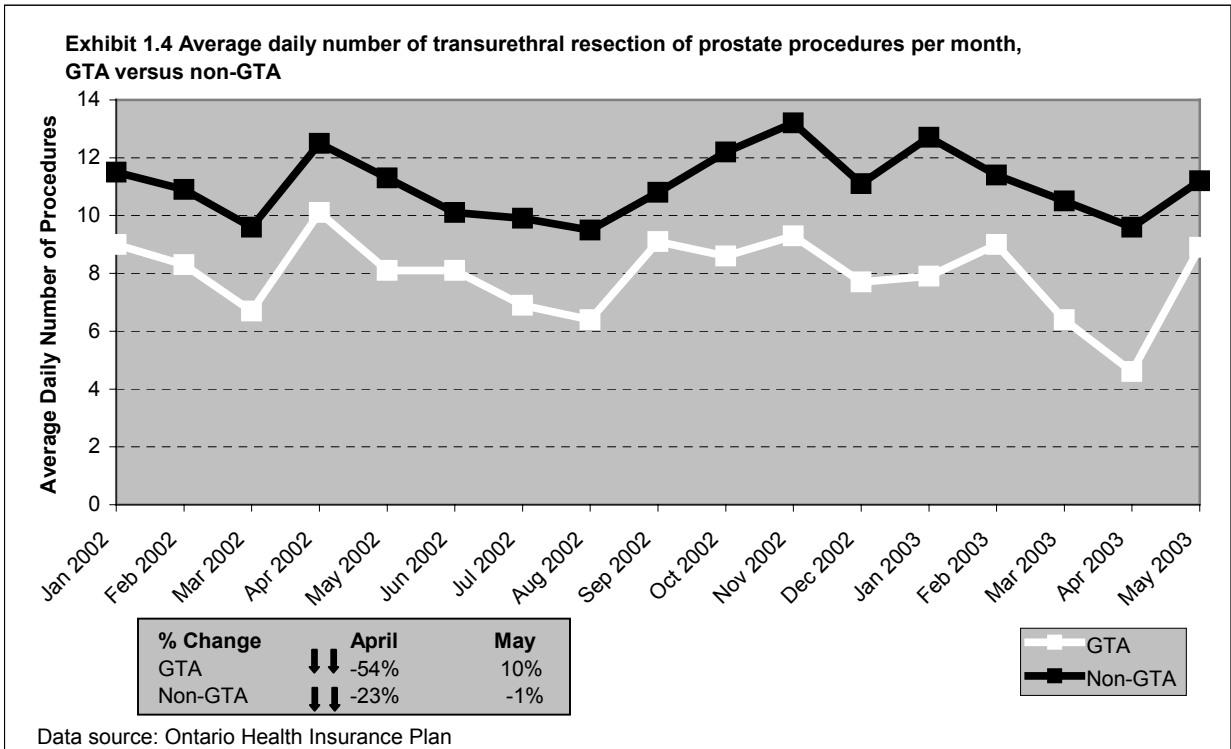
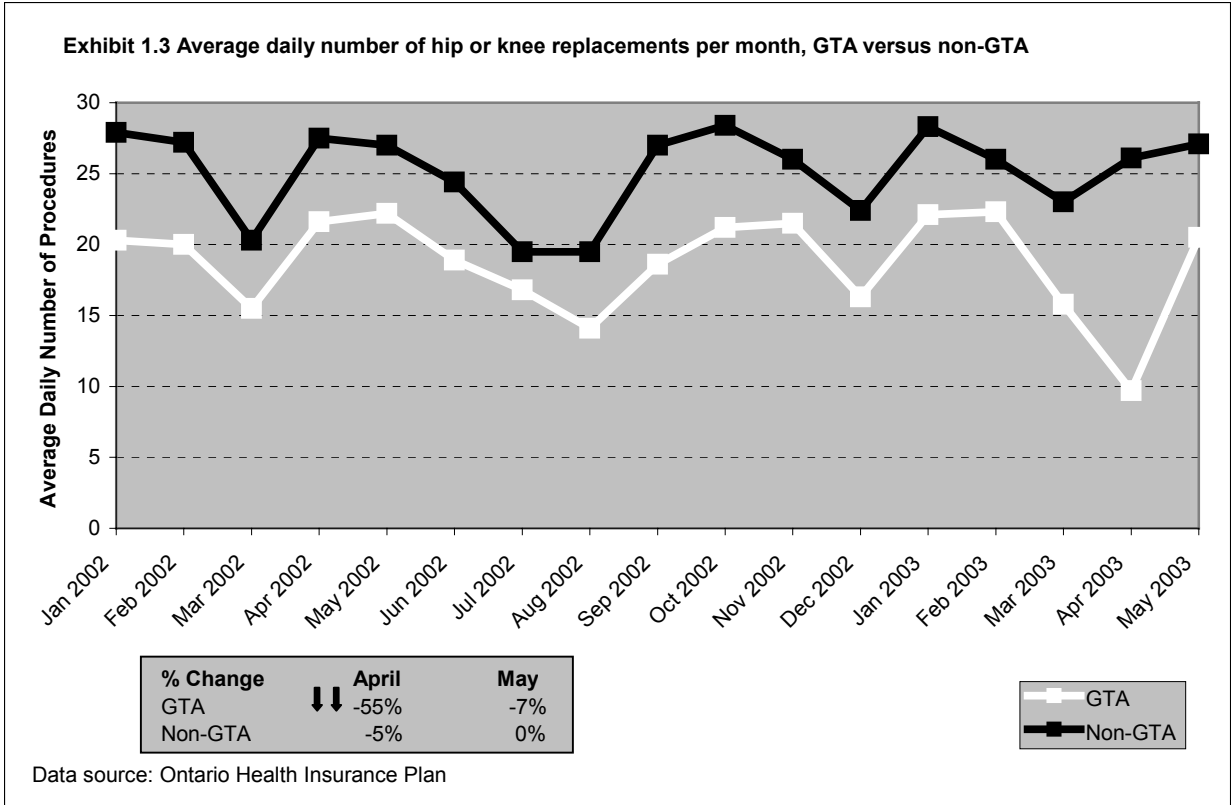
↑	= Increase
↓↓	= Major decrease

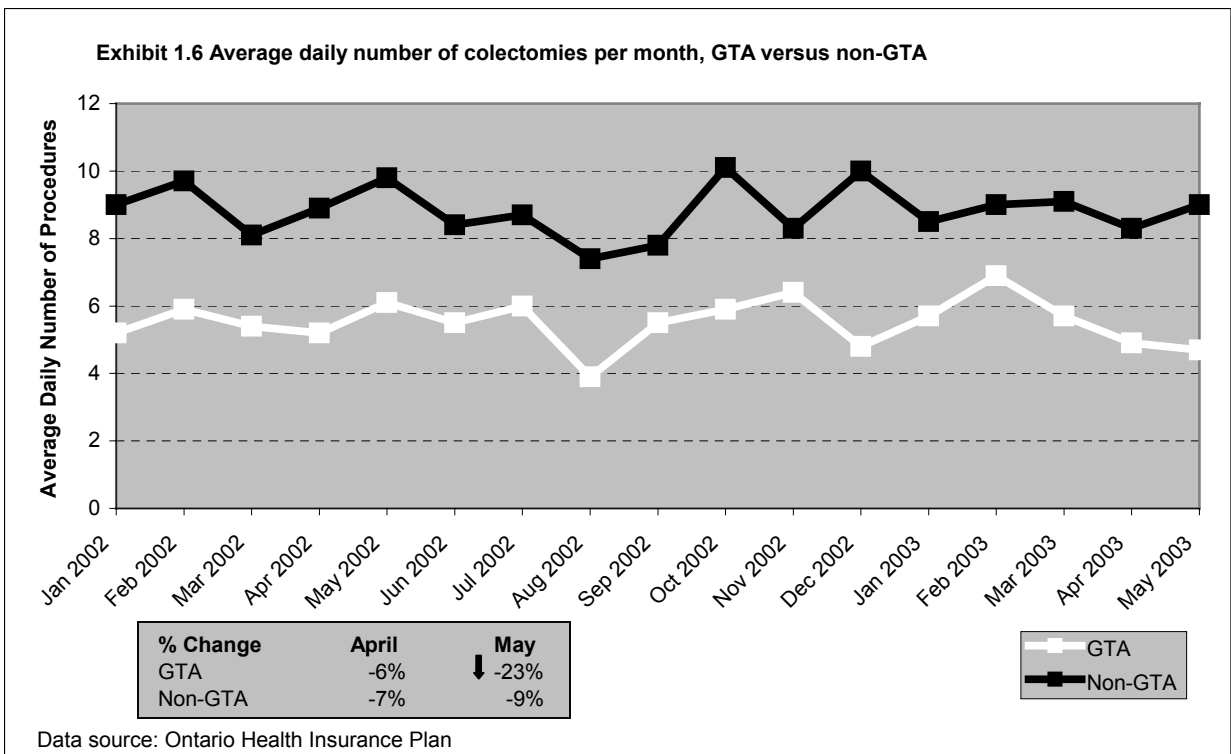
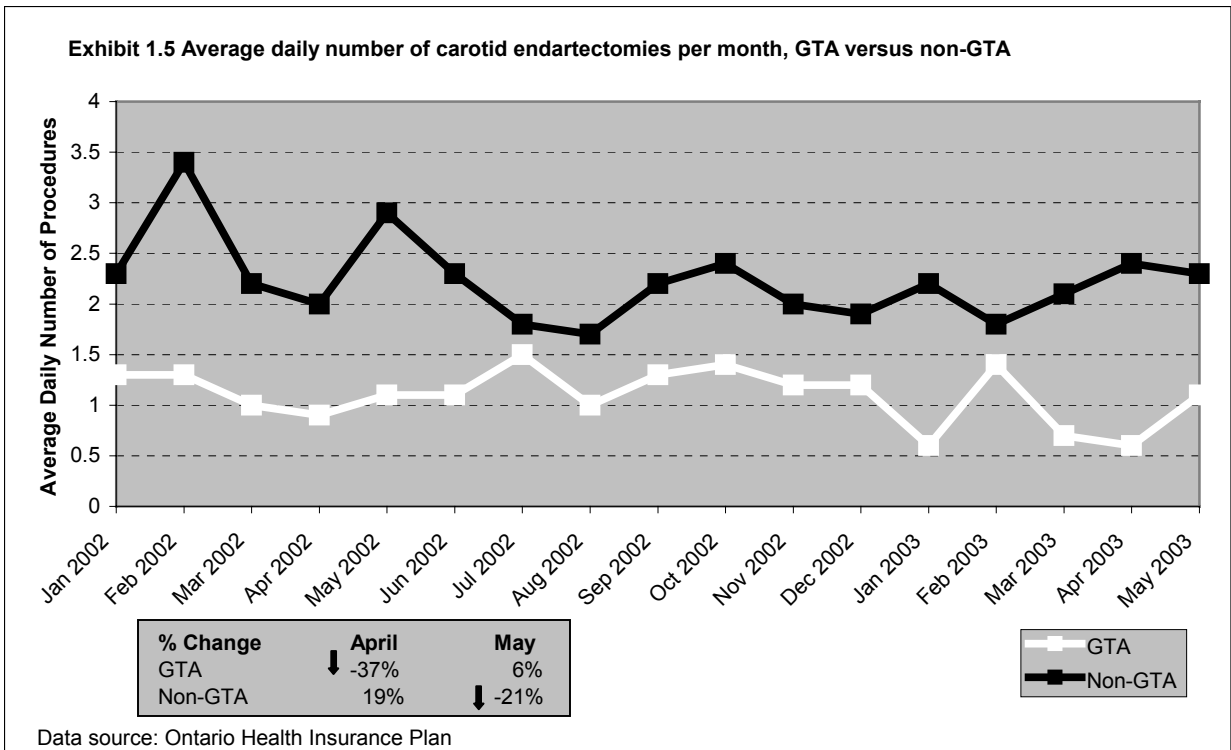
Greater detail regarding the associated methods is provided in Appendix A.

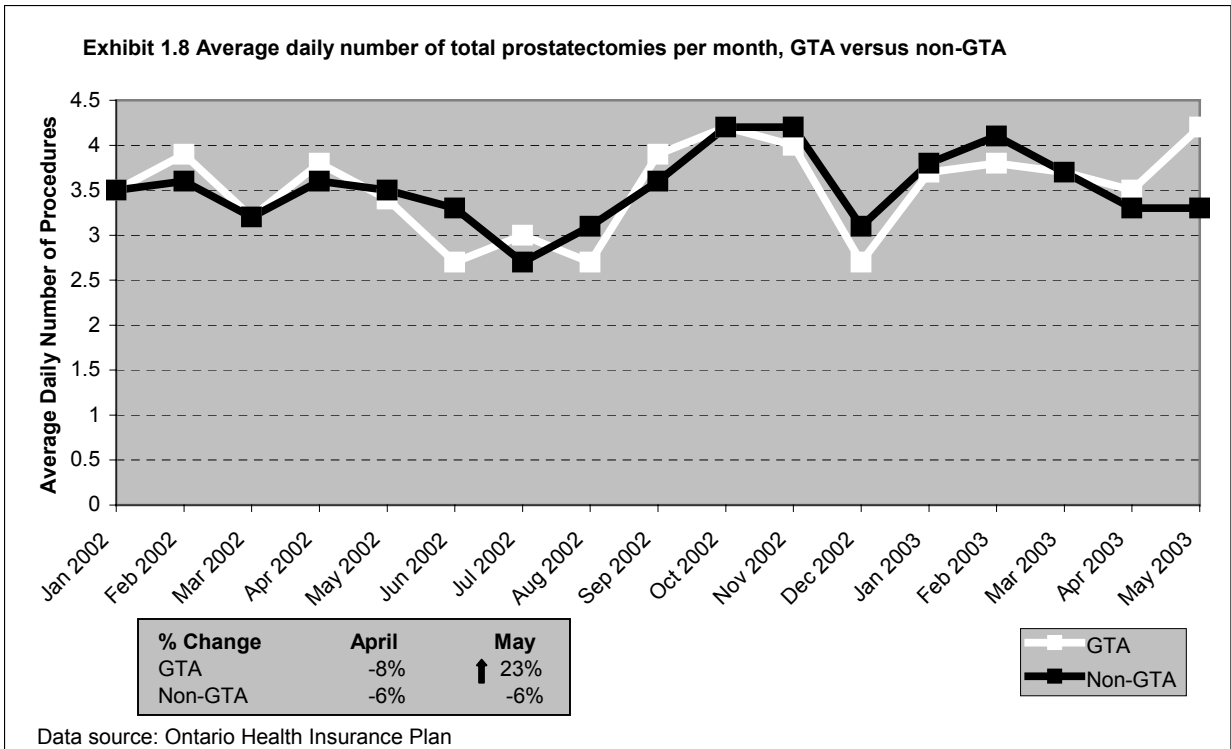
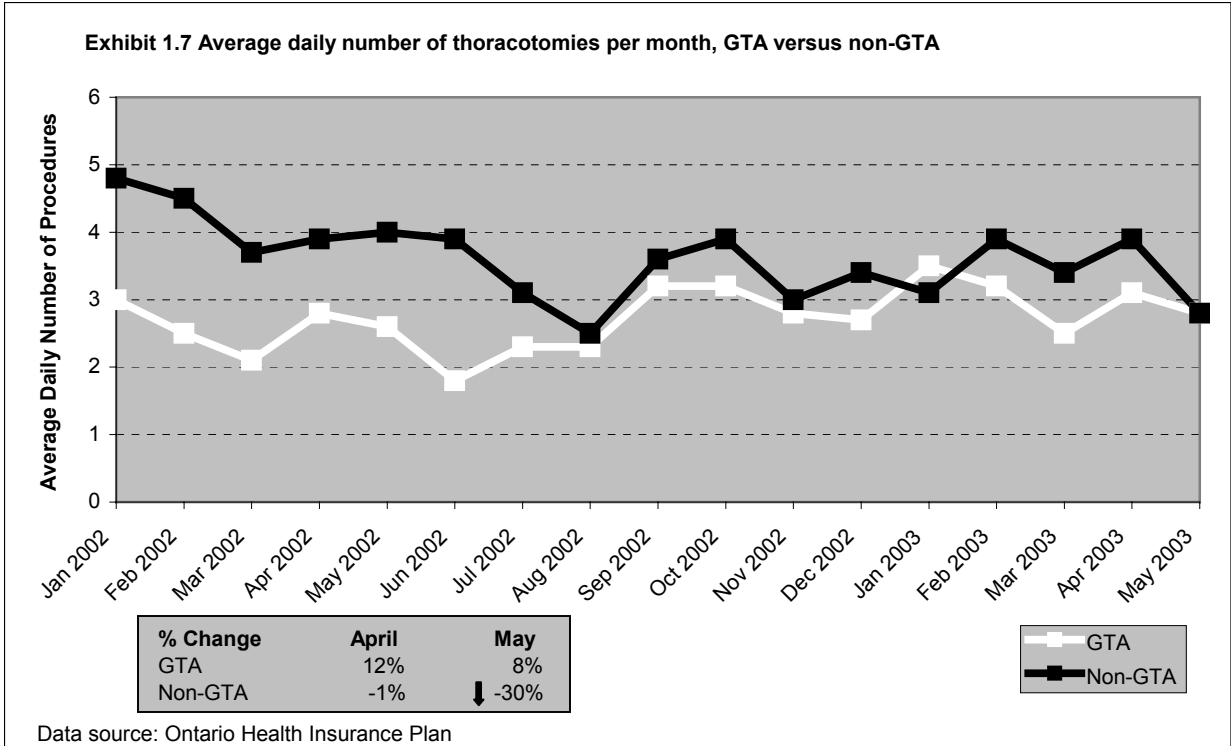
*Cardiac care charts show the average number of services per hospital per month, as the data provided did not allow us to calculate the average daily number of services.

