

A young boy is sleeping peacefully in a hospital bed. He is wearing a striped hospital gown and has a white identification band on his left wrist. The bed is covered with a white blanket. On a bedside table next to the bed, there is a brown teddy bear, a vase of yellow flowers, a rotary telephone, and two children's books. One book shows a cowboy on a horse, and the other shows a girl sitting at a table. To the right of the bed, on another table, is a toy steam locomotive. The background shows a window with white curtains.

**Inpatient and
day surgery use
by children in Ontario**

Research Atlas

ICES Institute for Clinical
Evaluative Sciences

Inpatient and Day Surgery Use by Children in Ontario

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KEY TERMS & CONCEPTS

- pyloromyotomy
- myringotomy
- tonsillectomy and adenoidectomy (T&A)
- area rate variations

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KEY MESSAGES

- ✓ Children in Ontario are admitted to hospital less frequently than in the past, with the notable exceptions of infants for jaundice and teenagers for psychiatric disorders.
- ✓ Previously documented regional variations for inpatient admissions and surgical procedures across the province still exist.
- ✓ Hospitalizations for teenage pregnancy and live births are declining.

Background

Since the publication of the second edition of the ICES Practice Atlas,¹ there have been a number of important changes to the health care system that are reflected in changes in utilization patterns of health services. The overall environment is one of decreasing per capita resources. Clear policies have been made to limit resource-intensive services such as inpatient care, with a shift to increased care in the community.

These changes are not limited to the pediatric population; however, as a group, there are some important considerations when analyzing trends in health care utilization among children. Over the past decade the health care literature has described a general movement to consider a routine stay in the hospital following uncomplicated childbirth as unnecessary. As a result, many institutions developed policies and approaches involving early discharge following these births. Outpatient disease management and home care have also become more obvious alternatives to hospitalization for children with chronic or subacute conditions. For example, the literature describes effective programs for disease education and training of children at home with a new diagnosis of diabetes mellitus. Children reliant on total parenteral nutrition can now receive this at home through home intravenous programs. For the more common and acute illnesses, one might expect patterns of hospitalization to change with the evolution of more effective therapy (e.g. inhaled corticosteroid therapy for asthma, oral rehydration solution for acute gastroenteritis and dehydration). Questions have also been asked about the utilization of common surgical procedures which have relatively discretionary indications, such as ventilation tubes for serous otitis media. Neonatal male circumcision has also been eliminated as an insured service.

As new health care budgets are developed in the future, there will continue to be challenges in allocating resources appropriately even if these budgets grow. These challenges include discerning benchmarks for appropriate hospitalization rates and funding targets for common diseases such as asthma and gastroenteritis, which are responsible for a large portion of hospitalization expenditure, and for which good evidence of optimal management exists. It may also include directing more resources to populations who are at risk for poor health outcomes, such as teenage mothers and their children, as well as newborns discharged early from hospital. It may also be expected that the survival associated with improved technology and therapeutics (especially in neonatology) will result in increased resource needs for the expansion in these special needs populations. Furthermore, resources will be needed to bolster the community care that is

required for an increasingly complex caseload.

In the last Practice Atlas¹ we documented regional variation in rates of hospitalization for common medical conditions (gastroenteritis and asthma) and common surgical procedures (tonsillectomy, circumcision and ventilation tubes). This area variation, which cannot be viewed solely as the result of differing rates of disease, highlights that delivery of medical care for children is not uniform across Ontario. Considering the forces at work in changing practice and policy over this past decade, determining whether substantial changes have occurred is of considerable interest. In this report we have chosen to highlight the trends over the period since the last Atlas in inpatient health care service utilization, with particular emphasis on common diseases and procedures, as well as at-risk populations identifiable through the administrative databases available for analysis.

Methods

Data used in this report were obtained from the Canadian Institute for Health Information (CIHI) for fiscal years 1991/92 to 1997/98. The CIHI data are mandatory collections of hospital discharges that cover all patients from public, private, and federal hospitals in Ontario, including acute and chronic care hospitals and acute psychiatric hospitals. CIHI data are used to describe hospital-based care. The database includes patient demographics (date of birth, sex, residence) and clinical data (admission date, discharge date, length of stay, diagnosis codes of the International Classification of Diseases, 9th Revision (ICD-9), up to 16 fields). Surgical procedures performed were coded by the Canadian Classification of Diagnostic, Therapeutic, and Surgical Procedures. Hospital utilization for children under 20 years of age, who were residents of Ontario, is described in this report. Children were divided into four main age groups consistent with the Canadian Institute for Child Health grouping: infants (under one year), preschool (one to four years), school age (five to 14 years) and late adolescent (15 to 19 years). Hospital discharges were examined by medical and surgical diagnoses separately. Annual rates in this report are calculated per 1,000 or 100,000 children in that age group based on the 1991 and 1996 Canada Census population data and the post-censal estimates. Since the rates calculated are discharges per 1,000 or 100,000 children, if there are multiple discharges per child in each fiscal year they would be included in the calculation.

Interpretive Cautions

Apart from the usual limitations inherent in analyzing and interpreting administrative data, there is a specific interpretive caution when viewing the rates of admission for live births and pregnancy losses. For the most part, the rate of admission for live births probably reflects a live birth rate, as most patients will deliver in hospital. The same is not true for problems in pregnancy. In other words, one cannot extrapolate that the admission rate for live births plus pregnancies resulting in fetal loss can approximate the overall pregnancy rate. Patients with pregnancy losses, such as therapeutic abortions and miscarriages, are not always treated as inpatients. The overall downward trend noted in this report is probably fairly accurate, although with the decrease in inpatient care documented in this report, it is possible that the overall pregnancy rate may be higher in later years than the rate of admission for pregnancy reveals.

Since all the rates were adjusted for the age-specific population, the change in rates of admission or days of care cannot be explained by the change in population size over time. In this report, readmissions of individuals have not been separated out from first admissions. For conditions such as asthma, readmissions may account for a significant proportion of total admissions. Further analysis of readmissions is warranted in the future.

Findings and Discussion

General Trends

Medical Admission Rates

Overall, the number of admissions and their corresponding rates decreased over the six years analyzed (1991/92 to 1997/98). The overall admission rates were 49.3 and 31.1 per 1,000 in 1991/92 and 1997/98 respectively, representing a 37.0 per cent relative decrease in hospitalizations (see Exhibits 1 and 2).

Among all children, infants under one year of age had the highest rates of hospital admissions (169.0 per 1,000 in 1997/98) and over the six-year time period, the smallest decrease in admission rates (19.3%). In contrast, children aged five to 14 years had the lowest admission rates (14.0 per 1,000 in 1997/98) and the largest decrease over time (41.7%).

Days of Care for Medical Admissions

As with the number of admissions, there was a substantial decline in the number of days of care for medical admissions (Exhibit 2). Infants under one year of age had the highest total number (805.3 per 1,000 in 1997/98) and the smallest relative decrease over the time period studied (23.2%) in days of care. The biggest decrease in days of care was among children aged one to four years, from 207.5 in 1991/92 to 107.9 per 1,000 in 1997/98 (48.0%).

The average length of stay (LOS) in hospital, however, was relatively stable over time, with a slight decrease noted. The biggest decrease was found in children aged one to four, from 2.9 days in 1991/92 to 2.5 days in 1997/98. The median and mean LOS did not differ.

Surgical Admission Rates

The absolute volume of inpatient surgeries decreased from 53,862 in 1991/92 to 28,525 in 1997/98 (19.2 to 10.3 per 1,000), representing an overall 50.5 per cent decrease in surgical discharges (Exhibits 1 and 2). Similar to hospitalizations for medical reasons, infants under one year of age had the highest hospital admission rate for surgery (20.3 per 1,000). The largest decrease was in children aged one to four years (60.2%) from 19.6 in 1991/92 to 7.8 per 1,000 in 1997/98.

In contrast to the decline in inpatient surgeries, the volumes of day surgeries increased from 67,558 in 1991/92 to 79,543 in 1997/98 (24.0 to 26.4 per 1,000), representing 10.0 per cent increase over time. Females aged 15 to 19 years had the highest day surgery rate in 1997/98 (33.7 per 1,000). Their day surgery rates also showed the biggest increase over time (19.5%).

Days of Care for Surgical Admissions

The total days of care for inpatient surgeries also decreased over the six years studied. Again, the biggest decline was in children aged one to four years (60.2%). The average LOS showed an overall increase (10.0%). Except for youths aged 15 to 19 years, all children showed an increase in average LOS. The biggest increase was in children aged one to four years (19.6%), from 3.3 days in 1991/92 to 3.9 days in 1997/98. The average LOS was substantially longer for infants (13.6 days in 1997/98) compared to the average of 4.7 days in all children. This overall increase in length of stay probably reflects the shift of less acutely ill children to day surgery, thus leaving more medically unstable and complex children in the inpatient group.

