Diabetes and Lower Extremity Amputations in Nova Scotia

November 2017
Prepared by:

Pam Talbot, Jennifer Payne, Peggy Dunbar, and Zlatko Karlovic
Diabetes Care Program of Nova Scotia
November 2017

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## GLOSSARY

### ACRONYMS

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCDSS</td>
<td>Canadian Chronic Disease Surveillance System</td>
</tr>
<tr>
<td>CIHI-DAD</td>
<td>Canadian Institute for Health Information Discharge Abstract Database</td>
</tr>
<tr>
<td>DC</td>
<td>Diabetes Centre</td>
</tr>
<tr>
<td>DCPNS</td>
<td>Diabetes Care Program of Nova Scotia</td>
</tr>
<tr>
<td>HCN</td>
<td>Health card number</td>
</tr>
<tr>
<td>LEA</td>
<td>Lower extremity amputation</td>
</tr>
<tr>
<td>NS</td>
<td>Nova Scotia</td>
</tr>
</tbody>
</table>

### DEFINITIONS

**Diabetes**

**Section 1 and 2:** Individuals were identified as having diabetes if, within a 2-year period, they had 1 hospitalisation and/or 2 physician claims with a diagnosis code for diabetes

**Section 3:** Type 1 or type 2 diabetes as reported in the DCPNS Registry

**LEA**

A procedure with a code denoting an amputation of the lower limb during an acute in-patient hospital admission (Specific codes can be found in Appendix B, p.36) Individuals can have one or more LEA procedures during a single admission

**LEA admission rate**

Average number of adults with one or more LEA admissions in a given 3-year period (sum of LEAs divided by 3) divided by the average population for that 3-year period (sum of population divided by 3)

**LEA admission rate ratio**

Rate of LEAs among those with diabetes divided by the rate among those without diabetes

**Level of LEA**

Location on the lower extremity where the amputation occurred, categorized into three groups: toes/foot/ankle, below knee, knee and above

For admissions with multiple procedures, level refers to the procedure performed closest to the pelvis

**Length of stay**

Days spent in hospital for a given admission (i.e., from admission to discharge)

**Median length of stay**

Number of days spent in hospital at which point half of those admitted have been discharged (i.e., if the median length of stay is 16 days, half of those admitted were discharged after 16 days or less in hospital)

**Zone of residence**

Nova Scotia Health Authority health management zone of residence

**Age**

**At fiscal year-end:** Age in years as of March 31 for a given year (those under 20 were excluded)

**At first LEA:** Age in years as of the date of discharge for the first LEA admission in the period

**Duration of diabetes at first LEA**

Number of years between the date of diabetes diagnosis and the date of discharge for the first LEA admission in the period

**Survival time**

Length of time between individuals’ discharge from the first LEA admission in the period until their death or the end of the period

**Median survival**

Length of time after discharge from the first LEA admission in the period by which half the individuals have died and half remain alive
EXECUTIVE SUMMARY

Foot problems are one of the most serious complications of diabetes, leading to significant physical suffering and financial burden. Over the last 25 years, the Diabetes Care Program of Nova Scotia (DCPNS) has provided ongoing leadership for a number of initiatives that focus intensive prevention efforts on patients at highest risk for foot problems, while promoting population-based prevention messages to the broader diabetes population. Since 2007, specific actions from The Diabetic Foot in Nova Scotia: Challenges and Opportunities¹ have been realized; however, the importance of this work continues and needs to grow.

This report describes the most extreme foot problem, lower extremity amputation (LEA), including trends over time and place as well as differences in the timing of LEA relative to diagnosis and survival post-LEA by type of diabetes (type 1 or 2). The report is timed to sustain our focus on foot care and to reenergize our efforts in a variety of settings to reduce the risk of LEA through more effective management of diabetes, focused provider and patient education, and access to the required foot care supports for those with the greatest needs. Building on the 2007 report, the Call to Action (see p.24) includes a number of recommendations and actions that span the health and wellness continuum from health promotion to prevention and disease management.

We are most pleased to report a 55% reduction in the rate of LEAs among people with diabetes between 1996/97 and 2012/13, exceeding the decrease observed among those without diabetes (50%). This outcome is extremely positive, considering the growing number of people with diabetes (a doubling in the proportion of people with diabetes over this period of time, from 5% to 11% of all adults).

**Key Findings (1996/97-2012/13)**

**LEA Admissions**

- The annual number of LEA admissions was fairly stable over time for those with diabetes, while it decreased for those without diabetes. As a result, most recently, 78% of LEA admissions occurred among those with diabetes.
- More LEAs per population were reported in Western and Eastern Zones.
- Those with diabetes, compared to those without:
  - Spent 1-4 more days in hospital
  - Were more likely to have multiple LEA admissions

**LEA Admission Rate**

- The LEA admission rate among those with diabetes declined by 55% to 21 per 10,000 – reflects the doubling of diabetes prevalence to 11%, while the number of LEAs remained stable.
  - The LEA admission rate decreased by 50% among those without diabetes to 1 per 10,000.

---

• For those with diabetes, the crude LEA admission rate was:
  – 2 times higher among males at 28 per 10,000
  – Highest among those 80 years of age and older at 31 per 10,000
  – Highest among those living in Eastern and Western Zones at 23 per 10,000

• Those with diabetes, compared to those without, were 25 times more likely to have an LEA admission
  – And more concerning, 52 times more likely to have an LEA admission in the 20-59 year age group

DIFFERENCES BY DIABETES TYPE (TYPE 1 VS TYPE 2)

• At the time of first LEA admission, those with type 1:
  – Were 13 years younger (54 vs 67), but
  – Had diabetes twice as long (30 years vs 13 years)

• Those with type 1 diabetes lived longer post-LEA regardless of the level of LEA, but only by one year.
  – For both those with type 1 and type 2 diabetes, people lived longer post-LEA if the LEA was at a lower level

• By 5 years post-LEA, nearly half of all people with type 1 had died (43%) and over half of those with type 2 (52%)

CALL TO ACTION

Since the 2007 report, DCPNS had continued to work with stakeholders across the continuum to address diabetes care generally and foot care specifically. However, LEAs continue to disproportionately affect people with diabetes.