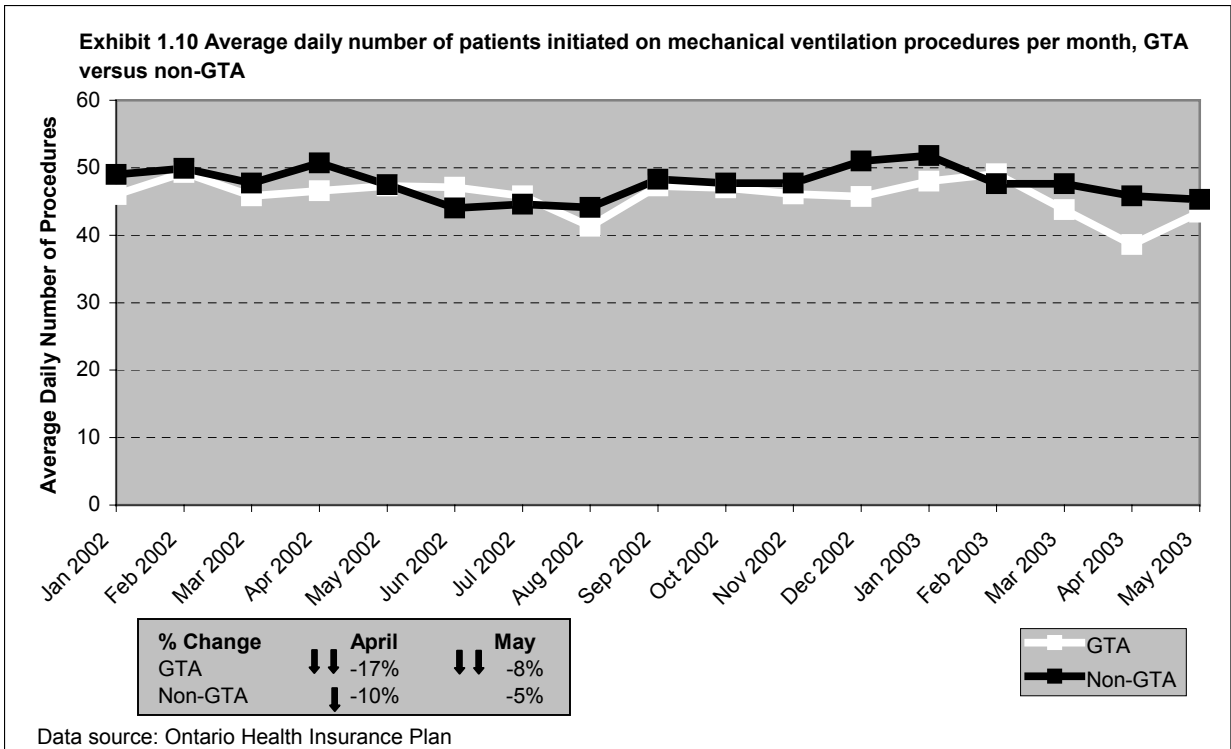
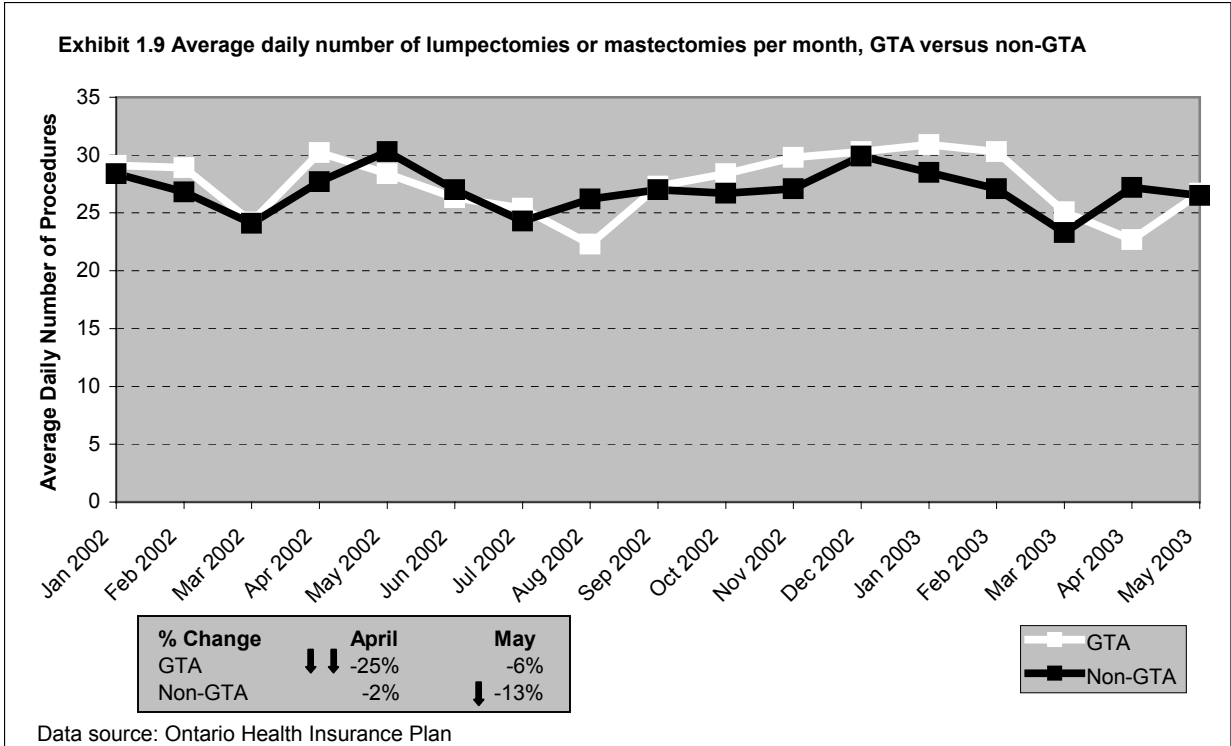
1. Inpatient Procedures



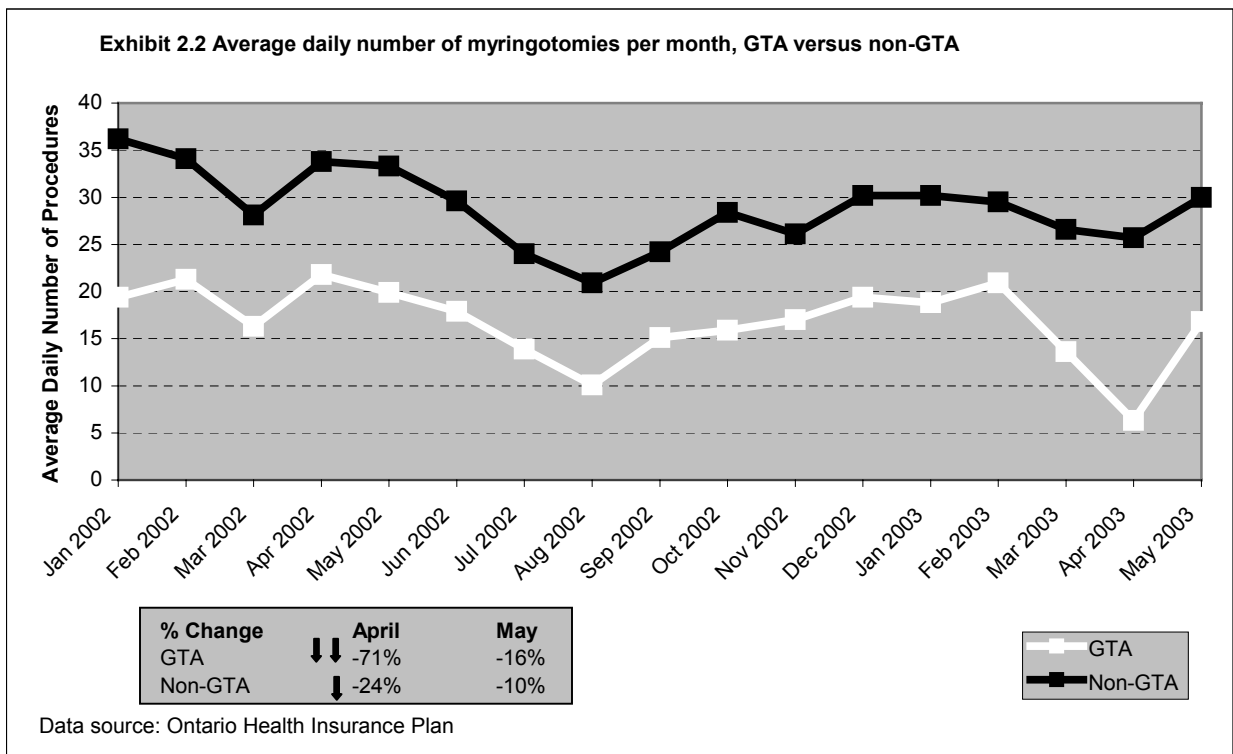
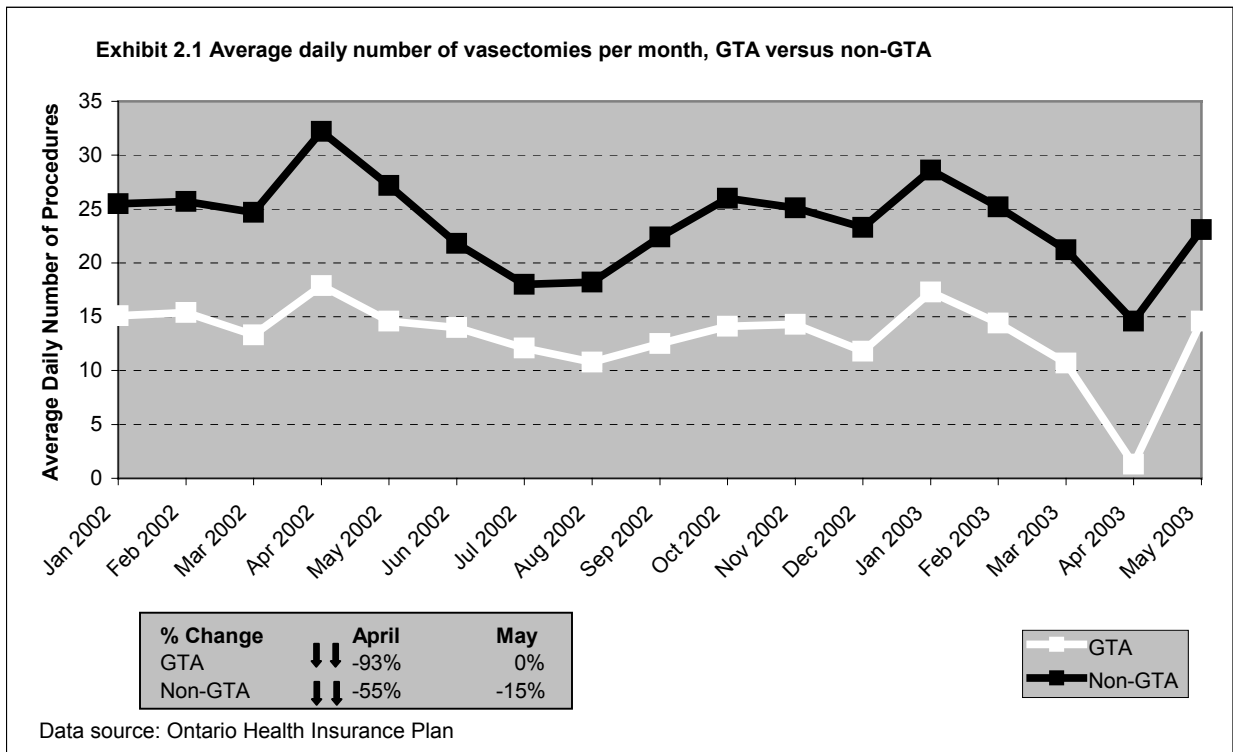


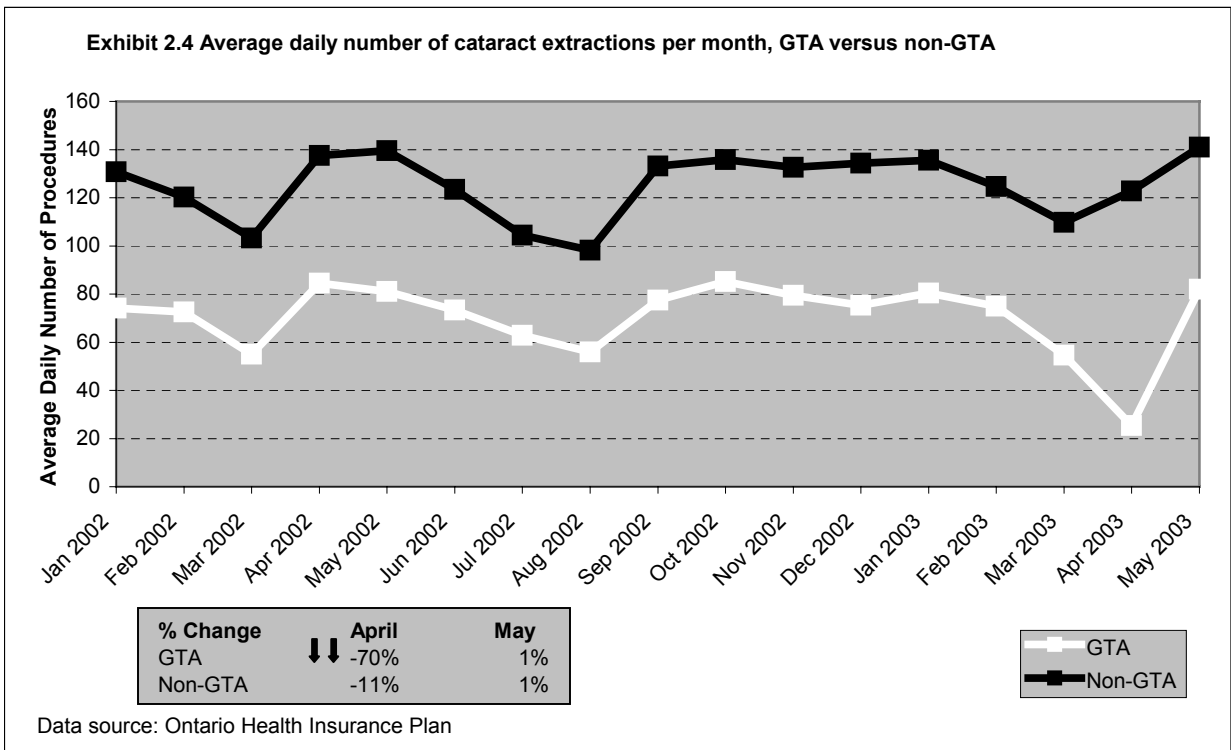
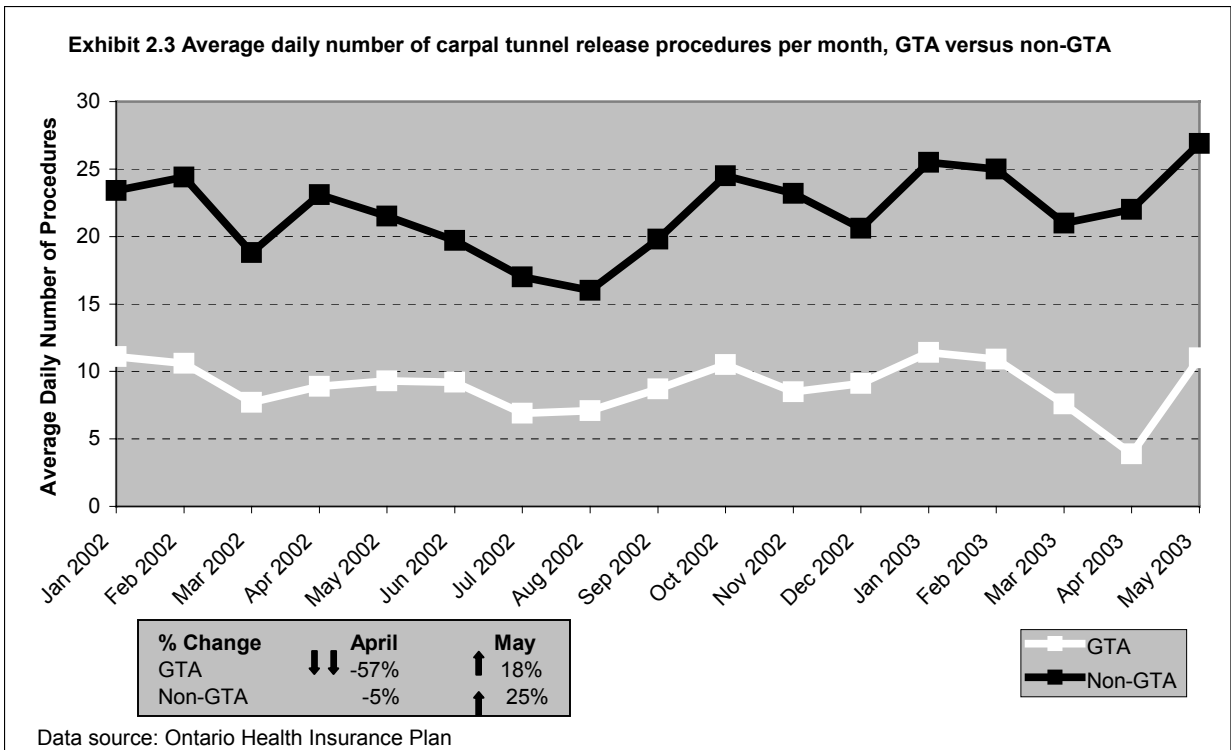