Children 0 to 14 Years

Most Common Reasons for Medical Admissions

Among children under 15 years of age, respiratory conditions were consistently the most common “responsible diagnosis” for hospital admission, with bronchiolitis the most prevalent in the under one year old group, and asthma in those children aged one to 14 years (Exhibit 3). In 1997/98 asthma accounted for 40.9 per cent of all respiratory conditions requiring hospitalization compared with 36.9 per cent in 1991/92. However, since 1991/92, the rate of admission due to asthma in children aged one to 14, showed a gradual decline from 5.2 to 2.9 per 1,000 in 1997/98. Asthma is the most common chronic illness in childhood and is commonly viewed as a growing health problem. Rates for hospitalization due to asthma increased in the 1980s. This recent decrease may reflect a number of issues. While there is no reason to believe that the prevalence of asthma is decreasing, there is evidence that recent therapeutic advances can significantly influence morbidity and reduce the risk of hospitalization for asthma in children.² Other factors that might account for the decrease in hospitalizations include changes in practice style, changing clinical thresholds for admission and the use of observation units in emergency departments. Further research is needed to delineate these factors and relate them to important clinical outcomes.

Neonatal jaundice was the most common diagnosis of the group of conditions classified by the International Classification of Diseases 9th revision (ICD-9) as “originating in the prenatal period,” and was the second most common diagnosis overall after acute bronchiolitis in the under one-year-old group. There was a 61.1 per cent increase in the rate of admission for this problem from 1991/92 to 1997/98. It has been suggested that this increase is attributable to the policy of early discharge from hospital, of newborns and their mothers.³ As of August 1999, Ontario has committed increased resources to allow mothers and their newborns to stay up to 60 hours in hospital following uncomplicated deliveries. It will be important to determine if this change in policy decreases the rate of subsequent admissions for neonatal jaundice and dehydration.

Most Common Reasons for Surgical Admissions

The most common surgical procedures performed in children are dependent on the age of the child (see Exhibits 4a and 4b). For infants under one year of age, pyloromyotomy was the single most common in-hospital surgery performed among surgical procedures on the digestive system and abdomen. The rates of

pyloromyotomy per 1,000 decreased from 2.0 in 1991/92 to 1.7 in 1997/98 representing more than a 14.0 per cent decrease over time. On the other hand, myringotomy with insertion of tubes was the most common day operation performed in infants in 1997/98.

Among procedures performed on male genital organs, circumcision was formerly the most common procedure performed on newborns under 28 days. Over half of these procedures were performed as a day procedure after discharge following delivery. The day surgery rate per 1,000 male newborns showed a dramatic decline of 78.0 per cent from 6.9 in 1991/92 to 1.5 in 1997/98. This decline may be partly due to the delisting of circumcision from OHIP reimbursement in 1994, and partly due to recent studies⁴⁻⁶ which challenge the previously held medical indication of lowering the risk of recurrent urinary tract infections. Currently both the Canadian Pediatric Society (CPS) and the American Academy of Pediatrics (AAP) are not recommending circumcision as a routine medical procedure.^{7,8}

The most common surgical procedures among children aged one to 14 years were operations on the nose, mouth and pharynx. Of these operations, tonsillectomy with adenoidectomy or adenoidectomy without tonsillectomy (T&A) were the most common procedures performed in these children. In 1991/92, the in-hospital T&A surgery rate was 7.9 per 1,000 and gradually declined to 1.6 per 1,000 in 1997/98, representing a more than 79.0 per cent decrease over time. Correspondingly, the same-day surgery rate for T&A increased from 3.2 to 6.3 per 1,000 in the same period of time (almost doubling). Although there was an apparent equivalent shift of the T&A from an in-hospital to a day procedure, the absolute volume of T&A surgery showed a decrease from about 22,000 to 17,000 annual procedures performed.

Myringotomy with the insertion of ventilation tubes (MVT) was the second most common procedure performed in this age group. MVT procedures were most commonly performed as a day procedure with a slight decrease over time from 8.9 in 1991/92 to 6.4 per 1,000 in 1997/98. In-hospital MVT rates per 1,000 dropped dramatically from 0.4 per 1,000 in 1991/92 to 0.1 per 1,000 in 1997/98 (69.2%). This overall decline in MVT rates may reflect a number of different factors, from reductions in overall operating room time to more consistent guidelines for the indications for ventilation tubes. Further investigation should address how this change in procedure rate correlates with important clinical outcomes such as recurrence of otitis media, hearing loss and speech problems.

Teenagers (Ages 15 to 19 years)

Reasons for admission for this group are markedly different than for younger children. The top reason for both surgical and medical admission for females aged 15 to 19 years is pregnancy related. Exhibit 5a, however, shows the downward trend in both rates of admission for pregnancy and live births in this group over the six years studied. Rates per 1,000 of live births decreased 16.8 per cent (23.3 in 1991/92 to 19.4 in 1997/98). This tendency is consistent with those in other Western countries such as the UK,^{9,10} although in the US the teenage live birth rate has stayed the same.¹¹ However, Exhibit 5b documents a much smaller decrease in the rates of admission for pregnancies and live births in girls 10 to 14 years of age, with a nine per cent decrease in those for live births from 1991/92 to 1997/98. Although low, these rates of admission reflecting rates of pregnancy in such a young population are an important area of concern. Both the children delivering and the children being delivered represent high-risk populations in terms of medical and social outcomes.

Most Common Reasons for Medical Admissions

Mental disorders became the most common reason for the medical admission of males 15 to 19 years by 1997/98, and is the second most common reason for admission of females of the same age (Exhibit 3). The most common single diagnosis for both males and females is recurrent manic disorders. In both cases, rates of admission for this disorder increased over time (by 85.8% in females and by 70.4% in males). Depressive disorders were also common reasons for admissions for both males and females and the rates of admission for this group of diagnoses increased slightly. Of the group of diagnoses relating to injuries and poisonings, acetaminophen overdoses were the leading cause of hospitalization for females (with a rate of 0.8/1,000 in 1997/98) whereas head injuries were the leading reason for admission for the males (rates per 1,000 for intracranial injury and concussion in 1997/98 were both 0.3). Acetaminophen was also the most common substance used in overdoses requiring hospitalization in males aged 15 to 19 years.

Most Common Reasons for Surgical Admissions

Appendectomies were the most common surgical procedures among teenagers. However, there was a moderate decrease in appendectomy rates over time in both male and female teenagers, 25.1% and 36.4% respectively, (Exhibits 4a and 4b).

Cervical cesarean section (C-section) was the most common same day surgical procedure among teenage girls followed by appendectomy and T&A surgeries. The C-section rate per 1,000 decreased from 2.6 in 1991/92 to 2.2 in 1997/98 (16.3%). The dilation and curettage (D&C) inpatient and day surgery rates per 1,000 showed a bigger decrease from 2.4 and 3.2 in 1991/92 to below 0.7 to 2.9 in 1997/98 respectively. This reduction in pregnancy-related procedures can be explained by the overall decline in pregnancies in this group.

Area Rate Variations for Medical Conditions

Asthma

From 1995/96 to 1997/98 there were over 9,000 annual asthma admissions in Ontario among children aged 19 years and under (Exhibit 6). The total rate per 100,000 declined 31.6 per cent from 447.6 in 1991/92 to 1993/94 to 306.3 in 1995/96 to 1997/98. The Hamilton-Wentworth DHC had the lowest rate for the two time periods observed, 225.4 and 175.4 per 100,000 respectively. On the other hand, Grand River DHC had the highest rates at 557.7 and 450.3 per 100,000. All 16 DHCs showed a decline in the admission rates for asthma. Champlain DHC had the largest decline in rates (62.6%) compared to the smallest decline (19.3%) in Grand River DHC. While the overall rates of admission due to asthma declined over time, the variations across DHCs remained relatively stable with a threefold difference. As well, most of the DHCs that ranked high in admission rates remained high, and those that ranked low remained low.

Gastroenteritis

In 1995/96 to 1997/98 there were 6,728 annual admissions due to gastroenteritis in Ontario among children aged 19 years and under (Exhibit 7). The total rate per 100,000 decreased nearly 30.0 per cent from 314.8 in 1991/92 to 1993/94 to 225.9 in 1995/96 to 1997/98. The Thames Valley DHC had the lowest rate per 100,000 for both time periods: 144.3 and 77.5 (46.3% over the time period analyzed). On the other hand, the DHCs of Essex, Kent and Lambton; Muskoka, Nipissing, Parry Sound and Timiskaming; and the Niagara Region had the highest admission rates in both periods. All 16 Ontario DHCs showed a decline in the gastroenteritis admission rates. Champlain DHC had the largest decline in rates (68.1%) compared to the smallest decline in Simcoe-York DHC (3.0%). While the overall rates of admission due to gastroenteritis declined over time, the variations

across DHCs showed a slight increase from an earlier threefold to fourfold variation. As with admissions for asthma, most of the DHCs that ranked high in admission rates remained high, and the low remained low.