In keeping with the 2007 report, recommendations target the following priority areas:

• **Educating health professionals** – perform and document routine foot assessments using standardized tools

• **Educating people with diabetes** – provide ongoing education about potential foot problems and proven preventive practices

• **Foot care** – explore mechanisms to off-set the out-of-pocket cost of routine foot care for those with moderate- to high-risk feet

• **Footwear** – develop guidelines for provincial needs-based healthcare coverage for appropriate footwear and off-loading devices for persons with diabetes

• **Treatment** – facilitate timely and appropriate access to supportive foot care and vascular services

• **Psychosocial determinants of health** – ensure foot care is provided in the holistic context that considers the whole patient and not just the foot pathology
BACKGROUND

Foot problems are one of the most serious complications of diabetes, leading to significant physical suffering and financial burden. Over the last 25 years, the Diabetes Care Program of Nova Scotia (DCPNS) has led several initiatives that focus intensive prevention efforts on patients at highest risk for foot problems, while promoting population-based prevention messages to the broader diabetes population in Nova Scotia (NS) – some key initiatives include the following:

1992  DCPNS Guidelines highlighted the need for routine foot assessments for people with diabetes

1997  DCPNS released *Surveying and Preventing Diabetes Complications in Nova Scotia*, with a specific chapter focused on foot problems

1998-2000  DCPNS led a multi-year public and provider campaign to raise awareness to diabetes-related foot problems

2004  DCPNS hosted a province-wide Diabetes Foot Care Roundtable

2007  DCPNS released *The Diabetic Foot in Nova Scotia: Challenges and Opportunities*¹, which included recommendations from the invited stakeholders of the Diabetes Foot Care Roundtable

2010  DCPNS updated standardized provider and patient resources for use across multiple care settings.

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APPOROH

Ten years have passed since *The Diabetic Foot in Nova Scotia*\(^1\) was released and 20 years since *Surveying and Preventing Diabetes Complications in Nova Scotia*, making it an ideal time to update and expand on the information presented in these reports.

Multiple data sources were linked at an individual level to describe the burden of LEAs among adults in NS (see Appendix B, pp. 32-33).

STRUCTURE OF REPORT

Similar to the 1997 and 2007 reports, the number and proportion of LEA admissions over time for those with and without diabetes are presented along with LEA admission rate ratios by age group. In addition, new and more in-depth information is presented in three sections.

**SECTION 1:** Includes a brief description of the people who had one or more LEA admissions followed by a detailed analysis of the LEA admissions that focuses on the following:
- Sex, age, and number of procedures
- Zone of residence
- Level of LEA, and
- Length of hospital stay

**SECTION 2:** The second section focuses on the number of adults with one or more LEA admissions in a given year relative to the population as a whole (i.e., LEA admission rate), comparing those with diabetes against those without diabetes (i.e., LEA admission rate ratio). These values are presented by:
- Year
- Sex and age
- Zone of residence

**SECTION 3:** The final section of the report draws on diagnostic data from the DCPNS Registry to describe the burden of LEA, separately for those with type 1 and type 2 diabetes, as follows:
- Sex, number of LEA admissions, and level of first LEA in the period
- Age and duration of diabetes at the time of the first LEA
- Survival following first LEA

Additional information can be found in the following sections:
- **Glossary** – List of acronyms and definitions
- **Appendix A** – Supplemental results by zone of residence or over time
- **Appendix B** – Detailed methodology describing the data sources and diagnostic and procedure codes
WHY DIFFERENTIATE BETWEEN TYPE 1 AND TYPE 2 DIABETES?

Type 1 and type 2 diabetes are distinct diseases with different underlying causes and patterns of progression.

- Comorbid conditions are often present at diagnosis with type 2 diabetes, but not with type 1.3
- It is vital to understand type 1 and 2 diabetes as separate entities and to reflect the distinction when reporting on burden

WHY NOVA SCOTIA IS UNIQUELY POSITIONED TO DO THIS WORK?

Nova Scotia is able to conduct an in-depth analysis of LEAs by diabetes type because of uniqueness of the population-based DCPNS Registry (see Appendix B, p. 33).

- As of March 2017, the DCPNS Registry included records for well over 100,000 adults referred to the province’s 38 Diabetes Centres (DCs) since 1994 (see below)
  - Represents the 70%-80% of Nova Scotian adults with diabetes who attended a DC at least once

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3 Talbot PJ. Factors associated with survival for a cohort of clinically confirmed diabetes cases in Nova Scotia [thesis]. Halifax: Dalhousie University; 2011.
RESULTS: SECTION 1

NS ADULTS WITH ONE OR MORE LEA ADMISSIONS

This section focuses on the people who had at least one LEA admission in the period 1996/97 – 2012/13.

There were 3,491 adult Nova Scotians with one or more LEA admissions (see Table 1):

• 2,286 (65%) with diabetes
• 1,205 (35%) without diabetes

Those with diabetes were more likely to have two or more LEA admissions:

• 31% of those with diabetes
• 17% of those without diabetes

<table>
<thead>
<tr>
<th>Number of LEA admissions</th>
<th>NS adults with one or more LEA admissions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Diabetes*</td>
</tr>
<tr>
<td></td>
<td>Number (%)</td>
</tr>
<tr>
<td>Total</td>
<td>2,286 (100%)</td>
</tr>
<tr>
<td>1</td>
<td>1,571 (68.7%)</td>
</tr>
<tr>
<td>2</td>
<td>511 (22.4%)</td>
</tr>
<tr>
<td>3 or more</td>
<td>204 (8.9%)</td>
</tr>
</tbody>
</table>

*Includes 20 adults diagnosed with diabetes after their first LEA in the period
LEA Admissions

This section describes the LEA admissions between 1996/97 – 2012/13, comparing those with and without diabetes by sex, age group, number of procedures, zone of residence, level of LEA, length of stay, and year.