2. Outpatient Procedures





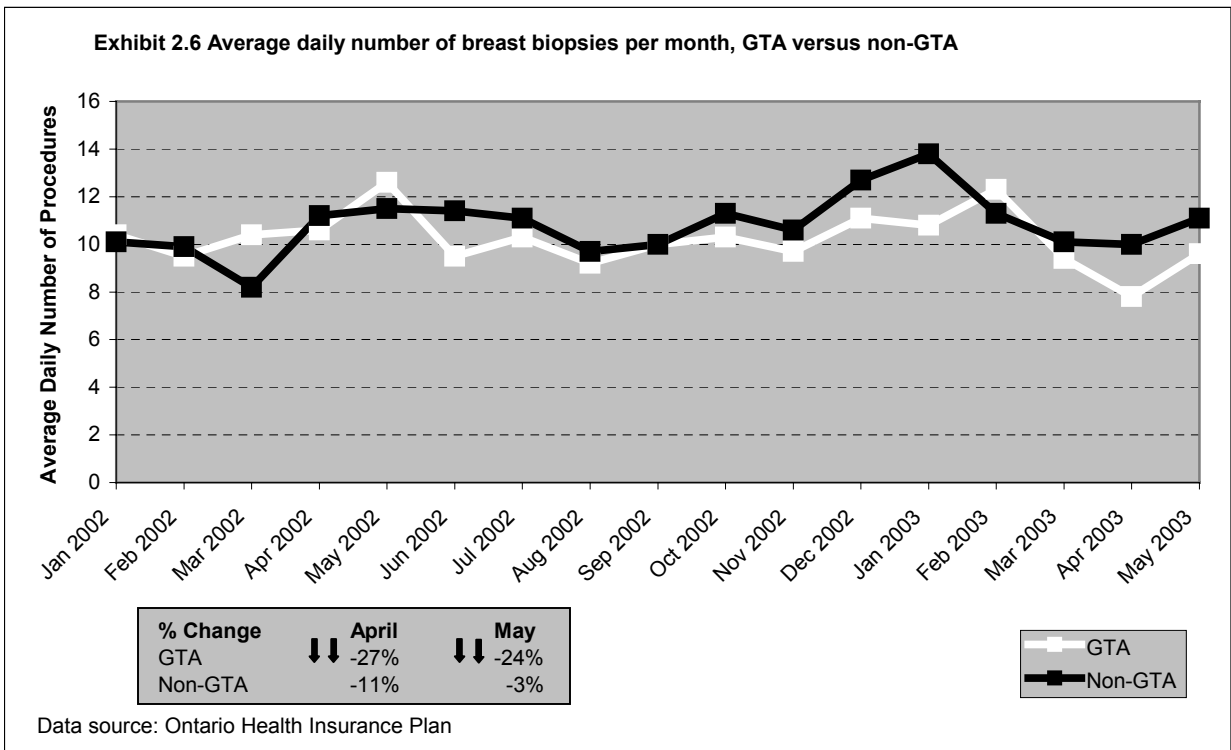
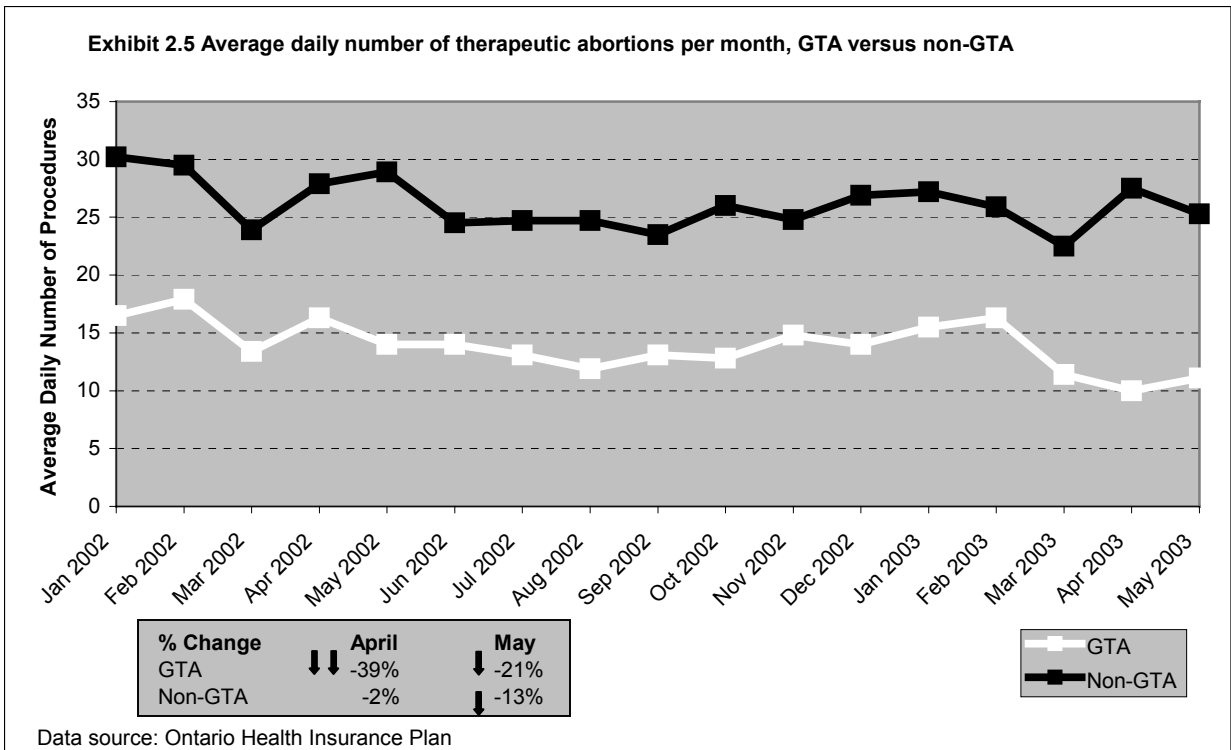
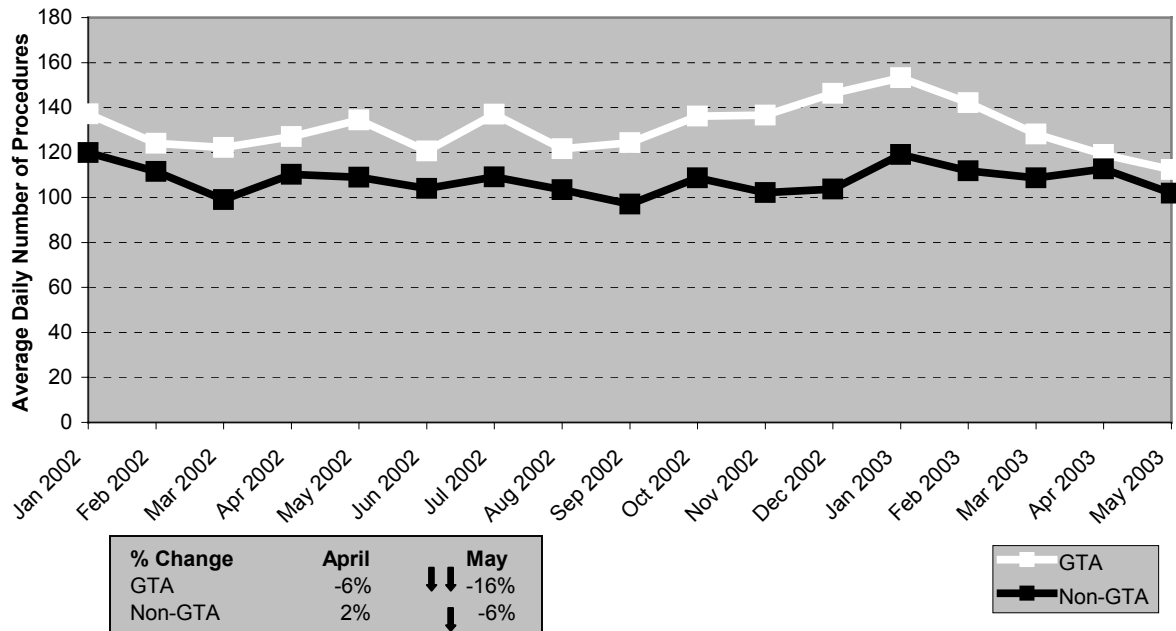
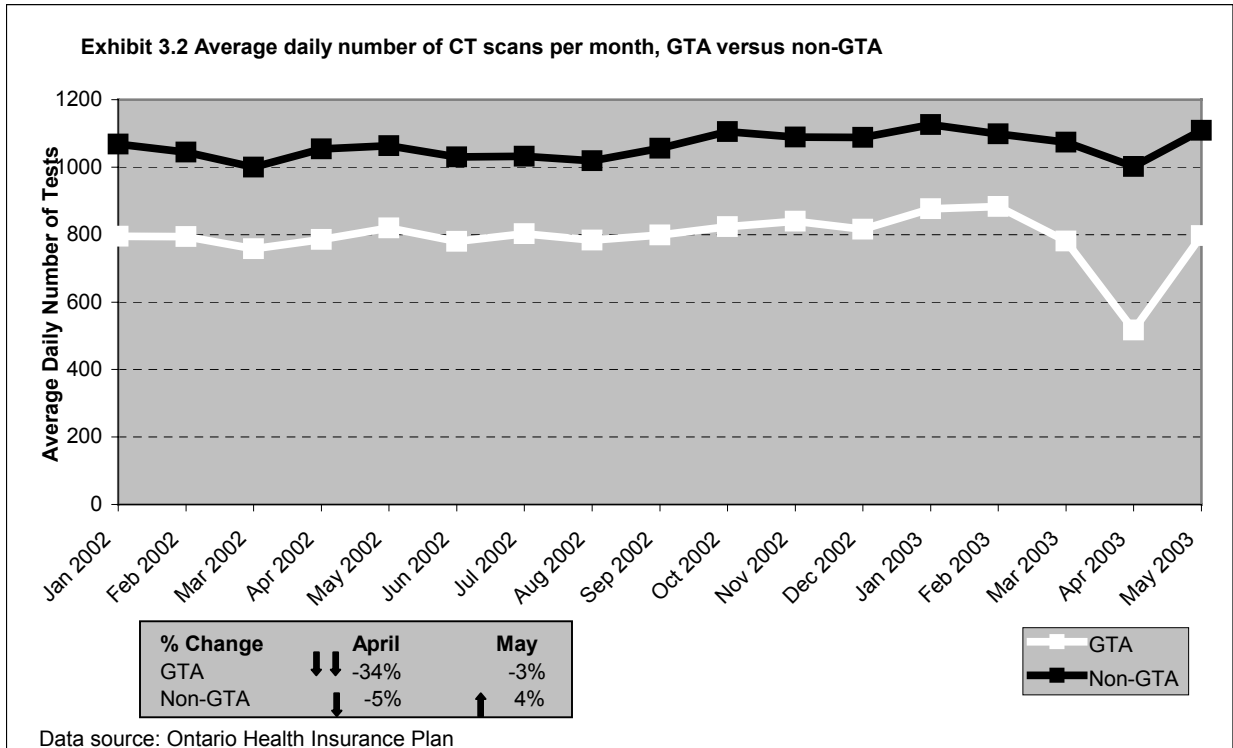
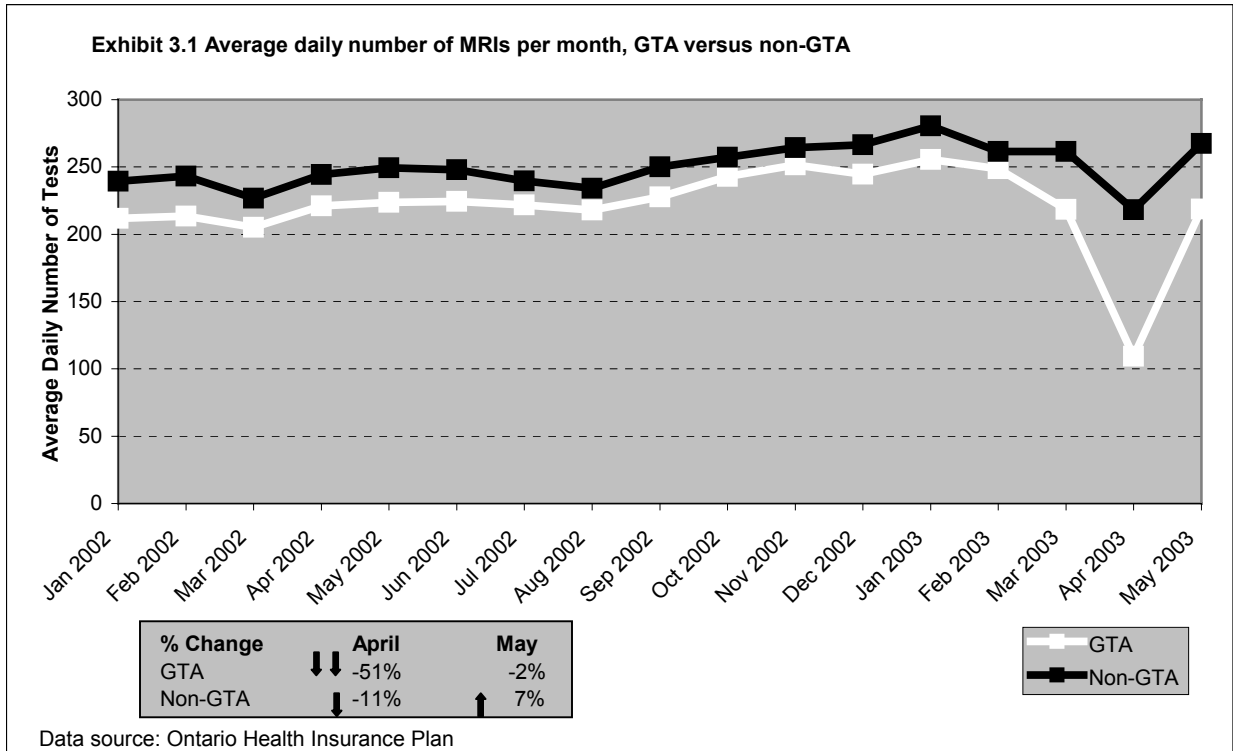