Area Rate Variations for Surgical Conditions

Tonsillectomy

As indicated earlier, there was quite a dramatic shift for T&A surgery from an in-hospital procedure to a same-day surgery (SDS). In 1995/96 to 1997/98, over 15,000 T&A surgeries were performed as a day procedure compared to slightly over 6,000 that were done as an in-hospital procedure (Exhibits 8a and 8b). The Niagara Region DHC had the highest T&A same-day surgery rates in both 1991/92 to 1993/94 and 1995/96 to 1997/98 (830.3 and 1,039.6 per 100,000 respectively). The DHC in Northwestern Ontario, however, had the lowest T&A same-day surgery rates (13.8 and 63.9 per 100,000 for the two time periods respectively). The Spearman correlation coefficient of 77.6 per cent indicates that most of the DHCs with high T&A same-day surgery rates remained high and those with low rates remained low over time. In the earlier time period, the geographic variations for T&A same-day surgery were relatively high (60-fold difference) due partly to DHCs such as Northwestern Ontario and Grey, Bruce, Huron and Perth which had very low volumes of T&A surgeries performed as day procedures. Over the past five years, these DHCs increased their T&A same-day surgery rates by five to seven times. Correspondingly, the area variations reduced to 16-fold.

There was an overall 60.0 per cent decrease in in-hospital T&A rates over the two time periods analyzed. The decline ranged from 12.0 per cent (Grand River) to 80.6 per cent (Hamilton-Wentworth). However, the area variations increased from sixfold in 1991/92 to 1993/94 to 11-fold difference in 1995/96 to 1997/98.

The variation statistics in Exhibits 8a and 8b show relatively large geographic variations for both in-hospital and same day surgical T&A rates across Ontario. These large variations underscore the necessity to implement guidelines for selecting appropriate candidates for same day T&A versus in-hospital operation to ensure the best patient outcomes and most efficient use of hospital resources.

Myringotomy with Ventilation Tubes (MVT)

During 1995/96 to 1997/98, there were over 20,000 MVT hospitalizations in Ontario (Exhibit 9b). Of these hospitalizations, over 90 per cent were for a same-day MVT surgery (Exhibit 9b). The volume of same-day MVT surgeries performed in Ontario, although decreasing slightly over time, remained relatively stable. The annual volume of same-day MVT surgeries was over 19,000 for the period of 1995/96 to 1997/98. The DHC in Northwestern Ontario had the lowest same day MVT rates in both time periods (350.4 and 397.7 per 100,000 respectively). The top three DHCs for same-day MVT rates in both time periods were Durham, Haliburton, Kawartha and Pine Ridge; Muskoka, Nipissing, Parry Sound, and Timiskaming; and Waterloo Region. The Spearman correlation coefficient of 87.1 per cent indicates that most of the DHCs with high same-day MVT rates remained high and those with low rates remained low. The regional statistics for same-day MVT rates showed a threefold variation across DHCs from 1995/96 to 1997/98.

Over the two time periods studied, the volume of in-hospital MVT surgery declined from 126.7 to 47.6 per 100,000, representing an overall decrease of 62.4 per cent. The DHC in Grey, Bruce, Huron and Perth had the highest in-hospital MVT rates in both 1991/92 to 1993/94 and 1995/96 to 1997/98 (296.6 and 127.2 per 100,000 respectively). The Champlain DHC, however, had the lowest in-hospital MVT rates (28.5 and 13.0 per 100,000 for the two time periods respectively). The Spearman correlation coefficient of 87.1 per cent indicates that most of the DHCs with high in-hospital MVT rates remained high and those with low rates remained low. The in-hospital MVT rates showed a much higher regional variation (tenfold variations in 1995/96 to 1997/98) compared to that of the same day MVT rates. Furthermore, there was no substantive decrease in regional variations over time.

Conclusions

There is an overall trend of fewer pediatric inpatient admissions for both surgical and medical conditions. This trend spans most diagnostic categories, as well as geographic regions. The factors most likely to account for this change relate to the health care system, rather than any advances in medical or surgical interventions. This is further supported by the fact that small area variation has not changed substantially. Those DHCs with relatively high rates in the earlier years (1991/92 to 1993/94) remaining relatively unchanged in the later years (1995/96 to 1997/98) and those with low rates also remaining low. This supports the hypothesis that the changes in health care utilization relate to overall health system factors rather than to the institution of appropriate therapeutic interventions or DHC-specific changes.

The extent of the use of appropriate management, particularly for diseases such as asthma, for which there are articulated standards of practice based on good medical evidence, is an important future research direction. Furthermore, it must be noted that successful discharge or avoidance of hospitalization is not synonymous with improved health status. Changes in the pattern in which hospitalization is used may have significant impacts on children and families when an equally effective alternative is not available. As data on the utilization of home care and other alternatives to hospitalization is not available for analysis, it is currently difficult to speculate on this issue.

In this environment of overall decreasing inpatient admissions, diagnostic categories with increasing rates of admission are noteworthy. We highlighted two such examples. The first is infants with jaundice and dehydration. The marked increase in these admissions, in the context of otherwise decreasing rates of admission, relate most likely to the policy of early discharge of mothers and their newborns. The Ontario Ministry of Health has recently reversed this policy. It will be important to follow whether this reversal is implementable, and if so, whether there is a change in important medical outcomes. The second example of a group with increasing rates of admission is teenagers of both genders for mental disorders, in particular manic and depressive disorders. In the context of overall decreasing inpatient care this change implies either there is an increasing burden of illness, an increase in diagnosis, a decrease in community or ambulatory-based interventions for these problems, or some combination of these factors. Delineating the role of these factors has important implications for the care of these children and the allocation of appropriate health care resources.

Finally, although there is a downward trend in livebirths to teenage girls, the decrease is less marked in the younger ones, aged 10 to 14 years. These children and their newborns are of particular concern, and represent children at high risk for poor medical and social outcomes. Preventative and supportive interventions need to be implemented and evaluated.

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Exhibit 1: Discharge Rates per 1,000 Children 19 Years and Under in Ontario, 1991/92 – 1997/98

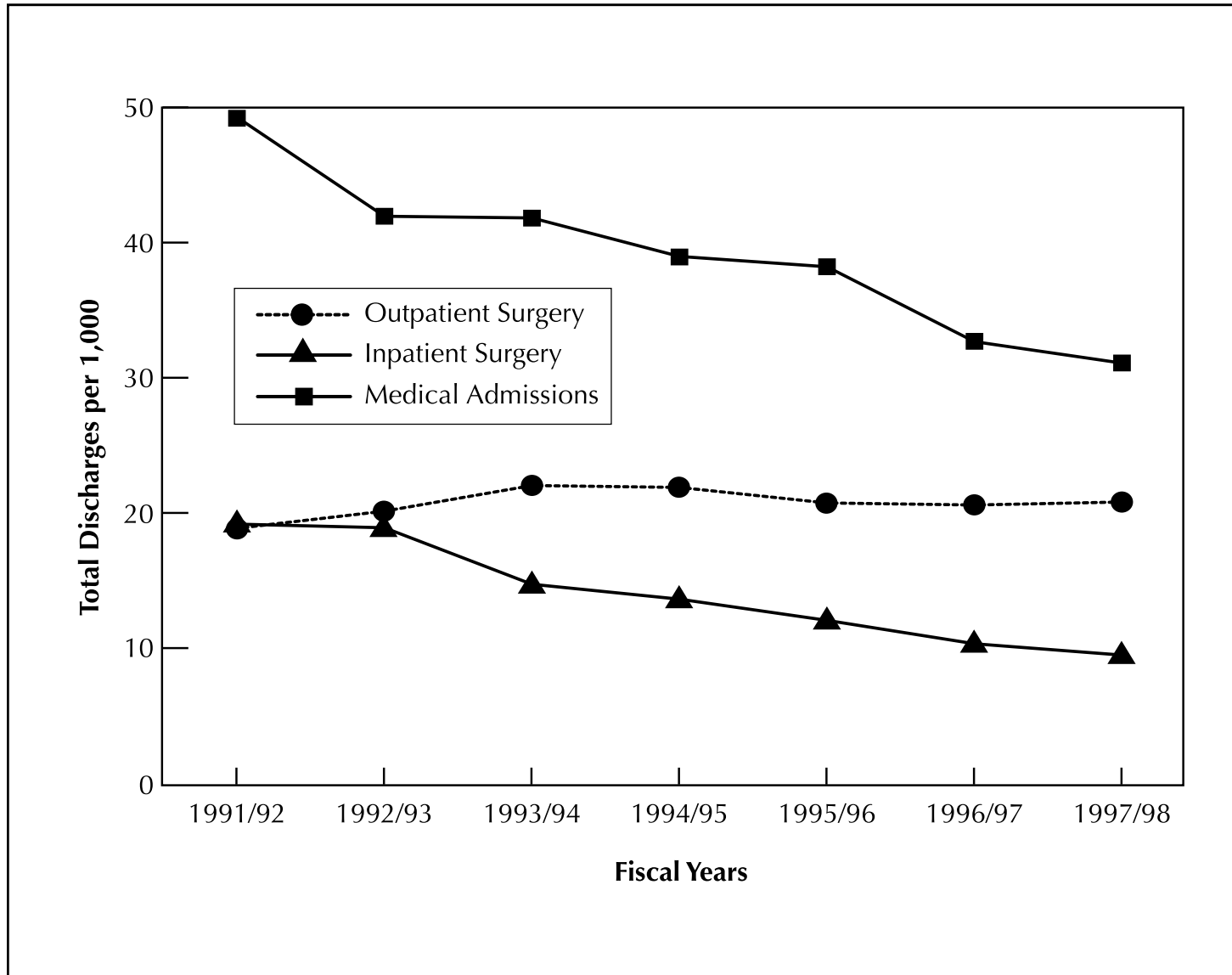


Exhibit Highlights

- ✓ From 1991/92 to 1997/98 there was a 37 per cent decrease in rates of childhood hospitalizations.
- ✓ Infants under one year of age accounted for the smallest decrease, while children aged five to 14 showed the biggest decrease (42%).
- ✓ Surgical discharge rates dropped by 51 per cent.
- ✓ The biggest drop was found in children aged one to 4 years (60%).
- ✓ There was an 18 per cent increase in the rate of surgical outpatient use.