DIABETES, SEX, AGE, AND NUMBER OF PROCEDURES

The 3,491 adults as described in the previous section had 4,772 LEA admissions over the period (see Table 2). Of these admissions,

- 3,292 (69%) were among those with diabetes
  - 70% were among males
  - 52% occurred before age 70
  - 14% had multiple procedures
- 1,479 (31%) among those without diabetes
  - 60% were among males
  - 41% occurred before age 70
  - 11% had multiple procedures

| Table 2: Proportion of LEA admissions among adults with and without diabetes by sex, age group, and number of LEA procedures per admission in NS, 1996/97 – 2012/13 |
|---|---|---|
| Characteristics | LEA Admissions |
| | Diabetes N=3,293 | No diabetes N=1,479 | Total N=4,772 |
| | Number (%) | Number (%) | Number (%) |
| **Sex** |
| | | |
| Female | 980 (29.8%) | 589 (39.8%) | 1,569 (32.9%) |
| Male | 2,313 (70.2%) | 890 (60.2%) | 3,203 (67.1%) |
| **Age (years) at fiscal year-end** |
| | | |
| 20-29 years | 6 (0.2%) | 24 (1.6%) | 30 (0.6%) |
| 30-39 years | 37 (1.1%) | 47 (3.2%) | 84 (1.8%) |
| 40-49 years | 232 (7.0%) | 83 (5.6%) | 315 (6.6%) |
| 50-59 years | 577 (17.5%) | 167 (11.3%) | 744 (15.6%) |
| 60-69 years | 860 (26.1%) | 283 (19.1%) | 1,143 (24.0%) |
| 70-99 years | 918 (27.9%) | 360 (24.3%) | 1,278 (26.8%) |
| ≥ 80 years | 663 (20.1%) | 515 (34.8%) | 1,178 (24.7%) |
| **LEA procedures per admission** |
| | | |
| 1 | 2,817 (85.5%) | 1,318 (89.1%) | 4,135 (86.7%) |
| 2 | 403 (12.2%) | 140 (9.5%) | 543 (11.4%) |
| 3 or more | 73 (1.5%) | 21 (1.4%) | 94 (2.0%) |
ZONE OF RESIDENCE

Relative to the size of the adult population, there were fewer LEA admissions among those with and without diabetes in Central Zone and more LEA admissions in Eastern and Western Zones, with the largest difference being in Eastern Zone (see Figure 1):

- 41% of NS adults lived in Central Zone, yet they accounted for 29% of the LEA admissions
- 19% of NS adults lived in Eastern Zone, yet they accounted for 28% of the LEA admissions
  - These figures were 21% and 24% respectively for Western Zone and 16% and 17% respectively for Northern Zone

Figure 1: Proportion of adult population versus proportion of LEA admissions by zone in NS, 1996/97 – 2012/13

<table>
<thead>
<tr>
<th>Zone</th>
<th>Diabetes Number (%)</th>
<th>No diabetes Number (%)</th>
<th>Total Number (%)</th>
<th>NS adult population* Number (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Western</td>
<td>787 (23.9%)</td>
<td>355 (24.0%)</td>
<td>1,142 (23.9%)</td>
<td>158,617 (21.0%)</td>
</tr>
<tr>
<td>Northern</td>
<td>563 (17.1%)</td>
<td>269 (18.2%)</td>
<td>832 (17.4%)</td>
<td>118,967 (15.8%)</td>
</tr>
<tr>
<td>Eastern</td>
<td>941 (28.6%)</td>
<td>381 (25.8%)</td>
<td>1,322 (27.7%)</td>
<td>140,855 (18.7%)</td>
</tr>
<tr>
<td>Central</td>
<td>934 (28.4%)</td>
<td>437 (29.5%)</td>
<td>1,371 (28.7%)</td>
<td>309,325 (41.0%)</td>
</tr>
<tr>
<td>Unknown</td>
<td>68 (2.1%)</td>
<td>37 (2.5%)</td>
<td>105 (2.2%)</td>
<td>26,315 (3.5%)</td>
</tr>
<tr>
<td>Nova Scotia</td>
<td>3,293 (100%)</td>
<td>1,479 (100%)</td>
<td>4,772 (100%)</td>
<td>754,078 (100%)</td>
</tr>
</tbody>
</table>

*Average of the annual adult population across the 1996/97 – 2012/13 period
LEVEL OF LEA

Level of LEA is defined as the location on the lower extremity where the amputation occurred (see below). For admissions with multiple procedures, level refers to the procedure performed closest to the pelvis.

For those with diabetes,

- LEAs were more likely to be at the toes, foot, or ankle (see Figure 2)
  - 41% vs 26% among those without diabetes
- LEAs at the knee and above decreased slightly over time (see Appendix A, p. 26)
  - A similar decrease was not observed for those without diabetes

Figure 2: Proportion of LEA admissions among adults with and without diabetes by level of LEA in NS, 1996/97 – 2012/13
LENGTH OF STAY

Length of stay is defined as the days spent in hospital for a given admission (i.e., from admission to discharge). The median length of stay refers to the number of days spent in hospital at which point half of those admitted have been discharged. If the median length of stay is 16 days, half of those admitted were discharged after 16 days or less in hospital.

For those with and without diabetes, nearly half of LEA admissions had a length of stay less than 15 days (see Figure 3; for trends over time see Appendix A, p. 27).

Figure 3: Proportion of LEA admissions among adults with and without diabetes by length of stay in NS, 1996/97 – 2012/13

After taking into account level of LEA, those with diabetes remained in hospital longer than those without diabetes (see Table 3):

- 4 days longer for LEAs below the knee
- 2 days longer for LEAs at the toes, foot, or ankle
- 1 day longer for LEAs at the knee and above

Table 3: Median length of stay (days) among adults with and without diabetes by level of LEA in NS, 1996/97 – 2012/13

<table>
<thead>
<tr>
<th>Level of LEA</th>
<th>Diabetes</th>
<th>Median LoS</th>
<th>No diabetes</th>
<th>Median LoS</th>
<th>Total</th>
<th>Median LoS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toes/foot/ankle</td>
<td>1,349</td>
<td>13</td>
<td>379</td>
<td>11</td>
<td>1,728</td>
<td>12</td>
</tr>
<tr>
<td>Below knee</td>
<td>930</td>
<td>21</td>
<td>351</td>
<td>17</td>
<td>1,281</td>
<td>20</td>
</tr>
<tr>
<td>Knee and above</td>
<td>1,013</td>
<td>19</td>
<td>747</td>
<td>18</td>
<td>1,760</td>
<td>18</td>
</tr>
<tr>
<td>Total</td>
<td>3,293</td>
<td>16</td>
<td>1,479</td>
<td>16</td>
<td>4,772</td>
<td>16</td>
</tr>
</tbody>
</table>
TRENDS OVER TIME

On average, there were 281 LEA admissions per year (see Figure 4a):

- 194 per year among those with diabetes; this number was relatively stable over time
- 87 per year among those without diabetes; this number decreased over time
  - 101 per year to the end of 2003/04
  - 74 per year from 2004/05 onward

These trends resulted in an increase in the percentage of LEA admissions occurring among those with diabetes (see Figure 4b; for zone-specific numbers, see Appendix A, pp. 28-29).