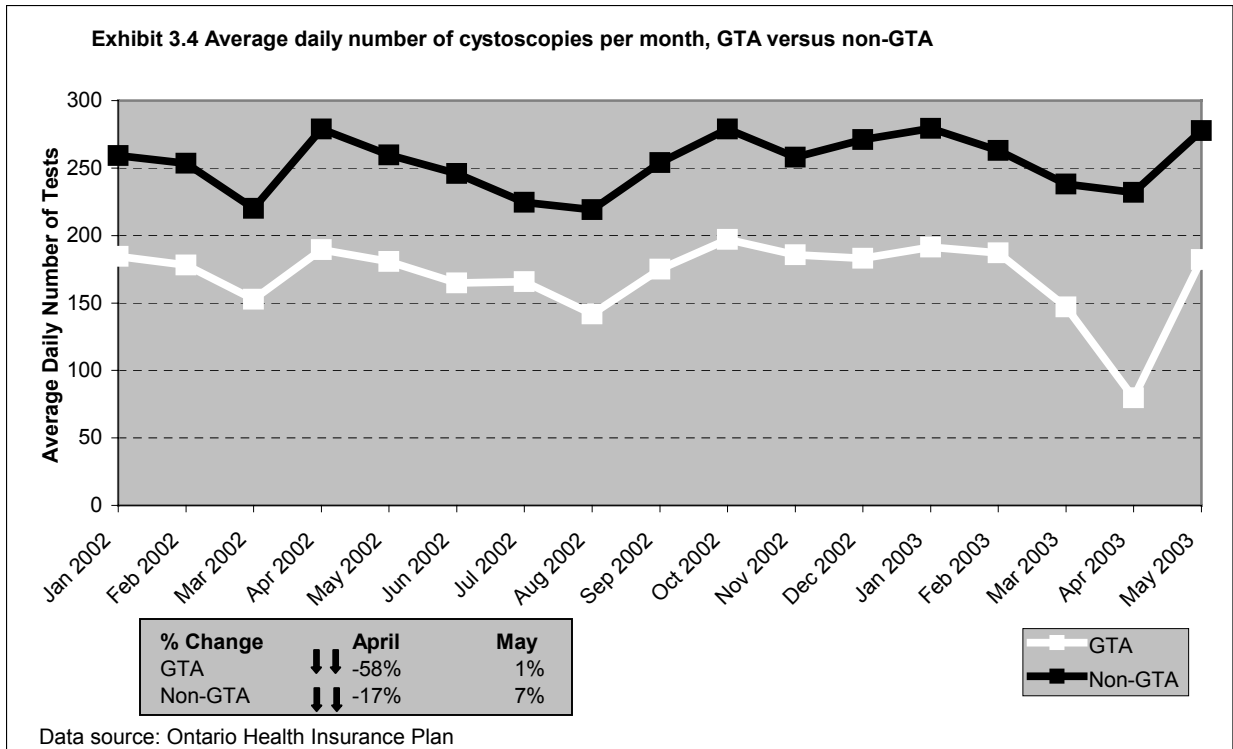
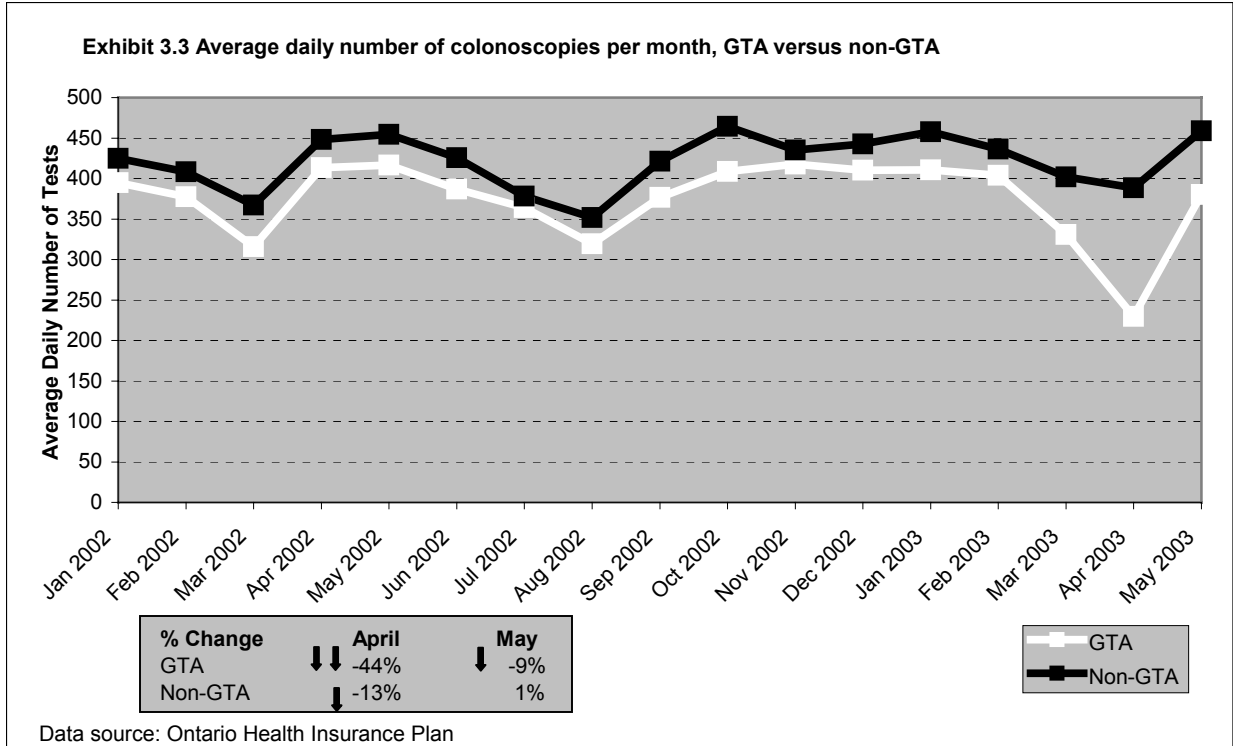
Exhibit 2.7 Average daily number of chemotherapy injections or infusions per month, GTA versus non-GTA

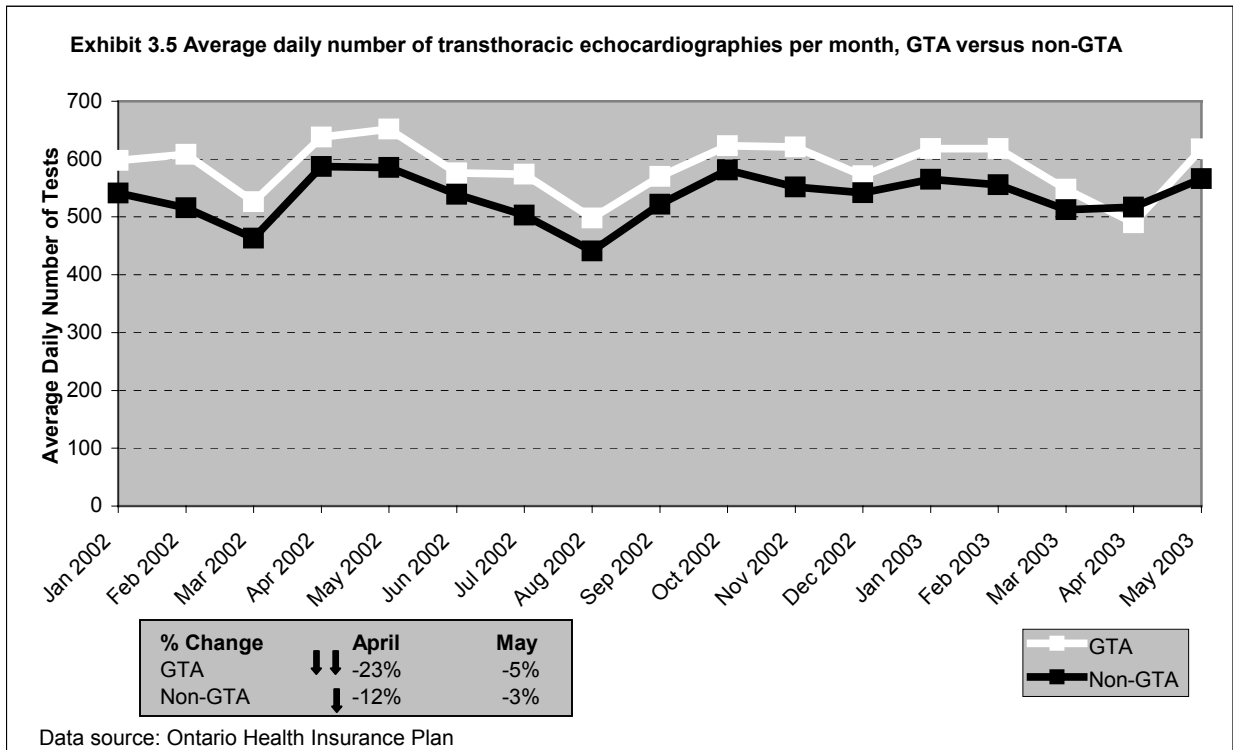


Data source: Ontario Health Insurance Plan

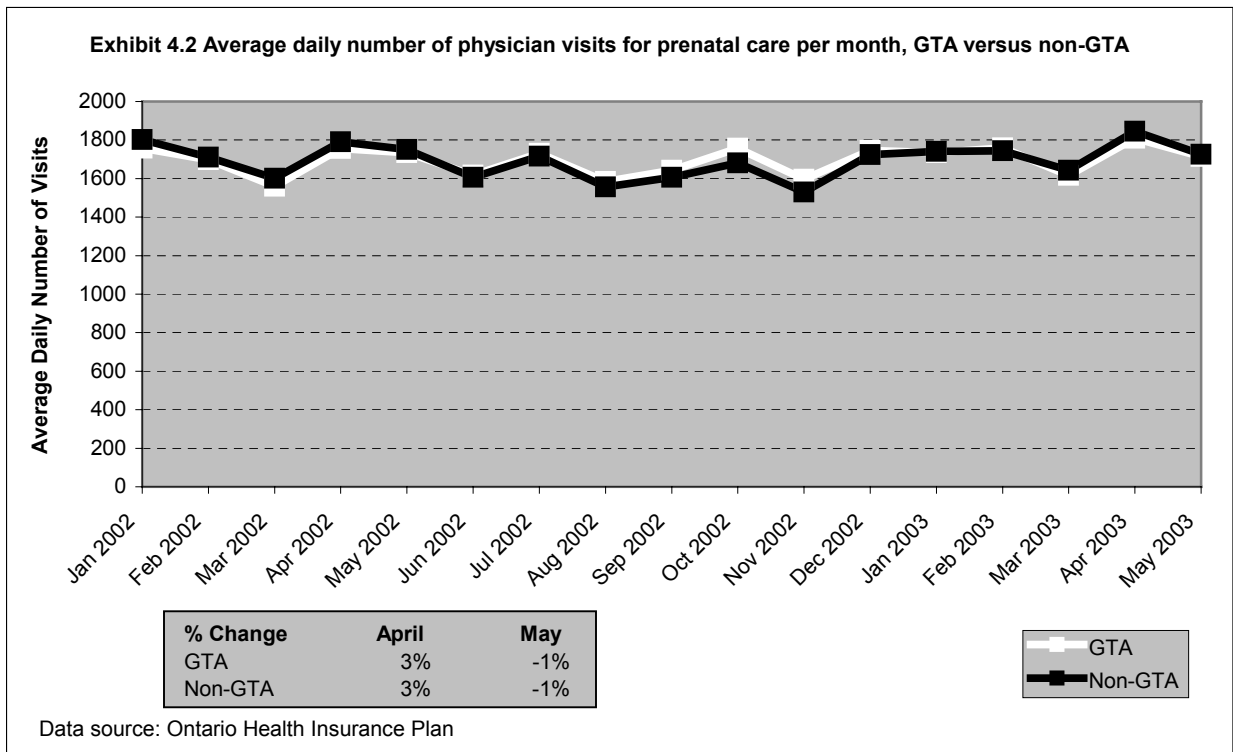
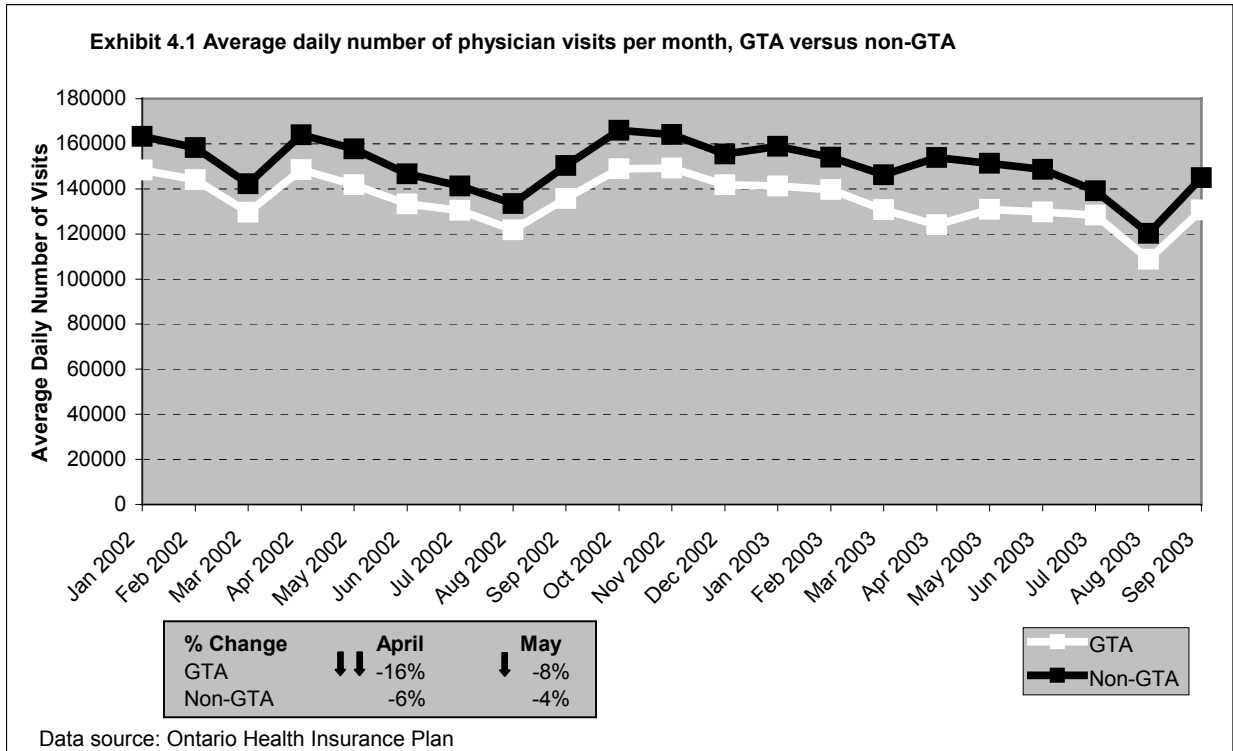
3. Outpatient Diagnostic Tests

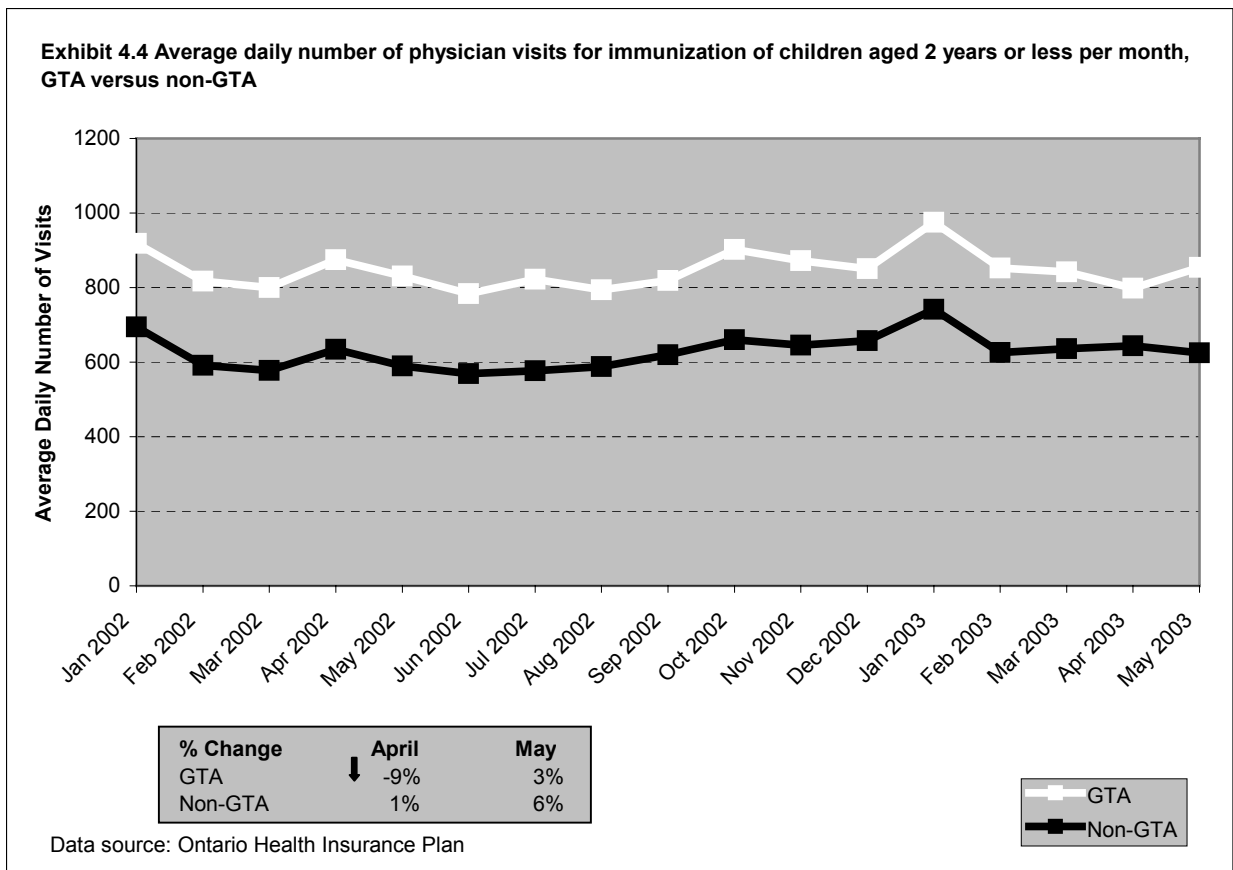
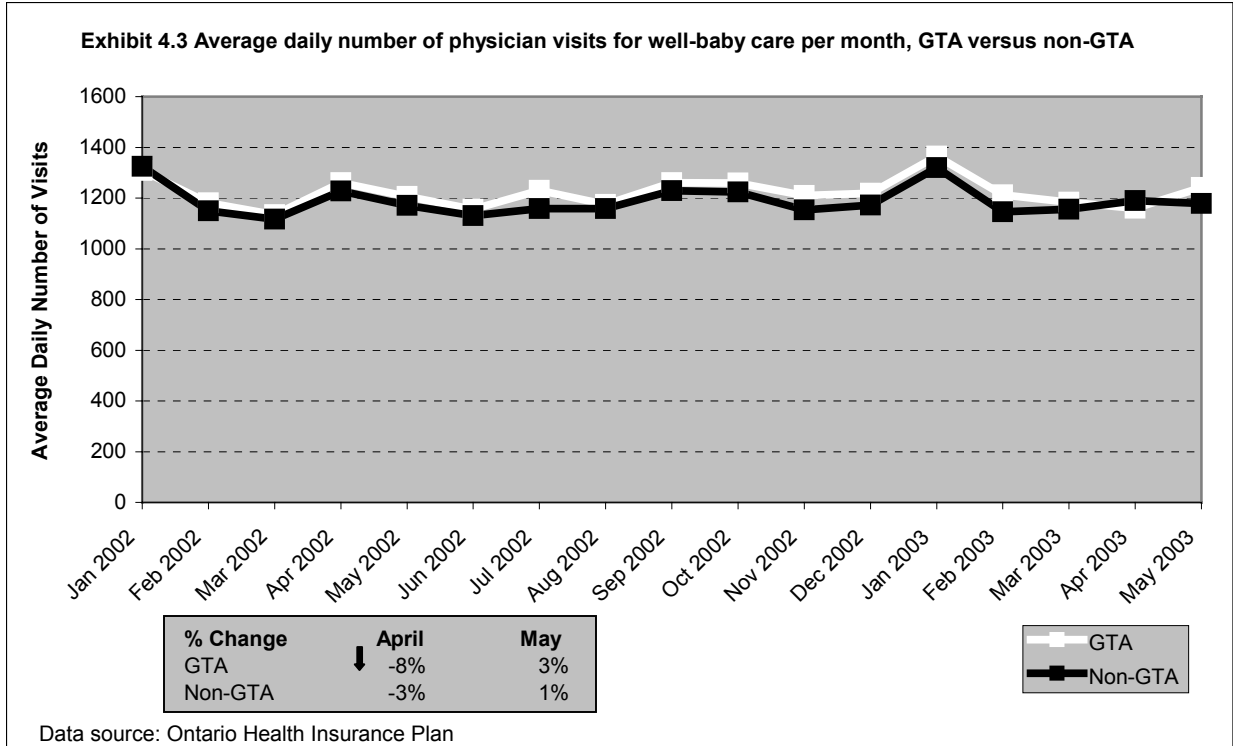