Data Source: Canadian Institute for Health Information

Exhibit 2: Hospital Utilization per 1,000 Children 19 Years and Under in Ontario, 1991/92 and 1997/98

	Discharge Rates		Days of Care Rates	
	1991/92	1997/98	1991/92	1997/98
Medical Admissions				
<1 year	209	169	1,049	805
1 to 4 years	71	43	207	108
5 to 14 years	24	14	88	49
15 to 19 years	46	31	200	126
Female	68	46	284	175
Male	25	16	122	80
Overall Rate	49	31	193	115
Inpatient Surgery				
<1 year	25	20	300	277
1 to 4 years	20	8	64	30
5 to 14 years	16	7	55	26
15 to 19 years	24	14	103	52
Female	29	16	115	57
Male	20	12	91	47
Overall Rate	19	9	82	45
Day Surgery				
<1 year	17	12		
1 to 4 years	30	32		
5 to 14 years	14	16		
15 to 19 years	21	23		
Female	28	34		
Male	13	13		
Overall Rate	24	26		
Medical and Inpatient Surgical Combined				
<1 year	234	189	1,348	1,082
1 to 4 years	90	50	271	138
5 to 14 years	40	21	143	75
15 to 19 years	70	44	303	178
Female	97	62	400	232
Male	45	28	213	127
Overall Rate	68	41	276	160

Exhibit Highlights

- ✓ Overall rates for hospital utilization decreased in all categories, except day surgery, between 1991/92 and 1997/98.

Data Source: Canadian Institute for Health Information

Exhibit 3: Age-specific Top Three Medical Hospitalization Rates per 1,000 Children by ICD Chapters in Ontario, 1997/98 Compared to 1991/92

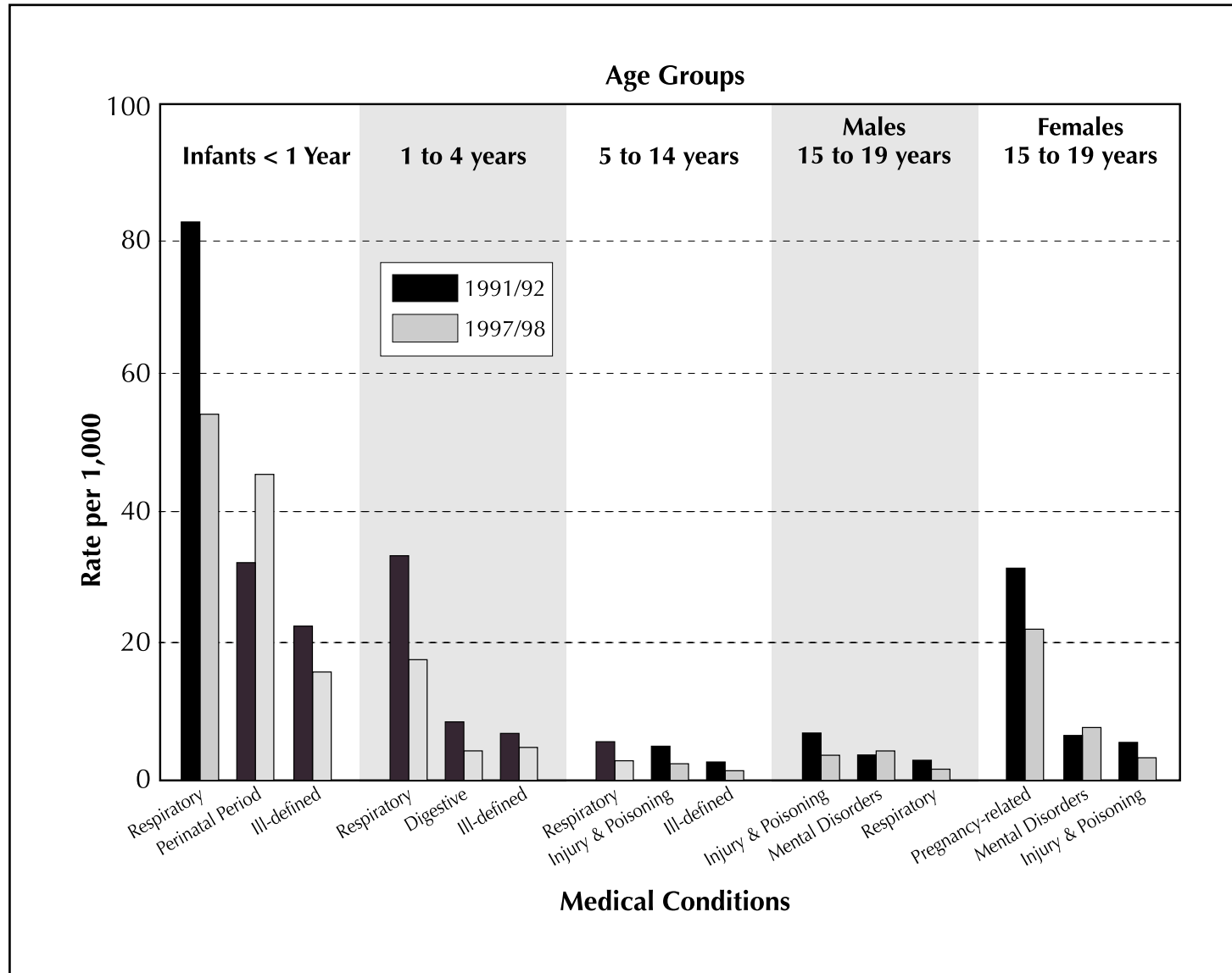


Exhibit Highlights

- ✓ Among children under 15 years, respiratory conditions were the leading cause for hospital admission.
- ✓ Pregnancy is the leading cause of admission for females 15 to 19 years (See Exhibit 4 for details).
- ✓ Rates of admission for mental disorders is increasing in both males and females 15 to 19 years.

Data Source: Canadian Institute for Health Information

Exhibit 4a: Age-specific Top Three Inhospital Surgery Rates per 1,000 Children by Major Clinical Category in Ontario, 1997/98 Compared to 1991/92