- In 1996/97, 58% of LEA admissions occurred among those with diabetes (vs 42% among those without)
  - By 2012/13, this percentage increased to 78% among those with diabetes (vs 22% among those without)

Figure 4: Annual number and proportion of LEA admissions among adults with and without diabetes in NS, 1996/97 – 2012/13
RESULTS: SECTION 2

LEA ADMISSION RATES

This section focuses on the people who had one or more LEA admissions in the period 1996/97-2012/13 relative to the population as a whole (i.e., the LEA admission rate), comparing those with and without diabetes, by year.

The LEA admission rate is defined as the average number of adults with one or more LEA admissions in a given 3-year period (sum of LEAs divided by 3) divided by the average population for that 3-year period (sum of population divided by 3). Individuals who have multiple admissions in a year are counted only once in that year. Individuals who have admissions in multiple years are counted once in each of those years.

The LEA admission rate decreased over time, and this decrease was greater for those with diabetes (see Figure 5; for zone-specific rates, see Appendix A, pp. 30-31):

- By 55% for those with diabetes – from 47.2 to 20.6 per 10,000
  - Although the annual number of LEA admissions remained stable, the prevalence of diabetes more than doubled from 5% to 11%
- By 50% for those without diabetes – from 1.6 to 0.8 per 10,000

Figure 5: Diabetes prevalence and LEA admission rate among adults with and without diabetes by year in NS, 1996/97 – 2012/13
LEA ADMISSION RATE RATIOS

This section focuses on the excess burden associated with having diabetes by sex, age, year, and zone of residence.

The LEA rate ratio is defined as the rate of LEAs among those with diabetes divided by the rate among those without diabetes. A high rate ratio indicates an excess burden for LEAs is associated with having diabetes.

SEX AND AGE

For those with and without diabetes, the LEA admission rates in 2010/11-2012/13 were higher among males than females (see Figure 6, table):

- 2.2 times higher for males with diabetes at 28.0 vs 12.6 per 10,000
- 1.8 times higher for males without diabetes at 1.1 vs 0.6 per 10,000

Comparing those with and without diabetes, the LEA admission rate ratio was also higher for males than females (see Figure 6). Across all ages,

- Males with diabetes, compared to those without, were:
  - 26.2 times more likely to have an LEA
- Females with diabetes, compared to those without, were:
  - 21.1 times more likely to have an LEA

Figure 6: LEA admission rate ratios among adults by sex and age group in NS, 2010/11-2012/13
AGE AND YEAR

The LEA admission rate ratios decreased with age, and this pattern was fairly stable over time (see Figure 7). Fluctuations from year to year are expected as there were few LEAs among the population without diabetes.

In 2010/11-2012/13, those with diabetes, compared to those without, were:

- 51.6 times more likely to have an LEA admission at 20 to 59 years of age
- 16.9, 10.1, and 5.3 times more likely to have an LEA at 60 to 69 years, 70 to 79 years, and 80 years or older, respectively

Figure 7: Trend over time in LEA admission rate ratios among adults by age group in NS, 1996/97-2012/13

Note: There was a small number of events among those 20-59 years without diabetes – interpret with caution
ZONE OF RESIDENCE

For those with and without diabetes, the LEA admission rates in 2010/11 – 2012/13 varied by zone (see Figure 8).

- The lowest rates were in Central Zone and highest in Western Zone:
  - 17.7 and 23.0 per 10,000, respectively for those with diabetes
  - 0.5 and 1.2 per 10,000, respectively for those without diabetes

Those with diabetes were 25 times more likely to have an LEA admission than those without diabetes; although, there were variations by zone (see Figure 8, table).

In 2010/11 – 2012/13, those with diabetes, compared to those without, were:

- 32 times more likely to have an LEA if they lived in Central Zone
- 19-24 times more likely to have an LEA if they lived in the other three zones

Figure 8: LEA admission rates among adults with and without diabetes by zone in NS, 2010/11-2012/13

<table>
<thead>
<tr>
<th>Zone</th>
<th>Diabetes (DM)</th>
<th>Adults with ≥ 1 LEA</th>
<th>Adult population</th>
<th>Admission rate (per 10,000)</th>
<th>Rate ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nova Scotia</td>
<td>DM</td>
<td>182</td>
<td>88,212</td>
<td>20.6</td>
<td>25.2</td>
</tr>
<tr>
<td></td>
<td>No DM</td>
<td>59</td>
<td>717,900</td>
<td>0.8</td>
<td>0.8</td>
</tr>
<tr>
<td>Western</td>
<td>DM</td>
<td>49</td>
<td>21,282</td>
<td>23.0</td>
<td>18.7</td>
</tr>
<tr>
<td></td>
<td>No DM</td>
<td>18</td>
<td>148,790</td>
<td>1.2</td>
<td>1.2</td>
</tr>
<tr>
<td>Northern</td>
<td>DM</td>
<td>30</td>
<td>14,365</td>
<td>21.1</td>
<td>24.0</td>
</tr>
<tr>
<td></td>
<td>No DM</td>
<td>10</td>
<td>113,826</td>
<td>0.9</td>
<td>0.9</td>
</tr>
<tr>
<td>Eastern</td>
<td>DM</td>
<td>44</td>
<td>19,061</td>
<td>22.9</td>
<td>22.2</td>
</tr>
<tr>
<td></td>
<td>No DM</td>
<td>13</td>
<td>126,727</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Central</td>
<td>DM</td>
<td>59</td>
<td>33,434</td>
<td>17.7</td>
<td>32.7</td>
</tr>
<tr>
<td></td>
<td>No DM</td>
<td>17</td>
<td>322,261</td>
<td>0.5</td>
<td>0.5</td>
</tr>
</tbody>
</table>
**RESULTS: SECTION 3**

**NS ADULT DIABETES CENTRE ATTENDEES WITH ONE OR MORE LEA ADMISSIONS**

This section focuses on people with one or more LEA admissions in the period and attended a NS Diabetes Centre (DC) at least once between 1994/95 and 2013/14 and who were identified as having clinically confirmed type 1 or type 2 diabetes.