4. Physician Visits





5. Emergency Department Visits

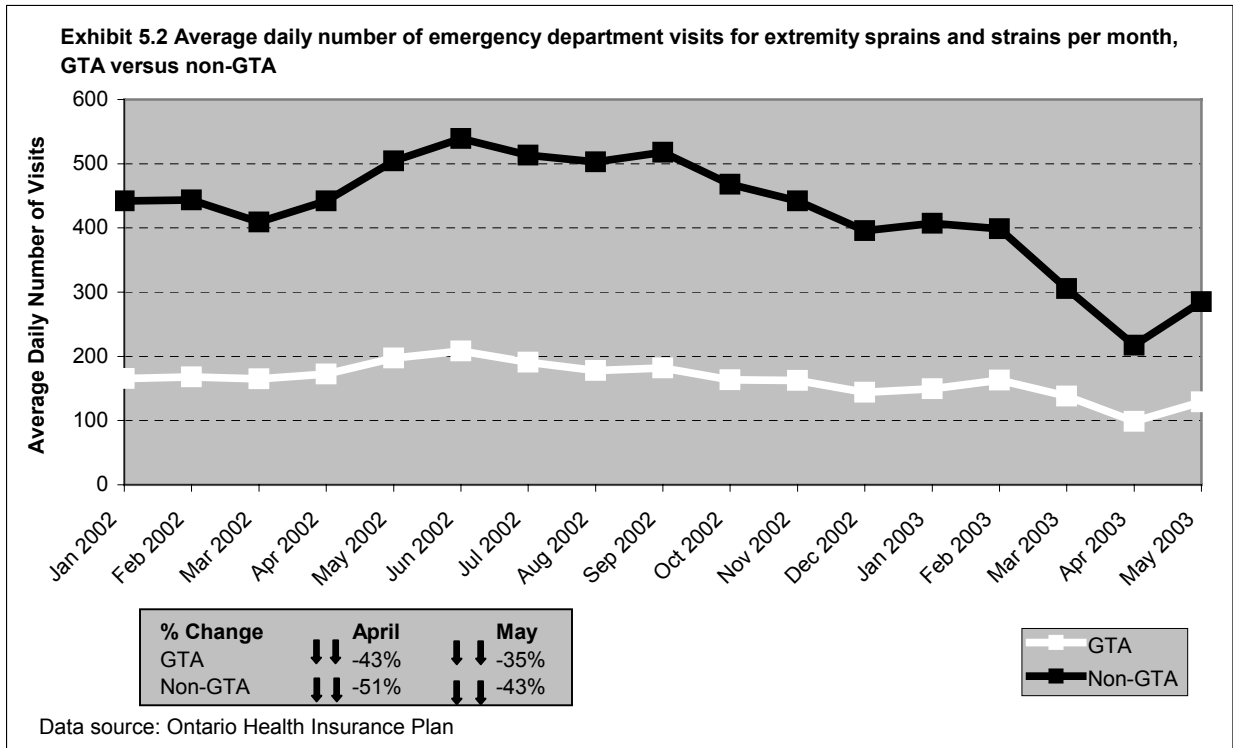
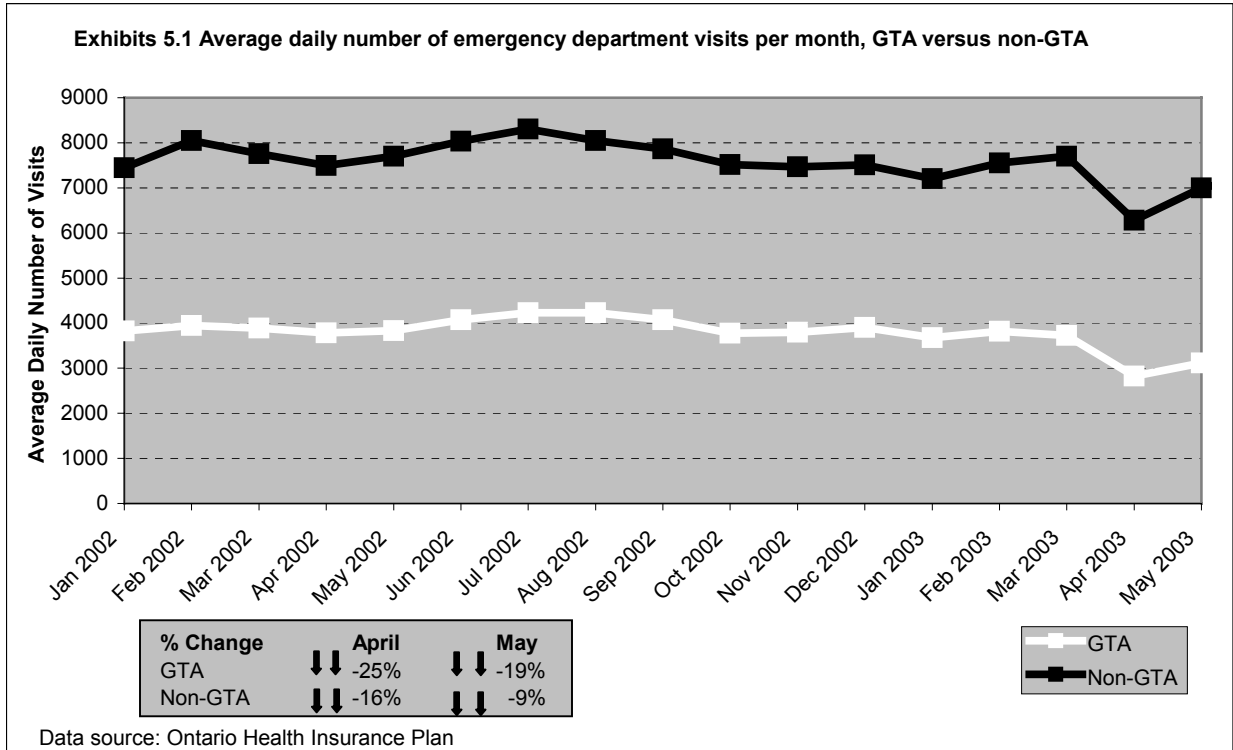
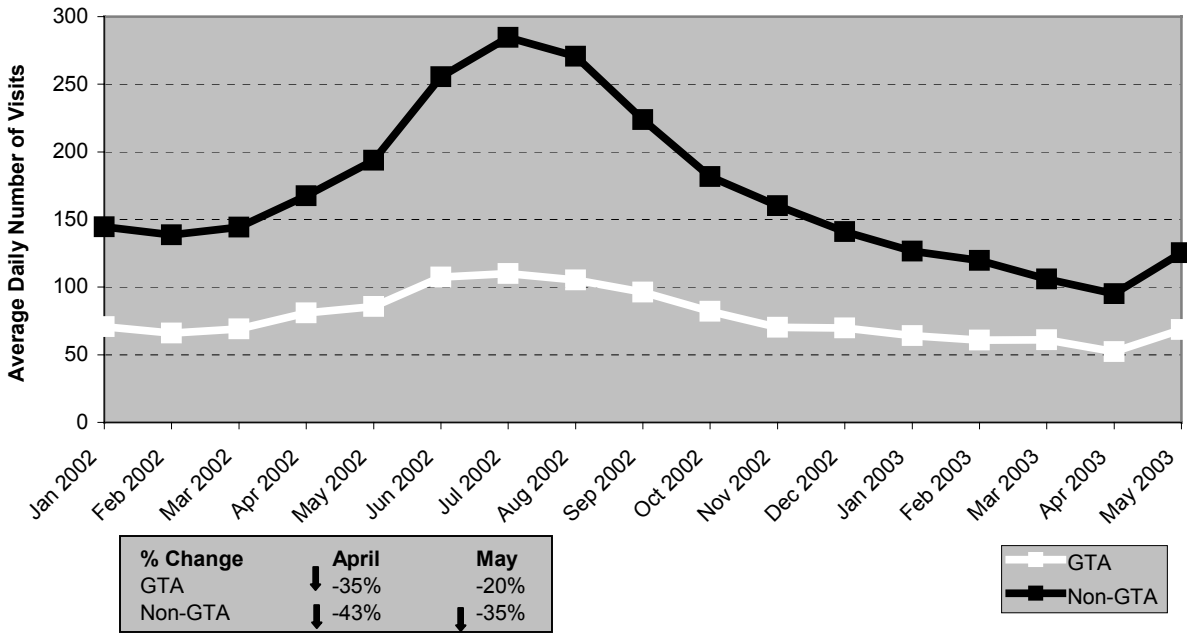
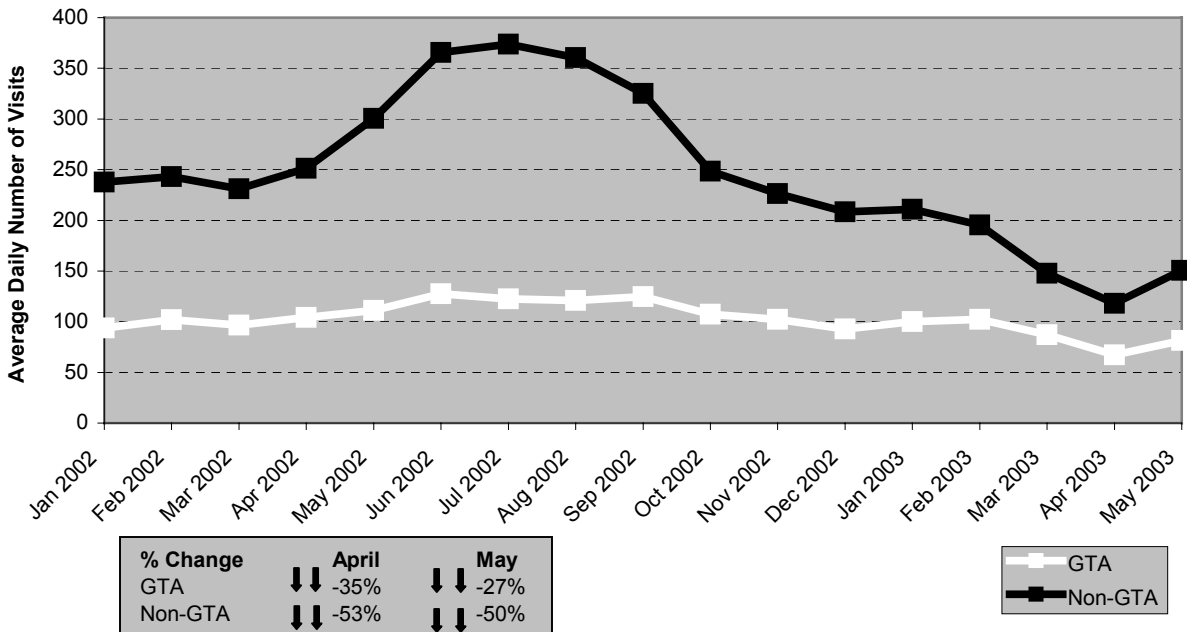


Exhibit 5.3 Average daily number of emergency department visits for cuts per month, GTA versus non-GTA

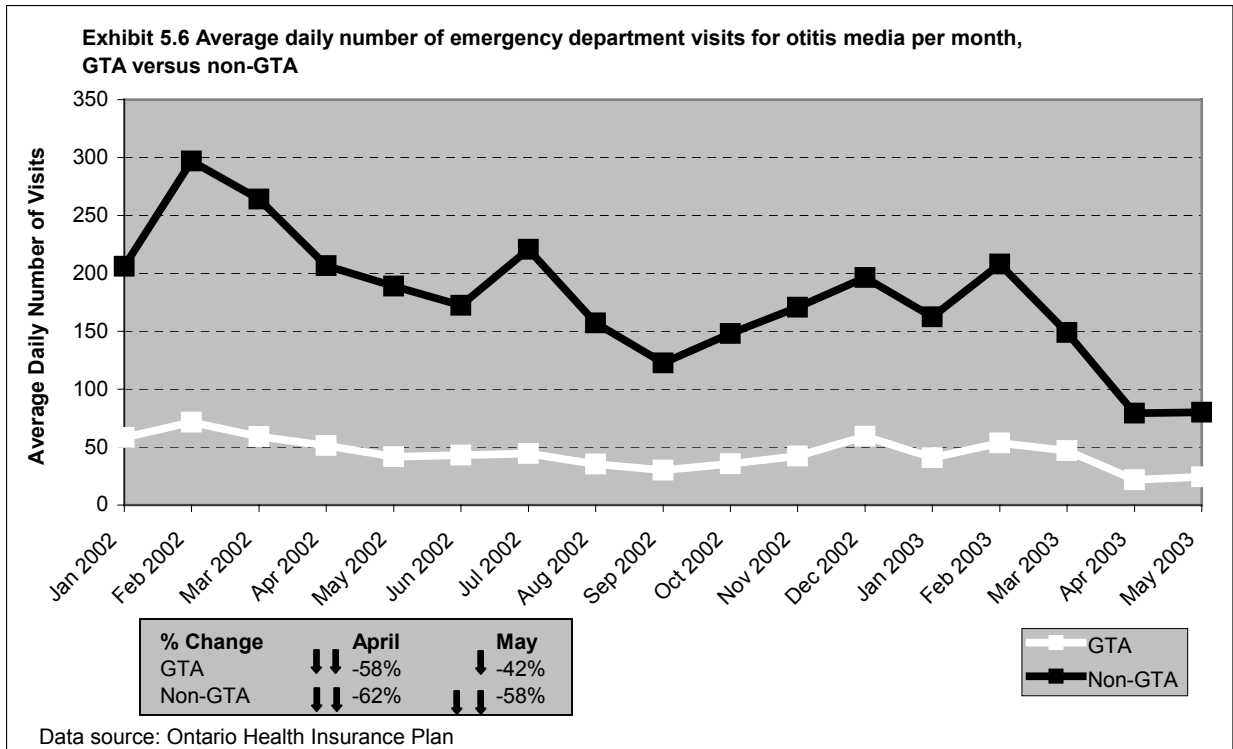
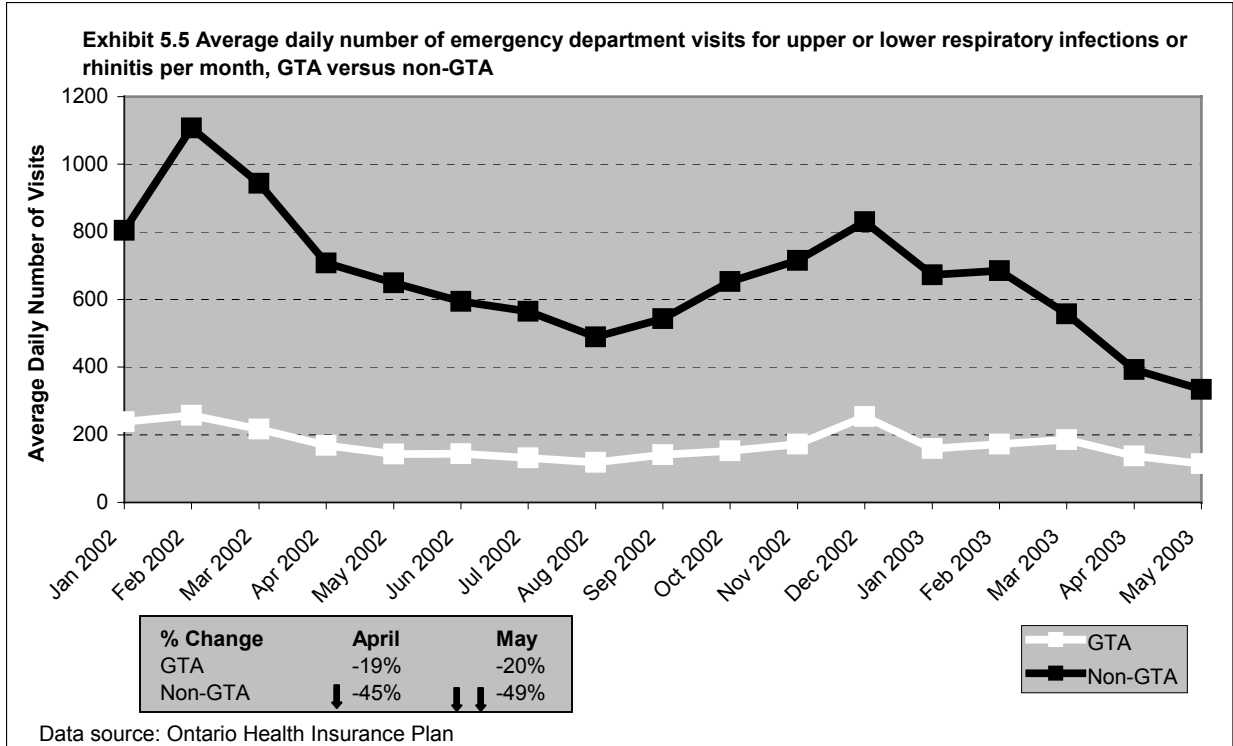