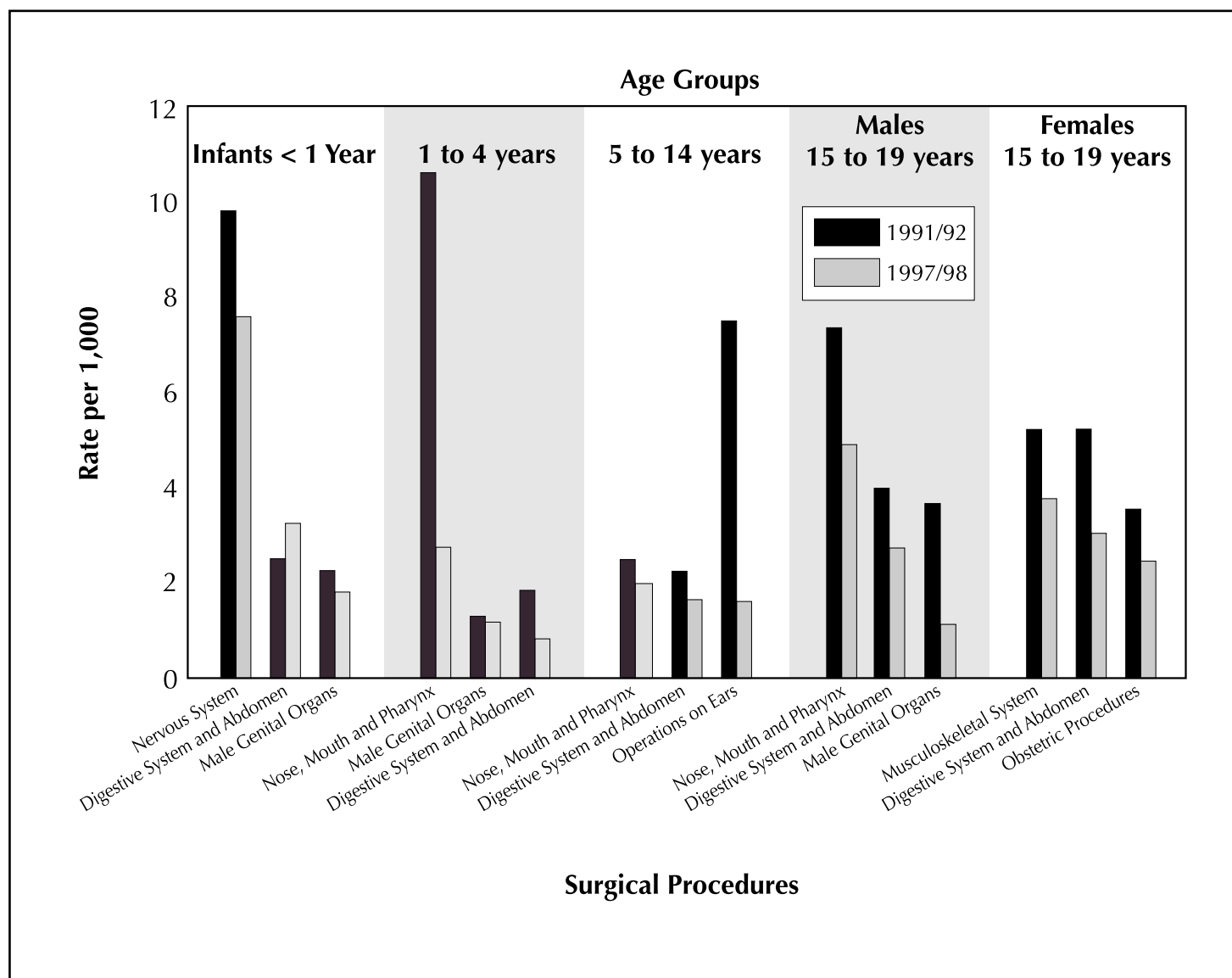


Exhibit Highlights

- ✓ Corrective surgeries for congenital anomalies were the most common nervous system procedures for infants under one year.
- ✓ Tonsillectomies were among the top surgical procedures performed in the nose, mouth and pharynx in children aged one to 14 years.
- ✓ Hernia operations were common digestive system and abdomen surgery among infants and children under five years of age, while appendectomy for acute appendicitis was consistently one of the top surgical procedures performed in children over the age of five.
- ✓ While the surgical rate for spontaneous abortion remained the most common obstetric surgical procedure performed in females aged 15 to 19 years, the rates had actually declined.

Data Source: Canadian Institute for Health Information

Exhibit 4b: Age-specific Top Three Same Day Surgery Rates per 1,000 Children by Major Clinical Category and Age Group in Ontario, 1997/98 Compared to 1991/92

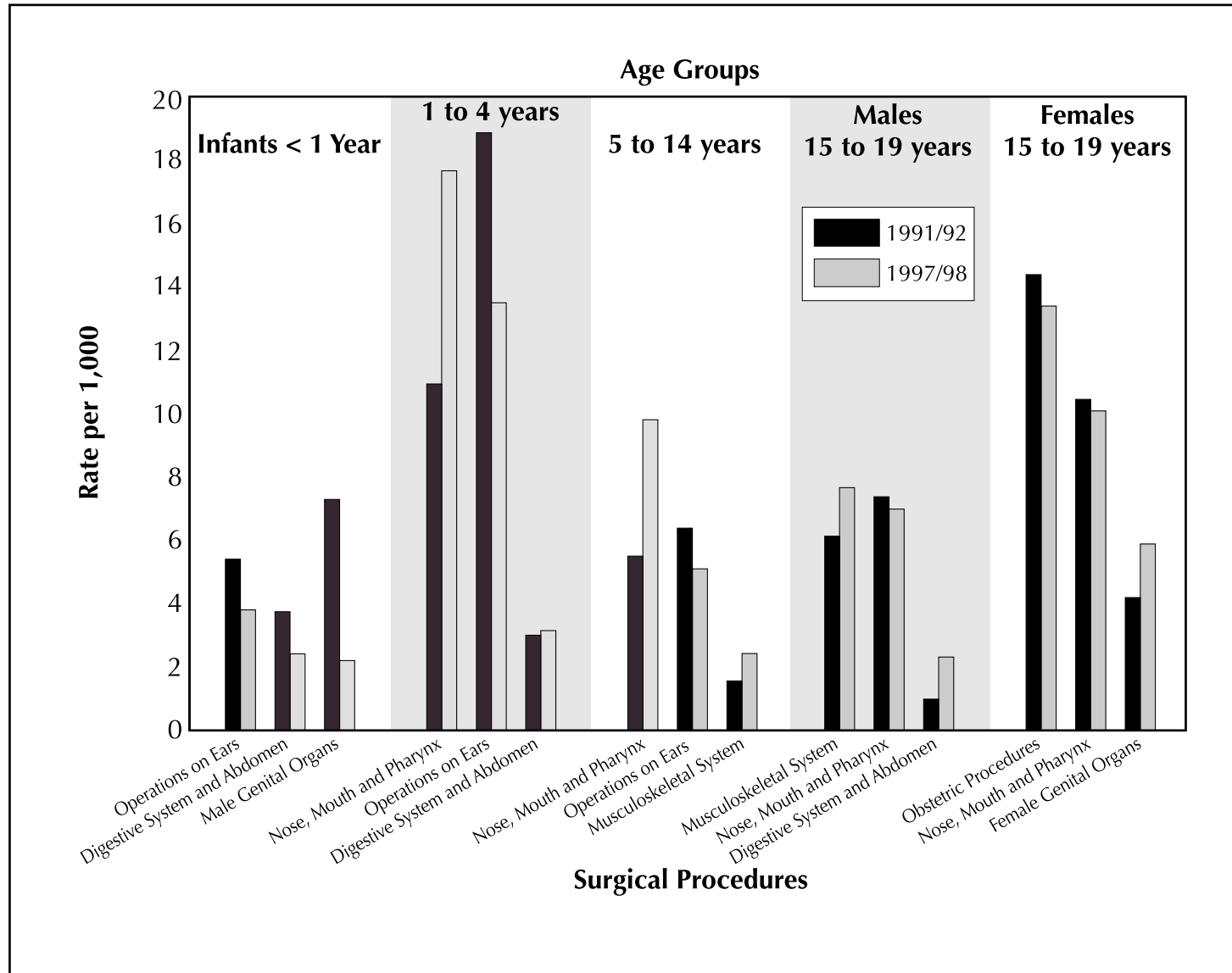


Exhibit Highlights

- ✓ Among nose, mouth and pharynx operations, the same-day surgery rate for tonsillectomy and adenoidectomy (T&A) among children aged one to 14 years doubled.
- ✓ Among operations on ears, myringotomy with the insertion of ventilation tubes (MVT) procedures were the second most commonly performed day procedure with a slight decrease over time.

Data Source: Canadian Institute for Health Information

Exhibit 5a: Overall Pregnancy Rates Versus Live Birth Rates per 1,000 Females Aged 15 to 19 Years in Ontario, 1991/92 – 1997/98