There were 1,256 adult Nova Scotians with one or more LEA admissions who attended a DC in the period (see Table 3). Of these individuals,

- 128 (10%) had type 1 diabetes
  - 67% were male
  - 40% had multiple admissions
  - 7% had their first LEA at the knee or above

- 1,128 (90%) had type 2 diabetes
  - 69% were male
  - 32% had multiple admissions
  - 24% had their first LEA at the knee or above

*Table 3: Description of adult Diabetes Centre (DC) attendees with type 1 or type 2 diabetes who had one or more LEA admissions in NS, 1996/97 – 2012/13*

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Adult DC attendees</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Type 1 (N=128)</td>
</tr>
<tr>
<td></td>
<td>Number (%)</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>42 (32.8%)</td>
</tr>
<tr>
<td>Male</td>
<td>86 (67.2%)</td>
</tr>
<tr>
<td><strong>Number of LEA admissions</strong></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>77 (60.2%)</td>
</tr>
<tr>
<td>2</td>
<td>29 (22.7%)</td>
</tr>
<tr>
<td>3</td>
<td>11 (8.6%)</td>
</tr>
<tr>
<td>4 or more</td>
<td>11 (8.6%)</td>
</tr>
<tr>
<td><strong>Level first LEA in period</strong></td>
<td></td>
</tr>
<tr>
<td>Toe/foot/ankle</td>
<td>79 (61.7%)</td>
</tr>
<tr>
<td>Below knee</td>
<td>40 (31.3%)</td>
</tr>
<tr>
<td>Knee and above</td>
<td>9 (7.0%)</td>
</tr>
</tbody>
</table>
LEA ADMISSIONS AMONG DIABETES CENTRE ATTENDEES

This section describes LEA admissions among adult DC attendees between 1996/97 and 2012/13, comparing those with type 1 and type 2 diabetes by age and duration of diabetes at first admission and by age at death.

AGE AT FIRST LEA ADMISSION

Age at first LEA admission is defined as the age in years as of the date of discharge for the first LEA admission in the period.

Those with type 1 diabetes were on average 13 years younger at the time of their first LEA admission compared to those with type 2 diabetes (see Figure 9, table).

On average, at the time of their first LEA admission in the period,

- Those with type 1 diabetes were 53-63 years old, depending on the level of LEA (see Figure 9).
- Those with type 2 diabetes were 65-71 years old, depending on the level of LEA.

Figure 9: Age at first LEA for adult Diabetes Centre attendees by diabetes type and level of LEA in NS, 1996/97 – 2012/13

<table>
<thead>
<tr>
<th></th>
<th>Diabetes type</th>
<th>Level of LEA procedure</th>
<th>Number</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1</td>
<td></td>
<td>Toes/foot/ankle</td>
<td>79</td>
<td>29</td>
<td>86</td>
<td>52.9 (12.9)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Below knee</td>
<td>40</td>
<td>26</td>
<td>85</td>
<td>54.1 (13.1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Knee and above</td>
<td>9</td>
<td>34</td>
<td>81</td>
<td>63.4 (13.7)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Subtotal</td>
<td>128</td>
<td>26</td>
<td>86</td>
<td>54.0 (13.2)</td>
</tr>
<tr>
<td>Type 2</td>
<td></td>
<td>Toes/foot/ankle</td>
<td>570</td>
<td>24</td>
<td>95</td>
<td>64.7 (11.8)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Below knee</td>
<td>285</td>
<td>35</td>
<td>91</td>
<td>67.3 (11.2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Knee and above</td>
<td>273</td>
<td>28</td>
<td>96</td>
<td>71.1 (10.9)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Subtotal</td>
<td>1,128</td>
<td>24</td>
<td>96</td>
<td>66.9 (11.7)</td>
</tr>
</tbody>
</table>
DURATION OF DIABETES AT FIRST LEA ADMISSION

The majority of adult DC attendees had their date of diabetes diagnosis recorded in the DCPNS Registry (N=1,043; 83%). Duration of diabetes at first LEA admission is defined as the number of years between the date of diabetes diagnosis and the date of discharge for the first LEA admission in the period; a negative duration means that individuals were diagnosed with diabetes after their first LEA in the period.

Those with type 1 diabetes had the disease on average 17 years longer than those with type 2 diabetes (see Figure 10, table).

On average, at the time of their first LEA admission in the period,

- Those with type 1 diabetes had the disease for 30-37 years, depending on the level of LEA (see Figure 10).
- Those with type 2 diabetes had the disease for 12-14 years; the duration of diabetes was similar across all levels of LEA.

Figure 10: Duration of diabetes at first LEA for adult Diabetes Centre attendees by diabetes type and level of LEA in NS, 1996/97 – 2012/13
AGE AT DEATH

By March 31, 2014, 59% of DC attendees with type 1 diabetes (N=75) and 65% of those with type 2 (N=731) had died. Age at death is defined as the number of years between date of birth and date of death.

Those with type 1 diabetes died on average 11 years earlier than those with type 2 diabetes (see Figure 11, table).

On average, at the time of death:

- Those with type 1 diabetes were 60-68 years old, depending on the level of the first LEA in the period (see Figure 11).
- Those with type 2 diabetes were 72-75 years old; age at death was similar across the three levels of LEA.

Figure 11: Age at death (to March 31, 2014) for adult Diabetes Centre attendees with one or more LEA admissions by diabetes type and level of LEA in NS, 1996/97 – 2012/13

<table>
<thead>
<tr>
<th>Diabetes type</th>
<th>Level of LEA procedure</th>
<th>Number</th>
<th>Age at death</th>
<th>Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1</td>
<td>Toes/foot/ankle</td>
<td>43</td>
<td>37</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td>Below knee</td>
<td>25</td>
<td>39</td>
<td>86</td>
</tr>
<tr>
<td></td>
<td>Knee and above</td>
<td>7</td>
<td>39</td>
<td>82</td>
</tr>
<tr>
<td></td>
<td>Subtotal</td>
<td>75</td>
<td>37</td>
<td>90</td>
</tr>
<tr>
<td>Type 2</td>
<td>Toes/foot/ankle</td>
<td>309</td>
<td>44</td>
<td>97</td>
</tr>
<tr>
<td></td>
<td>Below knee</td>
<td>198</td>
<td>36</td>
<td>96</td>
</tr>
<tr>
<td></td>
<td>Knee and above</td>
<td>224</td>
<td>47</td>
<td>98</td>
</tr>
<tr>
<td></td>
<td>Subtotal</td>
<td>731</td>
<td>36</td>
<td>98</td>
</tr>
</tbody>
</table>
SURVIVAL POST-LEA

This section focuses on adult DC attendees from the time of their first LEA admission in the period until death or March 31, 2014, describing difference in survival by diabetes type and level of LEA.