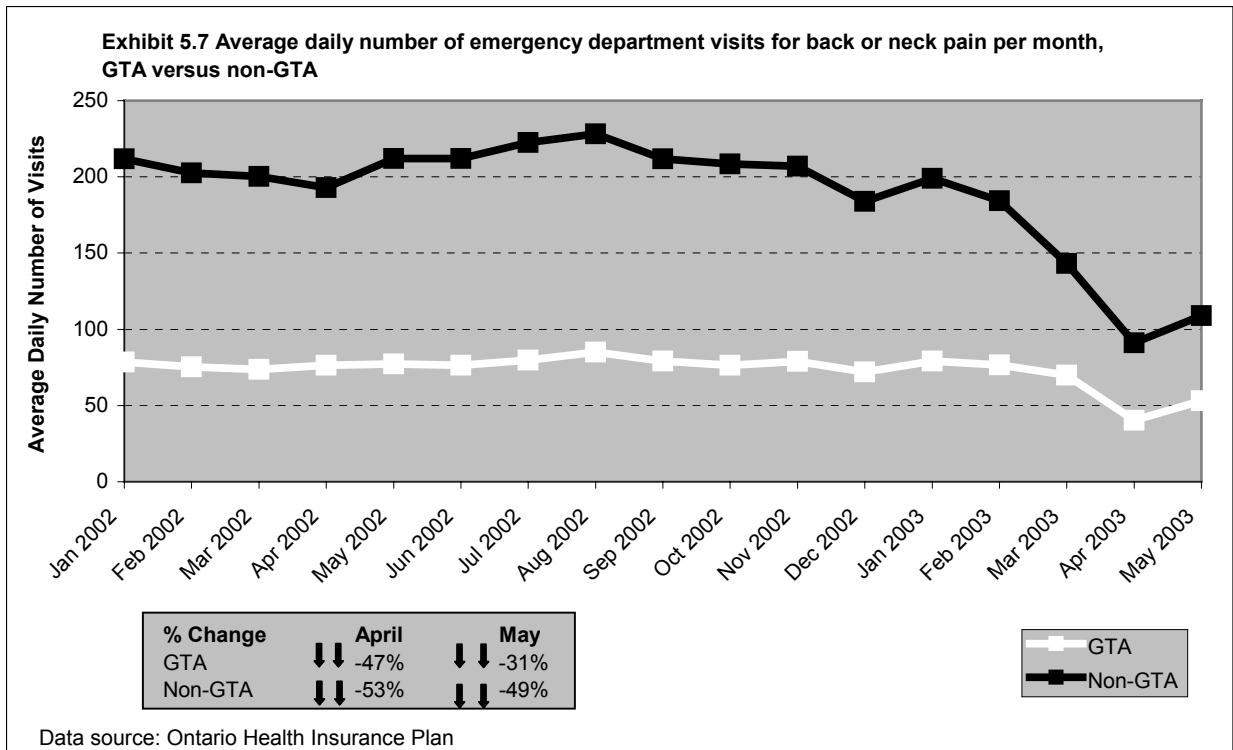
Data source: Ontario Health Insurance Plan

Exhibit 5.4 Average daily number of emergency department visits for superficial injuries per month, GTA versus non-GTA

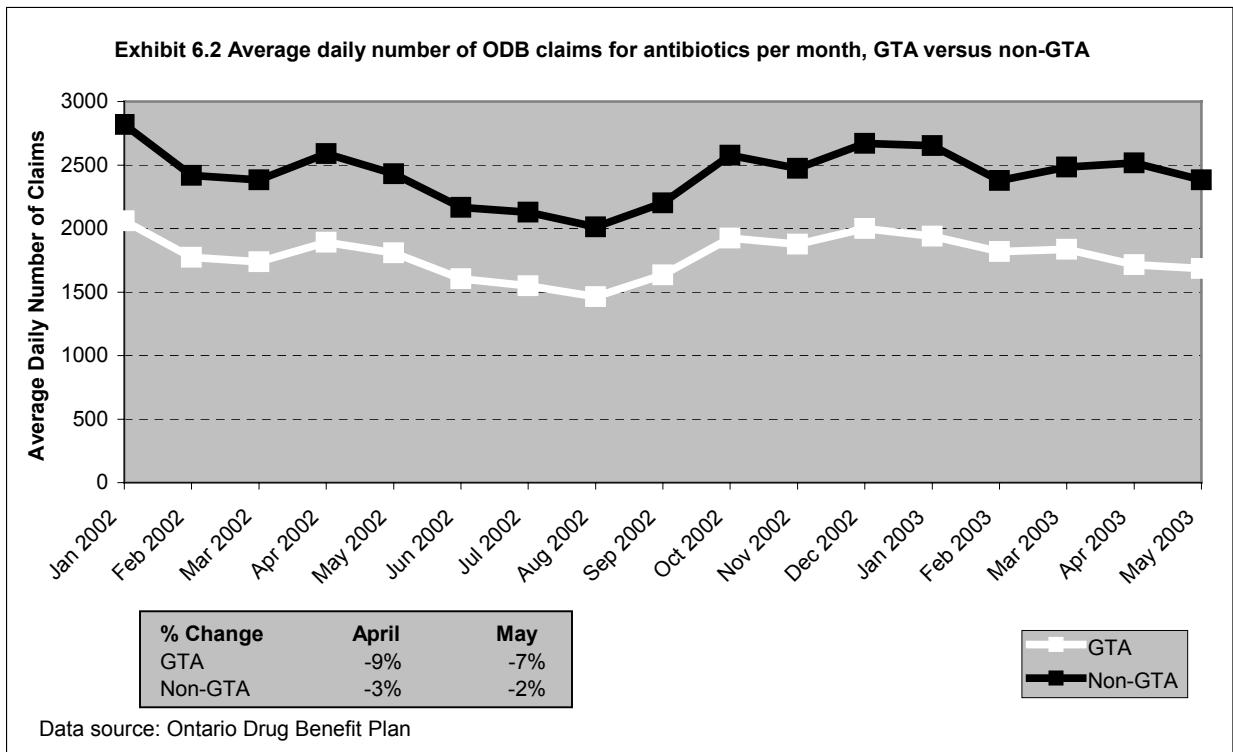
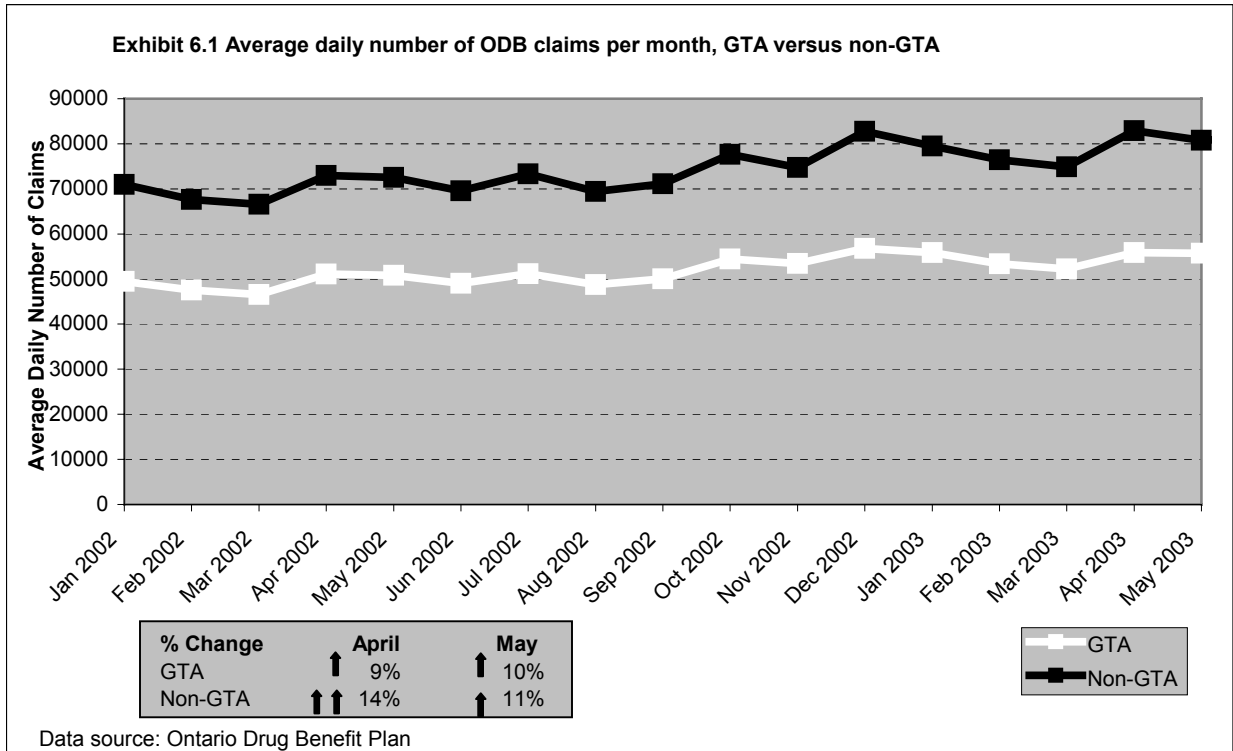


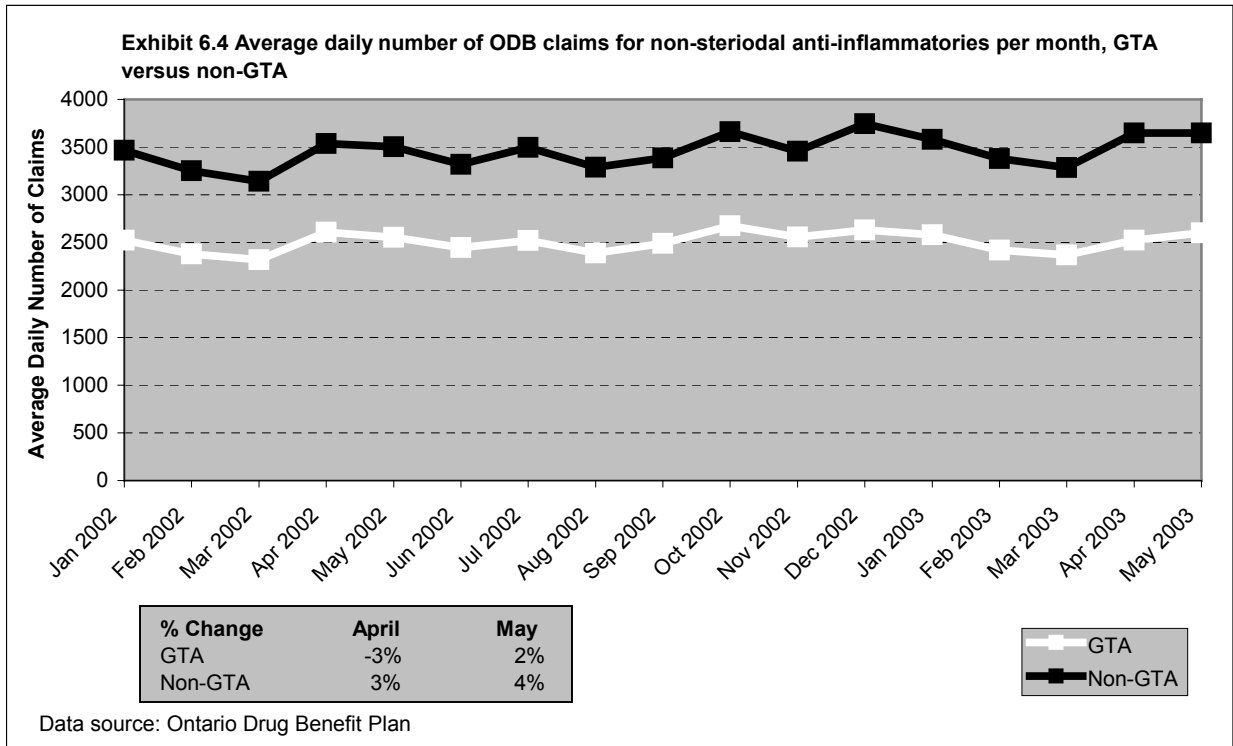
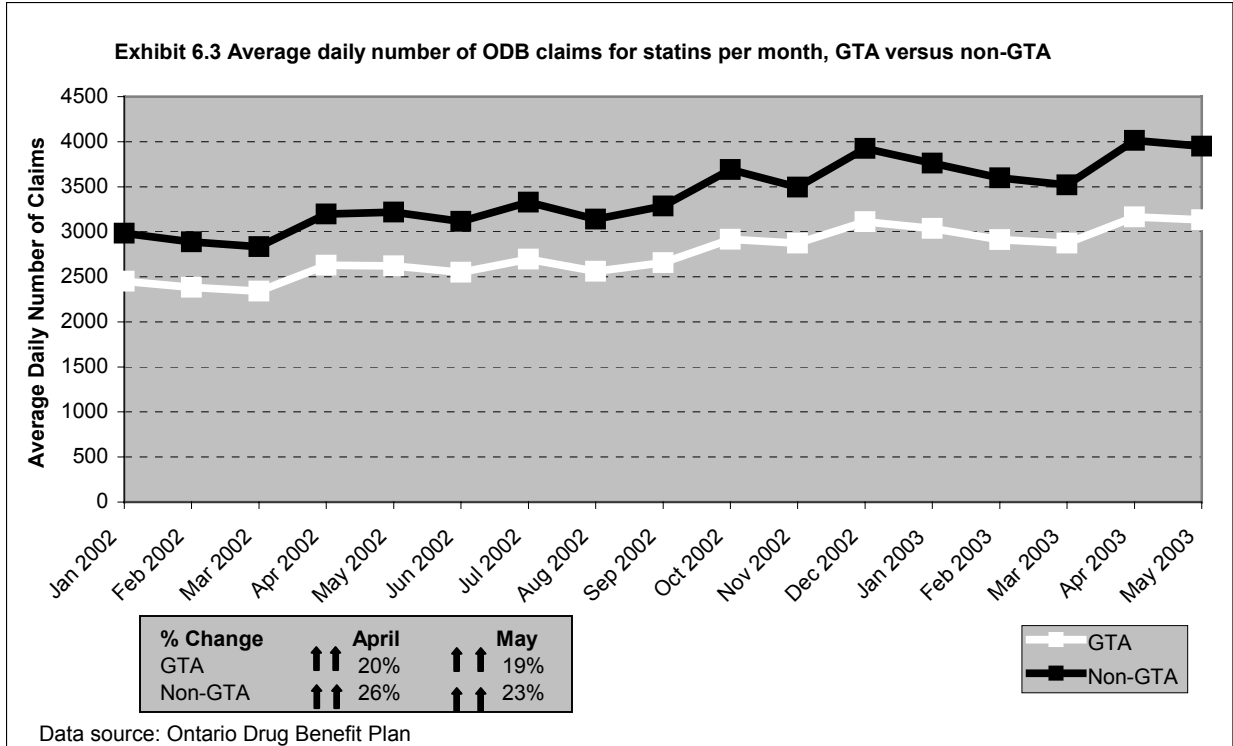
Data source: Ontario Health Insurance Plan