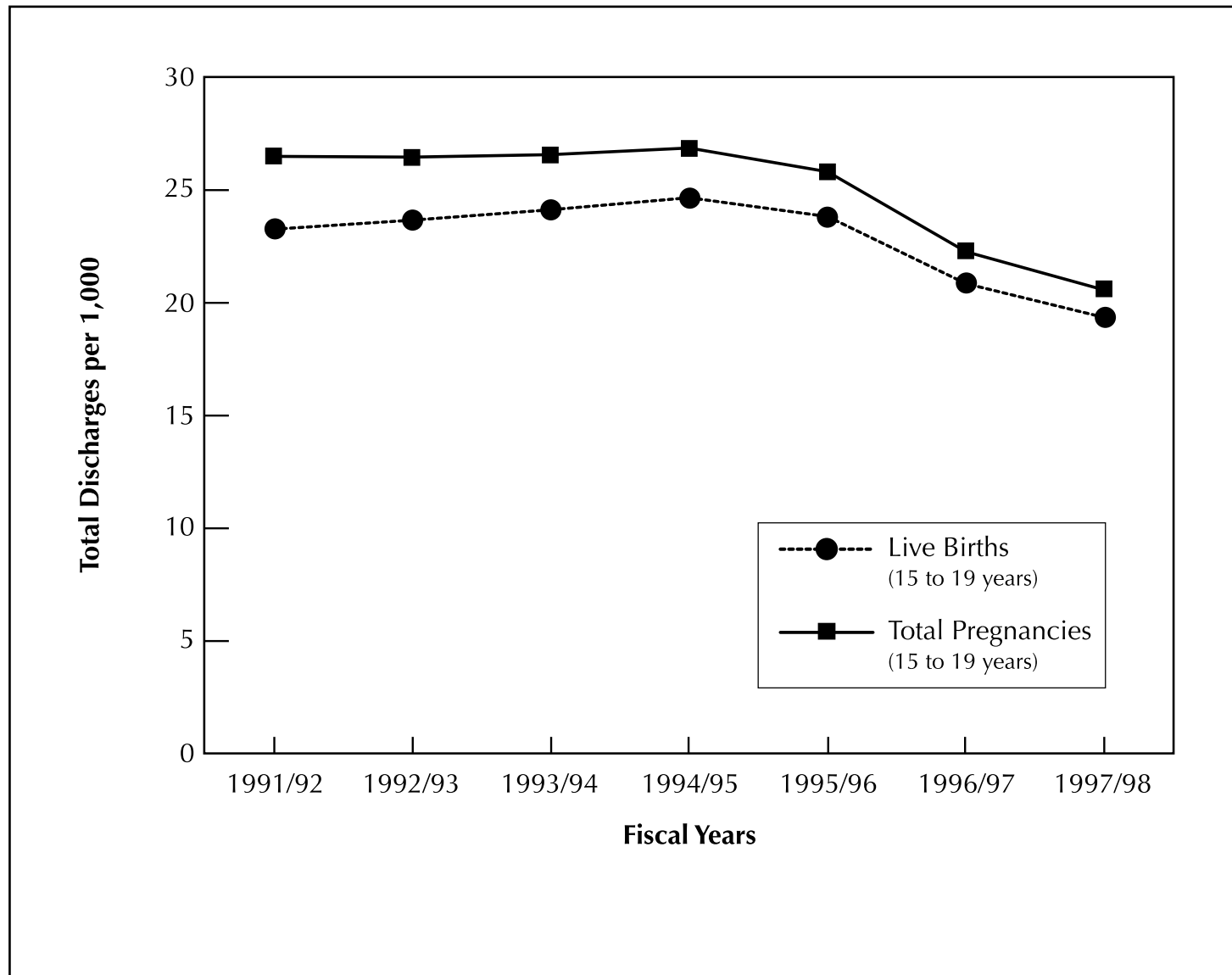


Exhibit Highlights

- ✓ Rates of both pregnancies and live births in females 15 to 19 years decreased between 1991/92 and 1997/98.

Data Source: Canadian Institute for Health Information

Exhibit 5b: Overall Pregnancy Rates Versus Live Birth Rates per 1,000 Females Aged 10 to 14 Years in Ontario, 1991/92 – 1997/98

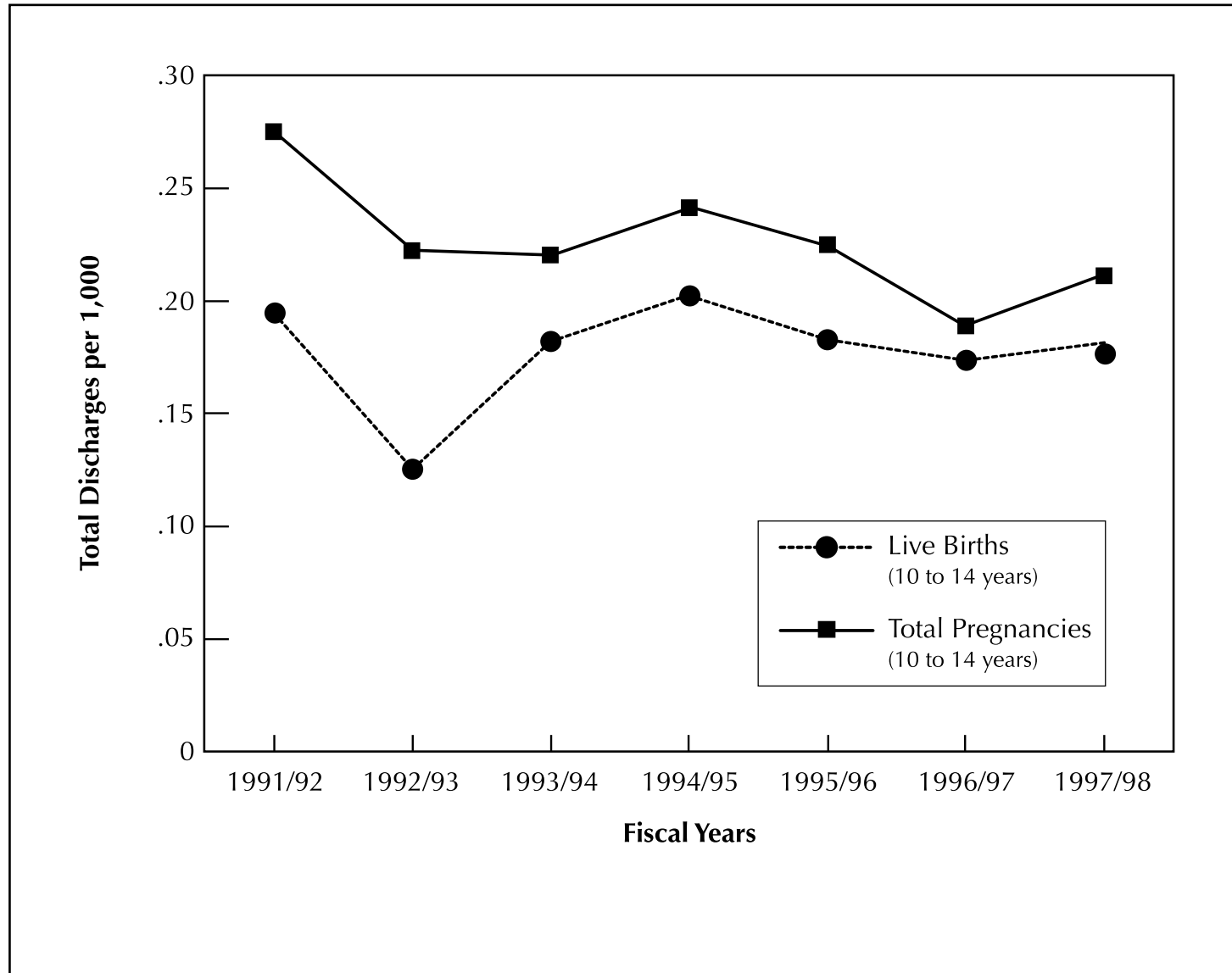


Exhibit Highlights

- ✓ Rates of pregnancy and live birth in females 10 to 14 years decreased between 1991/92 and 1997/98.
- ✓ This decrease in rates of admission is smaller than in females 15 to 19 years.

Data Source: Canadian Institute for Health Information

Exhibit 6: Age/Sex-adjusted Asthma Admission Rates per 100,000 Children by Ontario District Health Council of Patient Residence, 1991/92 – 1997/98

ASTHMA	1991/92 – 1993/94			1995/96 – 1997/98		
	Number of Admissions/Year	Age/Sex-adjusted Admission Rate per 100,000 Population	Rank/p-value*	Number of Admissions/Year	Age/Sex-adjusted Admission Rate per 100,000 Population	Rank/p-value*
District Health Council						
Algoma, Cochrane, Manitoulin and Sudbury	665	544.0	4 ■	487	425.1	3 ■
Champlain	1,342	506.8	7 ■	532	194.8	14 ■
Durham, Haliburton, Kawartha and Pine Ridge	989	455.1	10	703	312.0	11
Essex, Kent, and Lambton	902	550.8	3 ■	702	429.1	2 ■
Grand River	368	557.7	1 ■	292	450.3	1 ■
Grey, Bruce, Huron, Perth	377	452.7	11	290	359.8	4 ▲
Halton-Peel	1,315	404.2	13 ■	1,126	312.1	10
Hamilton-Wentworth	277	225.4	16 ■	220	175.4	16 ■
Muskoka, Nipissing, Parry Sound and Timiskaming	318	539.0	5 ■	191	342.2	6
Niagara Region	593	555.2	2 ■	375	355.0	5 ▲
Northwestern Ontario	328	437.9	12	247	338.4	7
Quinte, Kingston, Rideau	652	519.4	6 ■	420	332.9	9
Simcoe-York	871	335.4	14 ■	754	270.5	13 ■
Thames Valley	480	302.8	15 ■	295	182.4	15 ■
Toronto	2,453	460.0	9	1,970	336.7	8 ■
Waterloo Region-Wellington-Dufferin	882	498.6	8 ▲	516	280.0	12 ●
Total Ontario	12,812	447.6		9,120	306.3	
Coefficient of variation (%) (CV)		19.0			23.5	
Extremal quotient (EQ)		2.5			2.6	
Systematic component of variation (SCV)		44.6			67.8	
Adjusted Chi-square (likelihood ratio)		506 (d.f. 15, p < 0.0001)			521 (d.f. 15, p < 0.0001)	

● Significant at 5% level ▲ Significant at 1% level ■ Significant at 0.1% level

* The p-values shown in this exhibit are based on a Chi-square statistic used to compare each DHC with the overall mean rate for the province.

Exhibit Highlights

- ✓ Overall asthma admission rates declined 32 per cent between 1991/92 and 1997/98.
- ✓ This decrease was evident in all 16 District Health Councils.