Survival is defined as length of time between individuals’ discharge from the first LEA admission in the period (hereafter referred to as survival post-LEA) until their death or the end of the period. Median survival time is defined as the length of time after discharge from the first LEA admission in the period by which half the individuals have died and half remain alive, taking into account that some were followed for a longer period than others.

DIABETES TYPE

Those with type 1 diabetes lived one year longer post-LEA compared to those with type 2 diabetes:

• Median survival time was 5.6 and 4.7 years, respectively (see Figure 12)

The difference in survival for those with type 1 and 2 diabetes was evident at discharge (i.e., survival of 0 days) and persisted over time (see Figure 12):

• Over 96% of those with type 1 diabetes lived long enough to be discharged from hospital (vs 92% of those with type 2 diabetes)

• At any given time post-LEA, the percentage of those with type 1 diabetes still alive exceeded that of those with type 2 diabetes by 7% to 11% (see Figure 12, table)

Figure 12: Adult Diabetes Centre attendees alive (to March 31, 2014) at select time points post-LEA by diabetes type in NS, 1996/97 – 2012/13

<table>
<thead>
<tr>
<th>Survival post-LEA</th>
<th>Type 1 patients (N=128)</th>
<th>Type 2 patients (N=1,128)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td># Deaths</td>
<td># Alive*</td>
</tr>
<tr>
<td>0 days</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>1 month</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>1 year</td>
<td>18</td>
<td>110</td>
</tr>
<tr>
<td>5 years</td>
<td>52</td>
<td>58</td>
</tr>
<tr>
<td>10 years</td>
<td>71</td>
<td>22</td>
</tr>
<tr>
<td>15 years</td>
<td>75</td>
<td>6</td>
</tr>
</tbody>
</table>

* Adjusted for those alive as of March 31, 2014 but not followed for full 18 years (i.e., censored)
† Number suppressed – too small to report
LEVEL OF LEA

At each level of LEA, those with type 1 diabetes lived one year longer post-LEA compared to those with type 2; thus, they were grouped together when examining survival time by level of LEA.

Those with the first LEA in the period at the toes, foot, or ankle lived 2-4 years longer post-LEA compared to those with LEAs at higher levels:

- Median survival time was 6.3 years for those with an LEA at the toes, foot, or ankle versus 4.3 and 2.1 years for those with an LEA below the knee or at the knee or above, respectively (see Figure 13).

The differences in survival by level of LEA were evident at discharge (i.e., survival of 0 days) and persisted over time (see Figure 13):

- 97% of those with an LEA at the toes, foot, or ankle lived long enough to be discharged from hospital (vs 90% and 85% of those with an LEA below the knee or at the knee or above, respectively).

- At any given time post discharge, the percentage of those with an LEA at the toes, foot, or ankle still alive exceeded that of those with LEAs below the knee or at the knee or above by 9% to 14% and 16% to 30%, respectively.

* Adjusted for those alive as of March 31, 2014 but not followed for full 18 years (i.e., censored)
SUMMARY

Foot problems, leading to LEA, remain a significant concern for Nova Scotia. Advances in treatment (e.g., vascular surgery, wound healing, and use of orthotics and off loading devices), early identification of the high risk foot, and informed providers and patients/families are all making a difference, but there is more work to be done. As the prevalence of diabetes rises, so will the number of individuals at risk of developing serious foot problems leading to LEAs.

The rate of LEAs among those with diabetes declined by 55% between 1996/97 and 2012/13, exceeding the decline observed among those without diabetes (50%). This outcome is extremely positive, considering the growing number of people with diabetes (a doubling in prevalence over this period of time, to now 11% of all adults). The greater rate of decline among those with diabetes suggests that the province’s ongoing focus on the diabetic foot for this high-risk population is making a difference.

In general, LEAs were more common in males, affected all ages, and were over-represented in the Western and Eastern Zones, reflecting the ageing and more rural populations where barriers such as access to foot care specialists, transportation, income and employment may all play a contributing role. LEAs occurred more frequently at working ages (40-69 years) among those with diabetes compared to those without (51% vs 36%).

While the proportion of admissions by length of stay was similar for those with and without diabetes, the length of stay was 1-4 days longer for those with diabetes depending on the level of LEA. The proportion of LEAs by level of procedure was also different for persons with diabetes compared to those without. Persons with diabetes had a much larger proportion of procedures involving the toes/foot/ankle compared to those without diabetes; however, this finding may actually reflect shorter survival (time to death) in the diabetes population following their first LEA procedure.

Regardless of diabetes type, males were at greater risk for LEA. In terms of diabetes type, those with type 1 were on average 13 years younger than those with type 2 (54 vs 67 years) at the time of their first LEA. Although younger, people with type 1 diabetes had the disease on average twice as long as those with type 2 diabetes (30 vs 13 years).

Those with type 1 diabetes lived on average 1 year longer post-LEA than those with type 2 diabetes, regardless of the level of LEA. Of concern, by five years post-LEA, nearly half (42%) of those with type 1 diabetes had died, as had over half (52%) of those with type 2 diabetes.
CALL TO ACTION

In the 2007 report, *The Diabetic Foot in Nova Scotia: Challenges and Opportunities*\(^1\), LEAs among those with diabetes were projected to account for 80% of all LEAs by 2009. As of 2012/13, this projection had not yet been reached. People living with diabetes continue to account for a disproportionate percentage of LEAs in Nova Scotia. Diabetes also results in longer LEA admissions as well as multiple LEA admissions over time.

Since the 2007 report, the DCPNS has worked with stakeholders across the continuum to address the many recommendations. Some key illustrative examples include the following:

- Revision of foot care resources to provide a complete foot care package for use across multiple settings
- Enhancement of the DCPNS Registry to capture a foot risk stratification score
- Promotion of public foot care blitzes
- Facilitation of local quality improvement initiatives extending foot care to vulnerable populations

Delaying the onset of the disease in at-risk individuals and their families as well as slowing the progression in those with established disease (through improved treatment and management approaches) would result in significant benefit to individuals, families, and the healthcare system. Provincial initiatives focused on wellness and risk factor reduction are required to impact incidence rates (prevention or delayed development of diabetes) as well as progression to complications and to provide added support for diabetes self-management.