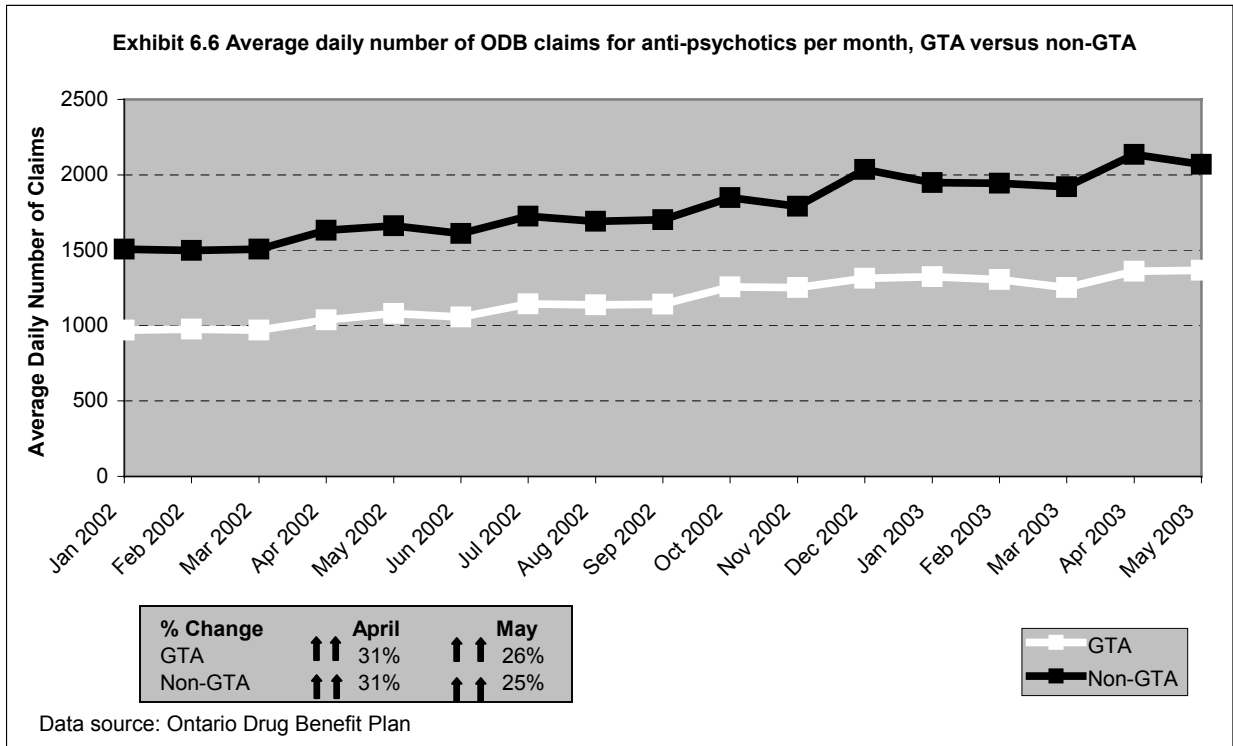
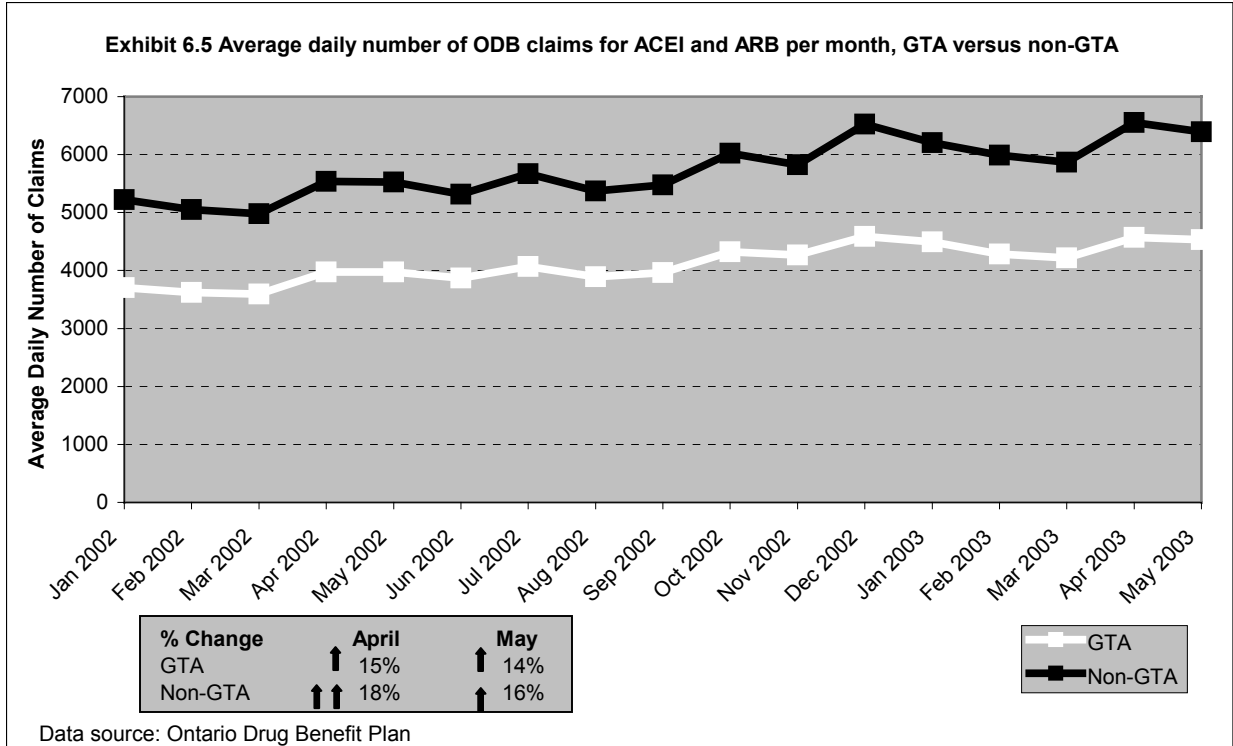


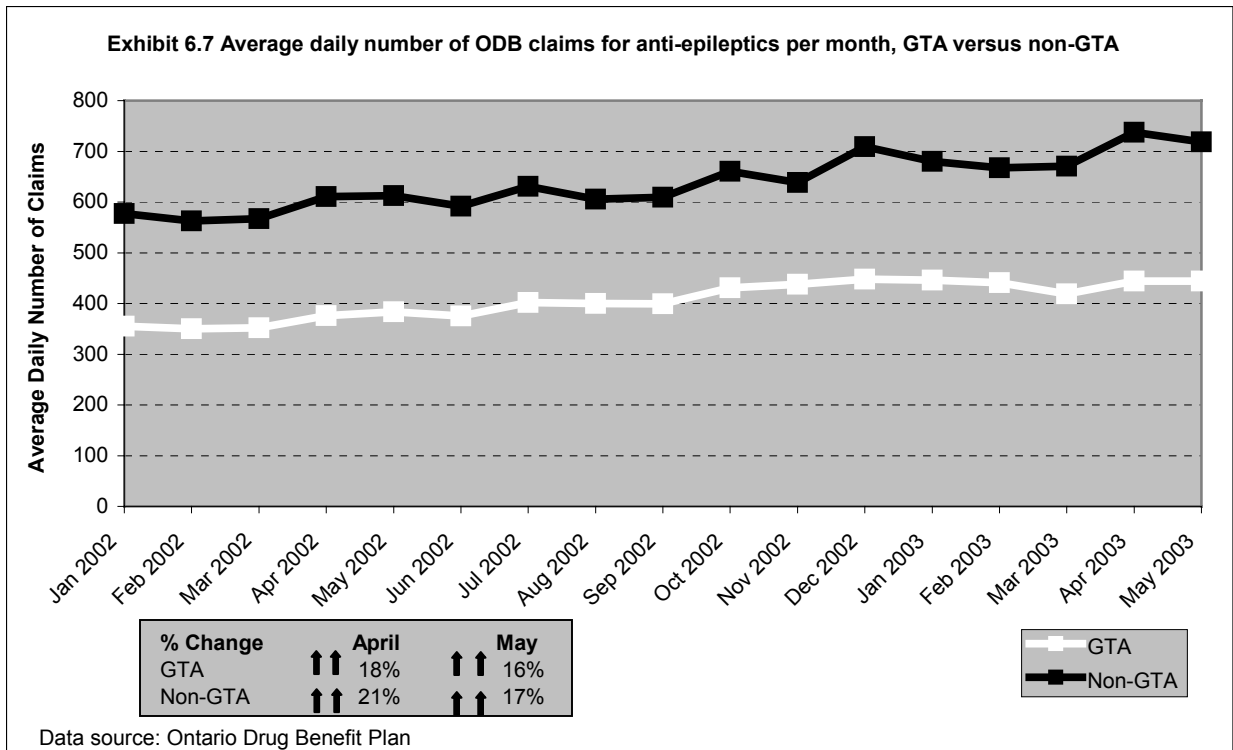


6. Prescription Medication Use

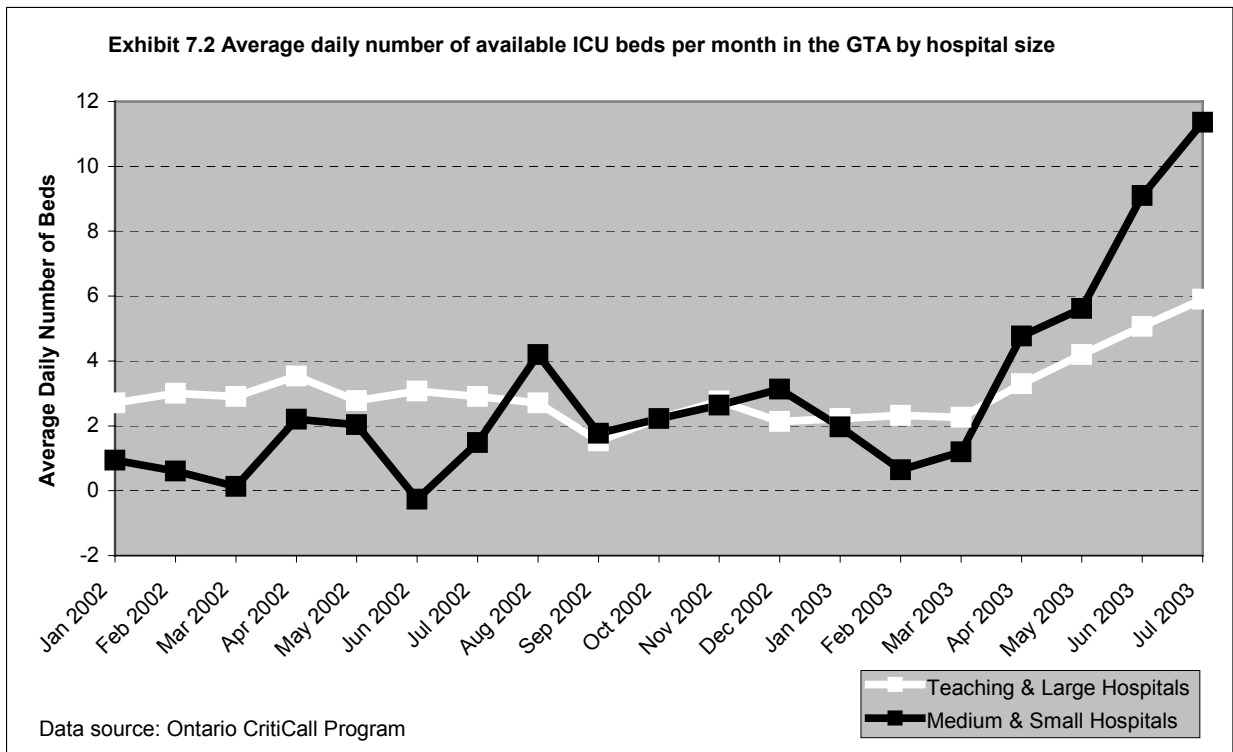
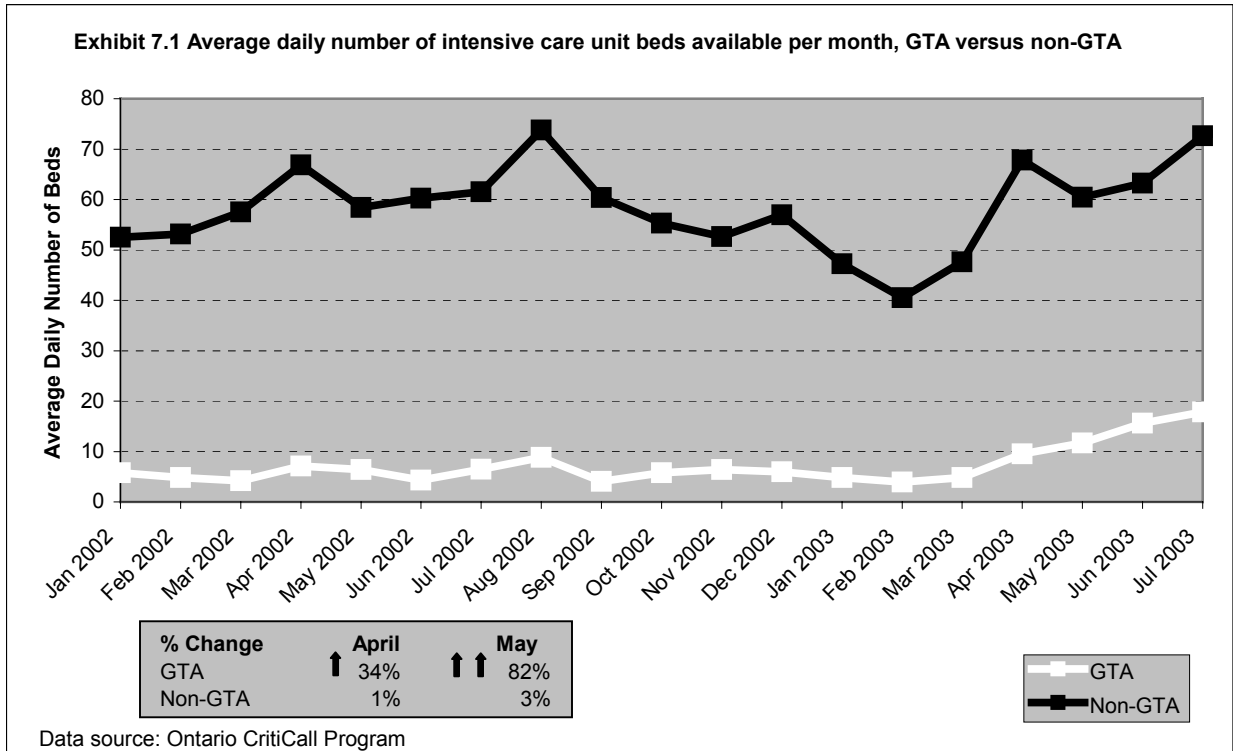