Data Source: Canadian Institute for Health Information

Exhibit 7: Age/Sex-adjusted Gastroenteritis Admission Rates per 100,000 Children by Ontario District Health Council of Patient Residence, 1991/92 – 1997/98

GASTROENTERITIS District Health Council	1991/92 – 1993/94			1995/96 – 1997/98		
	Number of Admissions/Year	Age/Sex-adjusted Admission Rate per 100,000 Population	Rank/p-value*	Number of Admissions/Year	Age/Sex-adjusted Admission Rate per 100,000 Population	Rank/p-value*
Algoma, Cochrane, Manitoulin and Sudbury	362	299.1	12	280	246.3	8
Champlain	863	324.6	10	283	103.4	15 ■
Durham, Haliburton, Kawartha and Pine Ridge	747	339.5	7 ●	646	285.6	4 ■
Essex, Kent, and Lambton	686	419.2	4 ■	549	336.9	1 ■
Grand River	305	461.6	2 ■	177	272.5	5 ●
Grey, Bruce, Huron, Perth	298	358.5	6 ●	178	221.7	10
Halton-Peel	1,064	326.6	9	828	229.1	9
Hamilton-Wentworth	295	239.4	14 ■	136	108.8	14 ■
Muskoka, Nipissing, Parry Sound and Timiskaming	253	432.3	3 ■	174	316.0	2 ■
Niagara Region	495	464.7	1 ■	326	309.1	3 ■
Northwestern Ontario	245	327.8	8	154	211.3	12
Quinte, Kingston, Rideau	462	367.8	5 ■	264	210.0	13
Simcoe-York	583	222.9	15 ■	600	216.2	11
Thames Valley	230	144.3	16 ■	125	77.5	16 ■
Toronto	1,576	294.1	13 ▲	1,543	262.0	6 ■
Waterloo Region-Wellington-Dufferin	565	317.8	11	462	250.1	7 ●
Total Ontario	9,030	314.8		6,728	225.9	
Coefficient of variation (%) (CV)		22.9			31.0	
Extremal quotient (EQ)		3.2			4.3	
Systematic component of variation (SCV)		72.3			103.2	
Adjusted Chi-square (likelihood ratio)		501 (d.f. 15, p < 0.0001)			743 (d.f. 15, p < 0.0001)	

● Significant at 5% level ▲ Significant at 1% level ■ Significant at 0.1% level

* The p-values shown in this exhibit are based on a Chi-square statistic used to compare each DHC with the overall mean rate for the province.

Exhibit Highlights

- ✓ Overall admission rates for gastroenteritis decreased 30 per cent between 1991/92 and 1997/98.
- ✓ Admission rates declined in all District Health Councils.

Data Source: Canadian Institute for Health Information

Exhibit 8a: Age/Sex-adjusted Inhospital Tonsillectomy Rates per 100,000 Children by Ontario District Health Council of Patient Residence in Ontario, 1991/92 – 1997/98

INHOSPITAL TONSILLECTOMY	1991/92 – 1993/94			1995/96 – 1997/98		
	Number of Admissions/Year	Age/Sex-adjusted Admission Rate per 100,000 Population	Rank/p-value*	Number of Admissions/Year	Age/Sex-adjusted Admission Rate per 100,000 Population	Rank/p-value*
District Health Council						
Algoma, Cochrane, Manitoulin and Sudbury	931	747.9	2 ■	377	320.9	5 ■
Champlain	404	153.9	16 ■	111	40.6	16 ■
Durham, Haliburton, Kawartha and Pine Ridge	1,345	623.7	5 ■	617	274.3	7 ■
Essex, Kent, and Lambton	920	554.9	9	568	341.5	4 ■
Grand River	286	432.9	14 ■	251	379.0	3 ■
Grey, Bruce, Huron, Perth	785	941.1	1 ■	370	451.8	1 ■
Halton-Peel	1,755	539.9	11	548	153.2	12 ■
Hamilton-Wentworth	626	511.4	13	124	99.3	15 ■
Muskoka, Nipissing, Parry Sound and Timiskaming	322	543.4	10	150	263.0	8 ▲
Niagara Region	554	518.7	12	113	106.4	14 ■
Northwestern Ontario	489	652.3	4 ■	328	443.4	2 ■
Quinte, Kingston, Rideau	854	680.9	3 ■	351	276.5	6 ■
Simcoe-York	1,595	615.5	6 ■	679	243.9	9 ■
Thames Valley	892	562.5	8 ●	360	222.5	10
Toronto	2,260	424.0	15 ■	839	144.3	13 ■
Waterloo Region-Wellington-Dufferin	1,050	597.6	7 ■	326	177.4	11 ▲
Total Ontario	15,068	527.0		6,111	205.2	
Coefficient of variation (%) (CV)		30.3			50.0	
Extremal quotient (EQ)		6.1			11.1	
Systematic component of variation (SCV)		98.6			369.6	
Adjusted Chi-square (likelihood ratio)		1,604 (d.f. 15, p < 0.0001)			1,575 (d.f. 15, p < 0.0001)	

● Significant at 5% level ▲ Significant at 1% level ■ Significant at 0.1% level

* The p-values shown in this exhibit are based on a Chi-square statistic used to compare each DHC with the overall mean rate for the province.

Exhibit Highlights

- ✓ There was a large decline in the number of inhospital tonsillectomy procedures due to a shift to same-day surgery.

Data Source: Canadian Institute for Health Information

Exhibit 8b: Age/Sex-adjusted Same Day Tonsillectomy Rates per 100,000 Children by District Health Council of Patient Residence in Ontario, 1991/92 – 1997/98

SAME DAY TONSILLECTOMY	1991/92 – 1993/94			1995/96 – 1997/98		
	Number of Admissions/Year	Age/Sex-adjusted Asthma Admission Rate per 100,000 Population	Rank/p-value*	Number of Admissions/Year	Age/Sex-adjusted Admission Rate per 100,000 Population	Rank/p-value*
District Health Council						
Algoma, Cochrane, Manitoulin and Sudbury	268	221.1	10 ■	626	541.3	8
Champlain	980	371.9	7 ■	1,110	406.3	13 ■
Durham, Haliburton, Kawartha and Pine Ridge	727	332.9	8 ■	1,423	631.2	5 ■
Essex, Kent, and Lambton	727	444.4	4 ■	889	543.5	7
Grand River	492	745.7	2 ■	424	647.3	3 ■
Grey, Bruce, Huron, Perth	30	36.1	15 ■	191	236.6	15 ■
Halton-Peel	479	147.5	13 ■	2,026	563.2	6 ■
Hamilton-Wentworth	479	390.8	6 ■	901	719.8	2 ■
Muskoka, Nipissing, Parry Sound and Timiskaming	243	414.0	5 ■	276	491.8	10
Niagara Region	885	830.3	1 ■	1,099	1039.6	1 ■
Northwestern Ontario	10	13.8	16 ■	47	63.9	16 ■
Quinte, Kingston, Rideau	238	189.5	11 ■	521	411.2	12 ■
Simcoe-York	616	235.9	9 ■	1,411	506.0	9
Thames Valley	212	133.4	14 ■	577	356.5	14 ■
Toronto	958	180.0	12 ■	2,491	428.2	11 ■
Waterloo Region-Wellington-Dufferin	854	480.9	3 ■	1,185	641.5	4 ■
Total Ontario	8,201	286.9		15,196	510.3	
Coefficient of variation (%) (CV)		62.1			31.6	
Extremal quotient (EQ)		60.0			16.3	
Systematic component of variation (SCV)		615.9			167.5	
Adjusted Chi-square (likelihood ratio)		2,937 (d.f. 15, p < 0.0001)			1,576 (d.f. 15, p < 0.0001)	

● Significant at 5% level ▲ Significant at 1% level ■ Significant at 0.1% level

* The p-values shown in this exhibit are based on a Chi-square statistic used to compare each DHC with the overall mean rate for the province.

Exhibit Highlights

- ✓ There was a large increase in the rates of same-day tonsillectomy surgery between 1991/92 and 1997/98.

Data Source: Canadian Institute for Health Information

Exhibit 9a: Age/Sex-adjusted Inhospital Myringotomy Rates per 100,000 Children by District Health Council of Patient Residence in Ontario, 1991/92 – 1997/98

INHOSPITAL MYRINGOTOMY	1991/92 – 1993/94			1995/96 – 1997/98		
	Number of Admissions/Year	Age/Sex-adjusted Admission Rate per 100,000 Population	Rank/p-value*	Number of Admissions/Year	Age/Sex-adjusted Admission Rate per 100,000 Population	Rank/p-value*
District Health Council						
Algoma, Cochrane, Manitoulin and Sudbury	184	153.4	8 ▲	73	64.7	6 ▲
Champlain	76	28.5	16 ■	35	13.0	16 ■
Durham, Haliburton, Kawartha and Pine Ridge	343	153.9	7 ■	154	68.5	5 ■
Essex, Kent, and Lambton	269	165.7	5 ■	138	85.2	4 ■
Grand River	45	68.1	15 ■	27	42.8	10
Grey, Bruce, Huron, Perth	245	296.6	1 ■	100	127.2	1 ■
Halton-Peel	357	108.6	11 ▲	110	30.3	15 ■
Hamilton-Wentworth	118	94.5	14 ▲	40	32.0	12 ●
Muskoka, Nipissing, Parry Sound and Timiskaming	111	190.3	3 ■	34	63.3	7
Niagara Region	110	103.0	12 ●	33	31.5	13 ●
Northwestern Ontario	142	190.1	4 ■	72	99.4	2 ■
Quinte, Kingston, Rideau	253	200.7	2 ■	112	89.4	3 ■
Simcoe-York	376	143.2	9 ●	144	52.5	8
Thames Valley	252	156.6	6 ■	79	49.1	9
Toronto	526	96.1	13 ■	189	31.4	14 ■
Waterloo Region-Wellington-Dufferin	253	140.8	10	78	42.4	11
Total Ontario	3,659	126.7		1,419	47.6	
Coefficient of variation (%) (CV)		41.6			52.7	
Extremal quotient (EQ)		10.4			9.8	
Systematic component of variation (SCV)		238.4			416.9	
Adjusted Chi-square (likelihood ratio)		665 (d.f. 15, p < 0.0001)			384 (d.f. 15, p < 0.0001)	

● Significant at 5% level ▲ Significant at 1% level ■ Significant at 0.1% level

* The p-values shown in this exhibit are based on a Chi-square statistic used to compare each DHC with the overall mean rate for the province.