RECOMMENDATIONS

A number of our 2017 recommendations reflect those found in our 2007 Report, indicating that they are as important today as they were then:

EDUCATING HEALTH PROFESSIONALS

- Make routine, annual foot assessments using a 5.07 monofilament (10 grams of force) part of basic diabetes care
  - Without proper assessment, preventive strategies cannot be implemented
- Use standard foot assessment tools and supporting materials across settings and disciplines
- Document foot assessments, record an objectively measured risk rating, and track changes over time
- Convene a follow-up Diabetes Foot Care Roundtable with various stakeholders to gain insight, ideas, and commitment related to the cause
EDUCATING PEOPLE WITH DIABETES

- Educate all people with diabetes upon diagnosis and routinely thereafter about potential foot problems including risks, signs/symptoms, and preventive practices (e.g., daily foot inspection, footwear, etc.)
- Routinely disseminate foot care tools and resources including a decision tree to guide how and when to access the healthcare system when the need arises
- Promote access to trained foot care experts/professionals
  - Develop targeted materials for the most vulnerable, high-risk populations and provide targeted interventions, especially among males who are less likely to have contact with the healthcare system
  - Ensure timely access to diabetes self-management education and supports
  - Partner with Diabetes Canada and consider the use of mass and social media to educate the general public

FOOT CARE

- Include routine foot care (podiatric services) for those with moderate to high-risk feet as an eligible item for partial or full provincial healthcare coverage

FOOTWEAR

- Develop parameters and guidelines for provincial healthcare coverage for footwear for persons with diabetes according to different risk factors and financial circumstances
- Define conditions for coverage for custom-made and therapeutic footwear and, when indicated, provide coverage for orthotics and off-loading devices

TREATMENT

- Establish satellite clinics outside urban areas of practice from existing Vascular Leg Ulcer Clinics
- Develop, within Diabetes Centres, criteria and approved mechanisms for direct referral to supportive foot care/vascular services
- Ensure standard foot assessment tools and routine foot assessment alerts are embedded within electronic medical records (EMRs)

PSYCHOSOCIAL DETERMINANTS OF HEALTH

- Ensure primary care providers are aware of community groups, compassionate use programs, and local service groups such as the Red Cross, War Amps, and local legions
- Ensure training programs and foot information materials reflect the importance of a holistic approach to prevention and treatment and identify potential social barriers and the most appropriate allied healthcare professionals to address these barriers (e.g., social workers, occupational therapists, physiotherapists, and dietitians)
APPENDICES

APPENDIX A: SUPPLEMENTAL RESULTS

Figure A1: Proportion of LEA admissions among adults with and without diabetes by level of LEA and year in NS, 1996/97 – 2012/13

a) Diabetes (N=3,293)

b) No diabetes (N=1,479)

SUMMARY

- Proportion of LEAs at or above the knee decreased slightly over time for those with diabetes

NOTE: Interpret with caution, as the number of LEAs among those without diabetes is very low
Figure A2: Proportion of LEA admissions among adults with and without diabetes by length of stay and year in NS, 1996/97 – 2012/13

• Length of stay was fairly stable over time for both those with and without diabetes

NOTE: Interpret with caution, as the number of LEAs among those without diabetes is very low
Figure A3: **Western Zone** – Annual number and proportion of LEA admissions among adults with and without diabetes, 1996/97 – 2012/13

- Average of 67 LEA admissions per year: 46 per year among those with diabetes (increasing trend over time) and 21 per year among those without diabetes (decreasing trend over time)
- Proportion of LEA admissions occurring among those with diabetes increased over time from an average of 66% to the end of 2003/04 to 72% from 2004/05 onward

**NOTE:** Interpret with caution, as the number of LEAs among those without diabetes is very low

Figure A4: **Northern Zone** – Annual number and proportion of LEA admissions among adults with and without diabetes, 1996/97 – 2012/13

- Average of 49 LEA admissions per year: 33 per year among those with diabetes (increasing trend over time) and 16 per year among those without diabetes (decreasing trend over time)
- Proportion of LEA admissions occurring among those with diabetes increased over time from an average of 61% to the end of 2003/04 to 73% from 2004/05 onward

**NOTE:** Interpret with caution, as the number of LEAs among those without diabetes is very low
Figure A5: Eastern Zone – Annual number and proportion of LEA admissions among adults with and without diabetes, 1996/97 – 2012/13

- Average of 78 LEA admissions per year; 55 per year among those with diabetes (fairly stable trend over time) and 22 per year among those without diabetes (decreasing trend over time)
- Proportion of LEA admissions occurring among those with diabetes increased over time from an average of 69% to the end of 2003/04 to 74% from 2004/05 onward

NOTE: Interpret with caution, as the number of LEAs among those without diabetes is very low

Figure A6: Central Zone – Annual number and proportion of LEA admissions among adults with and without diabetes, 1996/97 – 2012/13

- Average of 81 LEA admissions per year; 55 per year among those with diabetes (stable trend over time) and 26 per year among those without diabetes (decreasing trend over time)
- Proportion of LEA admissions occurring among those with diabetes increased over time from an average of 65% to the end of 2003/04 to 72% from 2004/05 onward

NOTE: Interpret with caution, as the number of LEAs among those without diabetes is very low
Figure A7: Western Zone – Diabetes prevalence and LEA admission rate among adults with and without diabetes by year, 1996/97 – 2012/13

- Over the period, diabetes prevalence more than doubled
- The LEA admission rate decreased by 51% among those with diabetes and by 33% among those without diabetes

NOTE: Interpret with caution, as the number of LEAs among those without diabetes is very low

Figure A8: Northern Zone – Diabetes prevalence and LEA admission rate among adults with and without diabetes by year, 1996/97 – 2012/13

- Over the period, diabetes prevalence more than doubled
- The LEA admission rate decreased by 58% among those with diabetes and by 61% among those without diabetes

NOTE: Interpret with caution, as the number of LEAs among those without diabetes is very low
**Figure A9: Eastern Zone – Diabetes prevalence and LEA admission rate among adults with and without diabetes by year, 1996/97 – 2012/13**