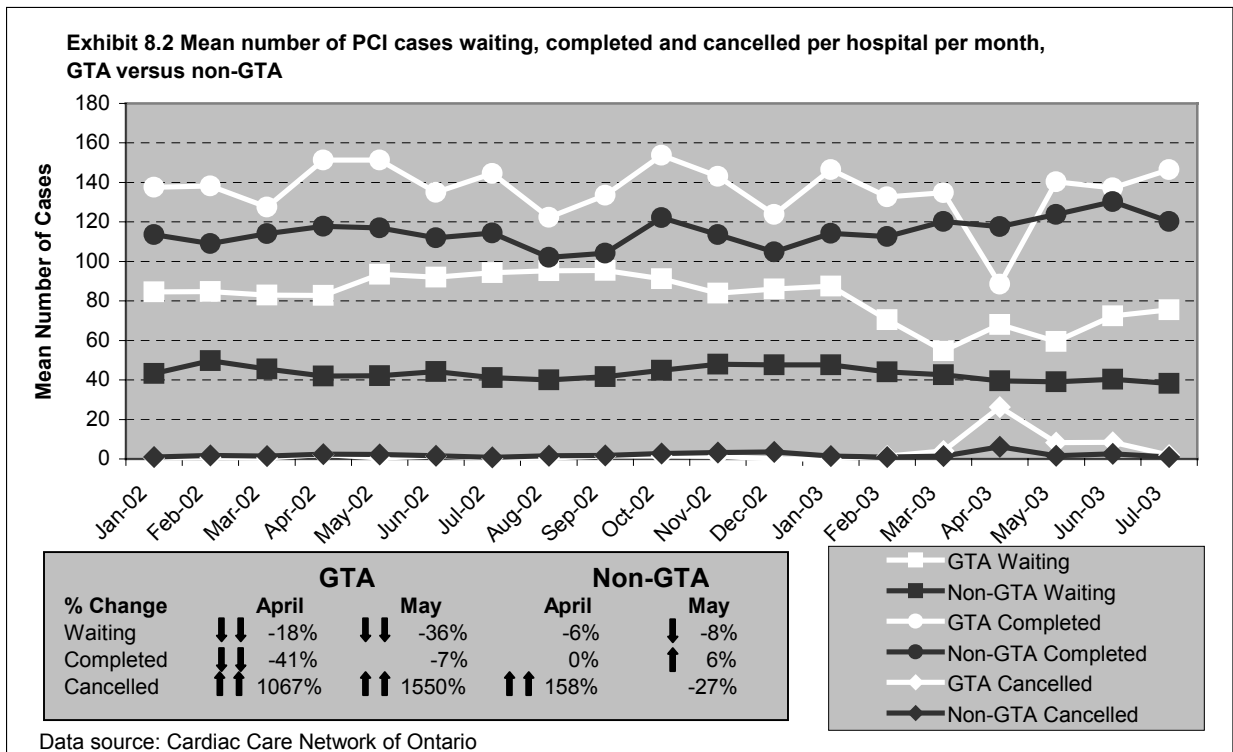
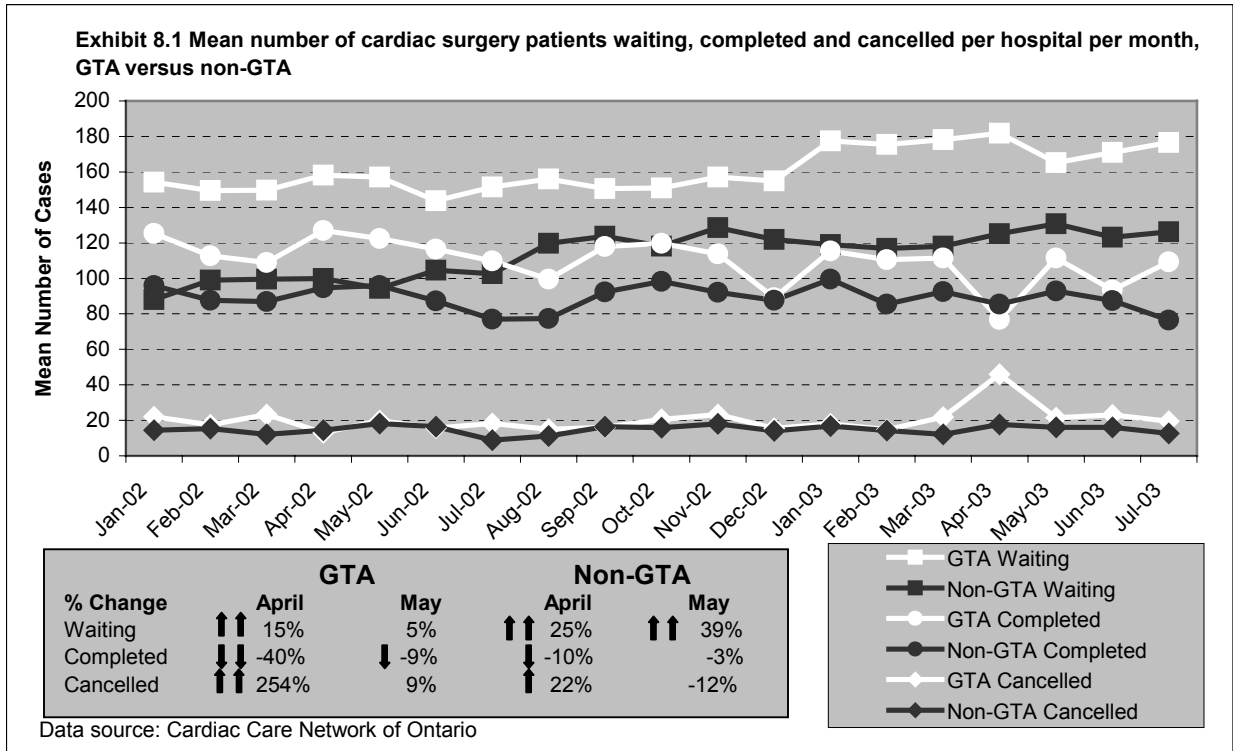


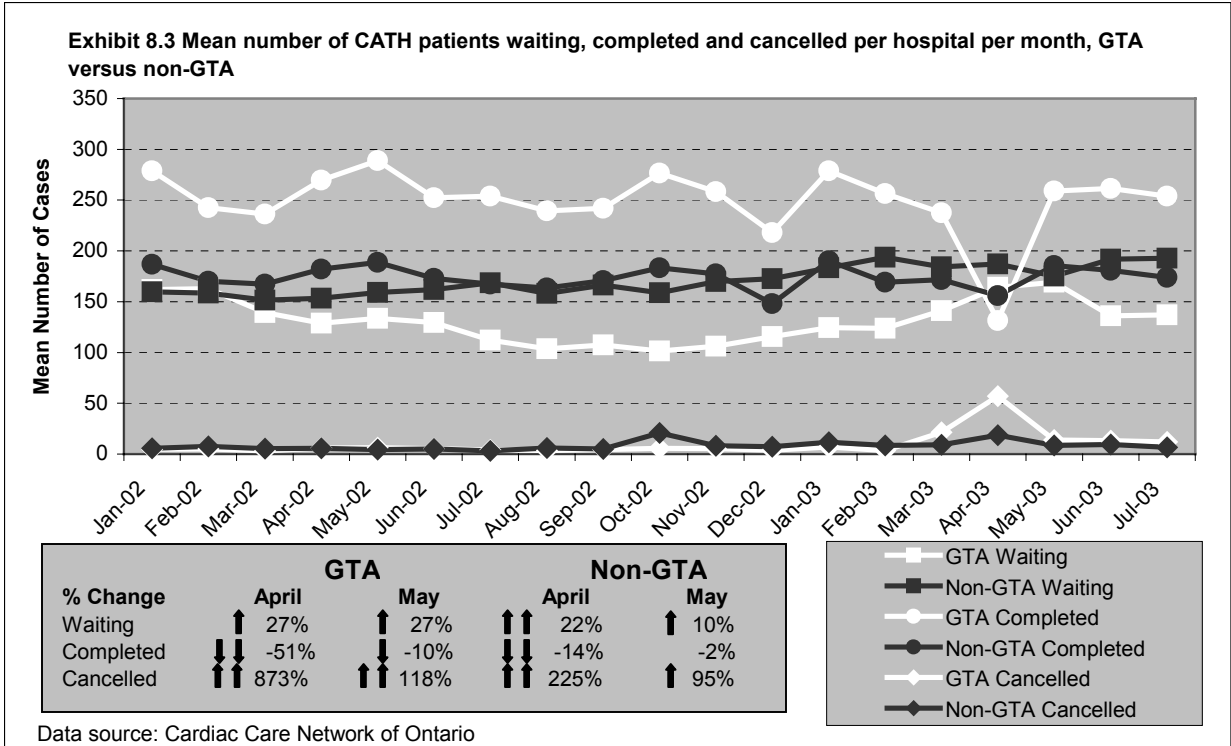


7. Available Intensive Care Unit Beds



8. Cardiac Care





Appendix A. Data sources and analytical methods

Data Sources

Ontario Health Insurance Plan

Approximately 94% of physicians practising in Ontario derive the bulk of their earnings from the Ontario Health Insurance Plan (OHIP) on a fee-for-service basis. The remaining physicians participate in alternate funding plans (AFPs) such as health service organizations, community health centres, academic group practice plans, or other salaried physician plans. Data from some of these AFPs may not have been included in these analyses, but this is not believed to have affected the findings. The percentage of physicians reporting to OHIP is not expected to have changed significantly during the study period. Thus, relative changes in service provision are not expected to have arisen from changes in physician payment plans.

For 2002, OHIP data is expected to be 100% complete (i.e. the data includes all payment records for that year). Due to some delays in physicians submitting claims and claims being processed, OHIP data is estimated to be 97-99% complete for the 2003 months studied.

Inpatient Procedures, Outpatient Procedures, Outpatient Diagnostic Tests, Physician Visits, and Emergency Department (ED) utilization were studied using OHIP data. Although data from the Canadian Institute for Health Information (CIHI) would have been preferable for studying inpatient procedures, outpatient procedures, and ED utilization, for a couple of reasons limited CIHI data were available at the time of the study:

- For April and May of 2003, data from the CIHI Discharge Abstract Database (DAD) were available for only 35 Ontario acute care hospitals, 8 of which were within the GTA. This subset of GTA hospitals included two hospitals that were closed as a result of SARS, Scarborough Grace and York Central, and was not considered representative of the GTA overall.
- For the outpatient procedures (day surgery) and ED measures, suitable data for April and May of 2003, captured using the National Ambulatory Care Reporting System (NACRS), were not available.

It is estimated that about 10% of Emergency Department (ED) visits are not captured in the OHIP database due to their payment schemes. This proportion and its distribution within the province are not expected to have changed during the study period. Therefore, relative changes in ED utilization are not assumed to be due to changes in ED payment plans.

Either an H or K code billed in conjunction with a patient assessment identified emergency department visits within the OHIP database. Due to stringent criteria for defining an ED visit, the absolute counts are likely lower than those reported independently by hospitals. However, the magnitude of the underestimate is expected to be consistent over time and, because the focus was on relative rather than absolute changes over time, this is not expected to affect the findings of this study.

Ontario Drug Benefit Program

The Ontario Drug Benefit (ODB) program of the Ministry of Health and Long-Term Care covers most of the cost of prescription drug products listed in the ODB Formulary. Individuals that belong to one of the following groups of Ontario residents and have valid Ontario Health Insurance are eligible for drug coverage under the ODB Program:

- People 65 years of age and older;
- Residents of long-term care facilities;
- Residents of Homes for Special Care;
- People receiving professional services under the Home Care program;
- Trillium Drug Program recipients.

In addition, individuals receiving social assistance (the Ontario Works program or the Ontario Disability Support Program) are eligible for ODB coverage.*

The ODB program was the source of all data related to the utilization of prescription medication. The majority of these data relate to Ontario residents aged 65 years or more. Prescriptions that are written but not filled or that are filled outside of the province are not included in the data. Data included all dispensed medications but does not describe whether the recipient used the medication.

Ontario CritiCall Program

The Ontario CritiCall Program is Ontario's one-number-to-call emergency patient referral program. Its mandate is to assist physicians in smaller communities to access the resources of the larger tertiary care hospitals in their regions. Program management is provided by Hamilton Health Sciences, Henderson Site, in Hamilton, Ontario.

Successfully managing emergency patient referrals requires the call takers to have immediate access to bed and resource availability for each participating hospital, as well as physician contact numbers for those on-call for each of 50 medical specialties. To manage this information, CritiCall pioneered the development of Ontario's internet-based Central Bed and Resource Registry.

The Ontario Resource Registry details acute and tertiary hospital bed availability, maternal and neonatal intensive care resources, Emergency Department status, Intensive Care Unit status and trauma status as well as contact information for physicians on-call in Ontario's hospitals. The system is active in about 140 Ontario hospitals.**

Data provided by the CritiCall Program were used to study the number of intensive care unit (ICU) beds available and staffed before, during, and after the SARS crisis. CritiCall receives this information daily from participating hospitals. Analysis included only those hospitals that were reporting bed data before January 1, 2003.

Cardiac Care

The Cardiac Care Network of Ontario (CCN) is funded by, and acts as a cardiac services advisory body to, the Ontario Ministry of Health and Long-Term Care. The CCN has maintained a cardiac surgery patient registry since 1990 and expanded this registry in 2000 to include cardiac catheterization, angioplasty and stent procedures. Extensive statistics on access to cardiac surgery are available from this registry, which includes all 17 hospitals in Ontario that perform adult cardiac catheterization, angioplasty or cardiac surgery.†

Cardiac care procedures were studied using data provided by the Cardiac Care Network (CCN) of Ontario. These data were provided in two formats. Monthly counts of patients cancelled, completed, and waiting were provided by CCN in an electronic format similar to the tables published in monthly *Statistical Reports*. Median wait times were provided by the CCN via the *Statistical Reports*, which did not allow us to aggregate the data to the GTA level. Thus, no analyses of wait times were carried out.

Analytical Methods

All measures were categorized as being within or outside of the Greater Toronto Area (GTA) according to the location of the place of service or the patient's place of residence. Areas included within the GTA were the City of Toronto and the Regions of Durham, York, Peel, and Halton. Inpatient procedures and ED visits were allocated to the GTA or non-GTA according to the hospital where the service was provided. Other ICES studies have found the OHIP institution number to be reliable and valid for this

* Source: Ontario Ministry of Health and Long-Term Care web site; http://www.health.gov.on.ca/english/public/program/drugs/drugs_mn.html; December 18, 2003

** Source: Shelly Moneta, Ontario CritiCall Program, personal communication, January 26, 2004

† Source: Cardiac Care Network on Ontario web site; <http://www.ccn.on.ca/mission.html>; December 18, 2003

purpose. ICU bed availability and cardiac care procedures also were summarized according to the location of the hospital. Outpatient procedures, outpatient diagnostic tests, and physician visits, were assigned to the GTA or non-GTA according to the patient's residence for two reasons. First, it was hypothesized that these measures would reflect not only institutional restrictions, but also the population's response to SARS and, as such, patient residence was deemed more appropriate. Second, the institution number in the OHIP database is not a mandatory field and was completed in less than 50% of the outpatient records. Physician visits did not include visits to the emergency department.

Monthly changes in service provision were studied for each indicator. With the exception of Cardiac Care, all analyses evaluated the mean number of procedures, visits, claims or beds per day for each month studied. The overall mean and standard deviation of these monthly means were then calculated using all months before SARS (January 2002 through February 2003) and the ratio of the SD to the mean was used as an estimate of expected variation. To assess whether or not there was a change during SARS, the percentage change from April 2002 to April 2003 and May 2002 to May 2003 was calculated, and then compared to the expected variation expressed as a percentage ($SD:Mean*100$). Changes in April or May that were between 1 and 2 times greater than the expected variation were considered to be increases or decreases depending on their direction. Changes that were more than twice the expected variation were considered large increases or decreases. The calculation of the monthly means excluded Good Friday (March 29, 2002; April 18, 2003) and December 24, 2002 through January 1, 2003 to help control for seasonal decreases in service during these holidays.

Similar monthly analyses were carried out using CCN data but due to the nature of the data provided, the monthly measure was the mean number of services per hospital per month. The data also did not allow the exclusion of services provided on Good Friday or during the Christmas season.

Two additional analyses were conducted using CritiCall data. Calculating the average daily number of available beds per week produced a more sensitive analysis. As well, the average daily number of available beds per month in the GTA was compared for small and medium sized hospitals versus large and teaching hospitals. Large hospitals were defined as those with 300 or more acute beds as of July 2003.*

For the majority of the indicators studied, the available data included service dates of January 1, 2002 through May 31, 2003. CritiCall and CCN data also were analyzed beginning January 1, 2002, but the available data allowed us to extend our analyses through July 31, 2003.

Indicators were identified using a variety of codes entered into OHIP and ODB data (Table A1). A unique event, such as one colectomy, one physician visit, one ER visit, or a single diagnostic test was defined as occurring on the same date involving the same physician and patient.

*Acute bed counts provided by the Ontario Joint Policy and Planning Committee (www.jppc.org)

Table A1. Diagnostic and service codes used to identify the selected indicators within the OHIP and ODB

Condition	Codes
Inpatient Procedures	OHIP Fee Service Codes
Elective abdominal aortic surgery	R802, R816, R817
Cholecystectomy	S287
Hip replacement	R440, R553, R241
Knee replacement	R441, R248, R244
Tran urethral resection of prostate	S654, S655
Carotid endarterectomy	R792, N220
Colectomy	S166, S167, S168, S169
Thoracotomy	M137, M138, M142, M143, M144, M145
Total prostatectomy	S641, S645-S653
Lumpectomy or mastectomy	R105, R107, R108, R109, R111, R117
Mechanical ventilation	G405, G557
Outpatient Procedures	OHIP Fee Service Codes
Vasectomy	S626, E545
Myringotomy	Z912, Z914
Carpal tunnel release	N290
Cataract surgery	E140
Therapeutic abortion	S752, S785
Breast biopsy	X121, Z141
Injection or infusion of chemotherapy	G281, G381, G339, G345, G359
Outpatient Diagnostic Tests	OHIP Fee Service Codes
MRI	X421, X431, X441, X451 X461 X471, X488, X490, X493, X496
CT scan	X400-X410, X412-X416, X124-X128, X231-X233
Colonoscopy	Z555, Z580, Z535
Cystoscopy	S470, Z628, Z606, Z607, Z635
Tran thoracic echocardiography	G561, G562, G567, G568, G571, G572, G575

Physician Visits	OHIP Fee Service Codes
Mechanical ventilation	G405, G557
Prenatal care	P003A, P004A
Well-baby care	A007 with an OHIP Dx of 916, or G538
Immunization, aged 2 or less	G538 or G539 for patients aged 2 years or less
Hip replacement	R440, R553, R241
Knee replacement	R441, R248, R244
Cholecystectomy	S287
Cataract extraction	E140
Emergency Department Visits	OHIP Diagnostic Codes (with a Patient Assessment & Fee Code Suffix of H or K)
Extremity strain/sprain	840, 842, 844, 845, 848
Cuts	884,894
Superficial injuries	919
URI/LRI/rhinitis	460-466
Otitis media	381, 382
Back/neck pain	847, 724
Prescription Medication Use	Drug Identification Number
Antibiotics	Due to the high number of DINs, this information will be provided upon request
Statins	
ACEI and ARB	
NSAID	
Anti-psychotics	
Anti-epileptics	

Appendix B. Average daily number of ICU beds available per week