Exhibit Highlights

- ✓ The volume of inhospital myringotomy surgery declined 62 per cent between the two time periods.

Data Source: Canadian Institute for Health Information

Exhibit 9b: Age/Sex-adjusted Same Day Myringotomy Rates per 100,000 Children by District Health Council of Patient Residence in Ontario, 1991/92 – 1997/98

SAME DAY MYRINGOTOMY	1991/92 – 1993/94			1995/96 – 1997/98		
	Number of Admissions/Year	Age/Sex-adjusted Admission Rate per 100,000 Population	Rank/p-value*	Number of Admissions/Year	Age/Sex-adjusted Admission Rate per 100,000 Population	Rank/p-value*
District Health Council						
Algoma, Cochrane, Manitoulin and Sudbury	763	637.1	11 ●	798	707.0	6 ▲
Champlain	1,396	522.1	13 ■	1,210	442.8	15 ■
Durham, Haliburton, Kawartha and Pine Ridge	2,458	1,102.0	2 ■	2,655	1,184.2	1 ■
Essex, Kent, and Lambton	1,070	658.0	10	930	574.4	11 ■
Grand River	468	709.2	8	382	590.8	9
Grey, Bruce, Huron, Perth	743	902.8	4 ■	545	699.1	7 ●
Halton-Peel	2,172	658.5	9 ●	2,287	628.8	8
Hamilton-Wentworth	573	461.1	15 ■	613	489.3	13 ■
Muskoka, Nipissing, Parry Sound and Timiskaming	658	1,134.2	1 ■	610	1,139.1	2 ■
Niagara Region	639	597.3	12 ■	617	589.9	10 ●
Northwestern Ontario	261	350.4	16 ■	289	397.7	16 ■
Quinte, Kingston, Rideau	911	723.8	7	891	713.6	5 ■
Simcoe-York	2,154	819.7	5 ■	2,104	767.4	4 ■
Thames Valley	1,226	760.4	6 ■	887	549.2	12 ■
Toronto	2,758	503.2	14 ■	2,684	448.3	14 ■
Waterloo Region-Wellington-Dufferin	1,730	966.3	3 ■	1,517	820.8	3 ■
Total Ontario	19,980	691.4		19,019	638.7	
Coefficient of variation (%) (CV)		28.8			33.1	
Extremal quotient (EQ)		3.2			3.0	
Systematic component of variation (SCV)		97.9			116.9	
Adjusted Chi-square (likelihood ratio)		1,640 (d.f. 15, p < 0.0001)			1,914 (d.f. 15, p < 0.0001)	

● Significant at 5% level ▲ Significant at 1% level ■ Significant at 0.1% level

* The p-values shown in this exhibit are based on a Chi-square statistic used to compare each DHC with the overall mean rate for the province.

Exhibit Highlights

- ✓ The volume of same-day myringotomy surgeries, although slightly decreasing over time, remained relatively stable.

Data Source: Canadian Institute for Health Information

Glossary

pyloromyotomy

an operation which corrects pyloric stenosis, which is the narrowing of the channel through which food moves from the stomach into the small intestine.

myringotomy

an operation where a small cut is made in the child's eardrum, fluid in the middle ear is gently drained and a small metal or plastic tube is put into the slit in the eardrum.

tonsillectomy and adenoidectomy (T&A)

tonsillectomy is the removal of the tonsils while adenoidectomy is the removal of the adenoids. The adenoids are pads of tissue located behind the nose in the throat. Both surgeries may be done together or only one may be done.

area rate variations

rates of surgery or medical diagnoses can differ across counties, regions or areas. These variations could be random or a function of service availability, patient population characteristics, physician uncertainty, patient's preference, differences in physician practice styles, absence of guidelines for treatment etc.

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Technical Appendix

Study Population

In general, for the Exhibits on medical and surgical admissions, all children aged newborn to 19 years (inclusive) were included. However, for the small area variation analysis, only those with valid Ontario residence codes were included. In most of this report, children were grouped into infants (under one year of age), one to four years, five to 14 years and 15 to 19 years. Teenagers aged 15 to 19 years were further stratified by sex.

Classification of the Most Common Medical Admissions and Surgical Procedures

We used the International Classification of Diseases 9th revision (ICD-9) chapters to classify the three most common diseases or conditions responsible for the medical admission. Within each of the top three chapters, we examined the ten single most common medical conditions (individual ICD-9 codes) responsible for the length of stay in hospital. For surgical admissions, the Canadian Classification of Diagnostic, Therapeutic and Surgical Procedures (CCP) chapters were used to classify the three most common operations performed in children. Similar to the study on medical admissions, within the top three chapters, we further examined the ten single most common surgical procedures (individual CCP codes) responsible for the length of stay in hospital.

Methodology for Area Variation

More detailed methodology for the analysis of area variation is found in the *Patterns of Health Care in Ontario: ICES Practice Atlas, 2nd Ed.*¹ This approach was followed for the analyses included in this report.

Technical Appendix

1991/92 – 1993/94—Live Birth Case Mix Group (CMG) Codes

CMG Codes	DESCRIPTION
600	Uncomplicated vaginal delivery
601	Complicated vaginal delivery
602	Vaginal delivery with dilatation and curettage or other sterilization procedure
603	Vaginal delivery with other procedure
604	Cesarean section

1994/95 – 1997/98—Live Birth Case Mix Group (CMG) Codes

600	Major procedure in pregnancy or childbirth
601	Repeat cesarean delivery with complicating diagnosis
602	Cesarean delivery with complicating diagnosis
603	Repeat cesarean delivery
606	Cesarean delivery
607	Vaginal delivery with sterilization procedure
608	Vaginal delivery with minor procedure
609	Vaginal delivery after cesarean with complicating diagnosis
610	Vaginal delivery with complicating diagnosis
611	Vaginal delivery after cesarean delivery

1991/92 – 1993/94—Losses in Pregnancy Case Mix Group (CMG) Codes

CMG Codes	DESCRIPTION
605	Ectopic pregnancy
607	Abortive outcome without dilatation and curettage
608	Abortive outcome with dilatation and curettage

1994/95 – 1997/98—Losses in Pregnancy Case Mix Group (CMG) Codes

612	Ectopic pregnancy with major procedure
613	Ectopic pregnancy with minor procedure
614	Ectopic pregnancy
616	Abortive outcome with injection
617	Abortive outcome with dilatation and curettage
618	Abortive outcome

Comparing total number of live births (mothers' records, all ages) using above CMG codes with newborn entries (babies' records) yields the following:

Year	Live Births	Newborn Entries
1991/92	152,557	153,738
1992/93	151,156	152,352
1993/94	149,110	150,336
1994/95	149,245	150,469
1995/96	147,101	148,195
1996/97	139,498	140,746
1997/98	135,849	137,114

Diagnosis and Surgical ICD-9 Codes (used in small area variation analysis)

ICD-9 Codes	DESCRIPTION
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Asthma

493 Asthma

Gastroenteritis

008.6 Viral enteritis not elsewhere classified
 008.8 Viral enteritis not elsewhere specified
 009.0 Infectious enteritis not elsewhere specified
 009.1 Enteritis of an infectious origin
 009.2 Infectious diarrhea not elsewhere specified
 009.3 Diarrhea of infectious origin
 558 Other noninfectious gastroenteritis

Tonsillectomy Diagnosis and Surgical Codes¹

ICD-9 Codes	DESCRIPTION	CCP Codes	DESCRIPTION
Diagnosis		Surgery	
474.0	Chronic tonsillitis	40.1	Tonsillectomy without adenoidectomy
474.1	Hypertrophy of tonsils and adenoids	40.2	Tonsillectomy with adenoidectomy
474.9	Unspecified chronic disease of tonsils and adenoids	40.3	Excision of tonsil tag
463.0	Acute tonsillitis	40.5	Adenoidectomy without tonsillectomy

¹ Tonsillectomy was defined by a combination of one diagnosis and one surgical code.

Technical Appendix (Cont'd)

Circumcision Surgical CCP Code

CCP Code	DESCRIPTION
76.0	Circumcision

Myringotomy with Insertion of Ventilation Tubes Codes

ICD-9 Codes	DESCRIPTION Diagnosis	CCP Codes	DESCRIPTION Surgery
380.0-380.9	Disorders of external ear	32.01	
381.0-381.9	Nonsuppurtative otitis media and eustachian tube disorders		
382.0-382.9	Suppurative and unspecified otitis media		



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