- Over the period, diabetes prevalence more than doubled
- The LEA admission rate decreased by 56% among those with diabetes and by 41% among those without diabetes

**NOTE:** Interpret with caution, as the number of LEAs among those without diabetes is very low

**Figure A10: Central Zone – Diabetes prevalence and LEA admission rate among adults with and without diabetes by year, 1996/97 – 2012/13**

- Over the period, diabetes prevalence nearly doubled
- The LEA admission rate decreased by 58% among those with diabetes and by 65% among those without diabetes

**NOTE:** Interpret with caution, as the number of LEAs among those without diabetes is very low
APPENDIX B: SUPPLEMENTAL DETAILS ABOUT METHODOLOGY

PURPOSE
Using a retrospective cohort design, we examined the burden of lower extremity amputations (LEAs) among Nova Scotian adults (≥ 20 years) with and without diabetes between 1996/97 and 2012/13. For a subset of individuals with clinically confirmed type 1 and type 2 diabetes who attended a Diabetes Centre (DC) at least once between 1994/95 and 2013/14, we examined time from the first LEA in period to death.

DATA SOURCES
Multiple data sources were linked at an individual level using health card number (HCN) as the linkage key.

NOVA SCOTIA INSURED PATIENT REGISTRY
The Nova Scotia (NS) Insured Patient Registry is a longitudinal database with information about all registered beneficiaries (past and present) of NS’ Medical Services Insurance Program including HCN, date of birth, date of death, sex, most recent postal code, etc.

Data from the NS Insured Patient Registry were used to determine the annual adult population (i.e., the denominator) for the calculation of LEA admission rates. The overall NS adult population for the period between 1996/97 and 2012/13 was calculated by averaging the annual population for each year in the period. Date of death from the NS Insured Patient Registry (supplemented by data from the DCPNS Registry) was used to calculate post-LEA survival.

CANADIAN INSTITUTE FOR HEALTH INFORMATION DISCHARGE ABSTRACTS DATABASE (CIHI-DAD)
The CIHI-DAD contains detailed information about all hospital separations from NS acute care hospitals (e.g., admission/separation times, diagnostic and procedure codes, etc.). Starting in 2005, records for out-of-province hospital separations for NS residents were also included in the NS CIHI-DAD.

Trained health records coders use a standardized data abstraction process to abstract data for the CIHI-DAD. The CIHI uses support personnel, education programs, abstracting software, and data edits/correction process to improve the accuracy of CIHI-DAD data. Results from a national study examining the quality of CIHI-DAD data indicated that 88% of the significant diagnoses reported to the CIHI-DAD were justified for inclusion based on chart documentation.

Between 1995/96 and 2012/13, there were changes in CIHI-DAD reporting related to diabetes and LEAs.

- 2001/02 – changed from the International Statistical Classification of Diseases and Health Related Problems, 9th Revision, Clinical Modification (ICD-9-CM) to the 10th Revision, Canada (ICD-10-CA) and its companion document, the Canadian Classification of Health Interventions (CCI)

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• 2007/08 – diabetes was made a secondary diagnosis, thus, becoming mandatory to code if it appears in the hospital record regardless of its impact on length of stay (previously, if diabetes did not affect length of stay, it was at the discretion of the institute whether to code it or not)

• 2009/10 – LEA codes involving the forefoot and toes were divided such that amputation involving the hallux (big toe) had their own set of codes (previously, LEAs involving the hallux were coded using the same set of codes as the other 4 toes)

Data from the CIHI-DAD were used to identify a cohort of Nova Scotian adults (20 years or older) who had one or more acute hospital admissions with evidence of an LEA procedure between 1996/97 and 2012/13. These data were also used to determine the level of LEA and the associated length of hospital stay.

**Canadian Chronic Disease Surveillance System (CCDSS)**

The CCDSS derives nationally comparable data about diabetes using an administrative case definition applied to the CIHI-DAD and provincial physician billing claims. As of March 31, 2013, the CCDSS for NS contained records for 131,215 unique type 1 or type 2 diabetes cases (living and deceased) as defined by having either a hospitalization or 2 or more physician billing claims over 2 consecutive years with a diabetes diagnostic code.

Data from the CCDSS were used to identify individuals with diabetes for Sections 1 and 2 of this report.

**DCPNS Registry**

Nova Scotia is served by 38 Diabetes Centres (DCs) across the province that use the DCPNS Registry for data collection. The DCPNS Registry includes records for all new referrals to NS DCs from January 1, 1992 onward for paediatric cases (diagnosed before 19 years of age) and April 1, 1994 onward for adult cases (diagnosed at 19 years of age or older). The Registry includes all paediatric diabetes cases diagnosed in the province since 1992 as well as a large percentage of adult diabetes cases. Based on local estimates, between 70%-80% of Nova Scotian adults with diabetes attend a DC at least once, with this figure being slightly lower for the frail elderly and other non-ambulatory individuals.

As of March 2017, the DCPNS Registry contained records for over 700,000 visits made by nearly 107,000 individuals. Core data, derived from a standardized Physician Referral Form and standardized documentation forms used by DC staff include demographics, type of diabetes, date of diagnosis, treatment, and clinical (e.g., glycated hemoglobin, etc.) and self-care (e.g., self-monitoring of blood glucose, etc.) measures.

There are several checks in place to ensure that the data held in the DCPNS Registry are accurate. The Registry software has a built-in check to prevent the entry of out-of-range or out-of-province health card numbers (HCNs) as well as a Mod 10 check to validate HCNs. Data from all DCs are updated monthly and additional quality checks are run: sex, date of birth, and date of death are checked against the NS Insured Patient Registry file. Reports of any suspected errors are sent to the originating DCs for correction.

Data from the DCPNS Registry were used to identify individuals with type 1 and type 2 diabetes as well as the associated date of diagnosis for Section 3 of this report. These data allowed for an in-depth analysis of LEAs by diabetes type, focusing on age and duration of diabetes at the time of the first LEA as well as time to death post-LEA.
MEASURES

For the first two sections of results in this report, diabetes was defined using the CCDSS case definition: any individual who within a 2-year period had 1 hospitalisation and/or 2 physician claims with a diagnosis of diabetes. In rare cases, diabetes was identified after the first LEA admission. For the third section of results, diabetes was defined as type 1 or type 2 diabetes as reported in the DCPNS Registry (prediabetes and gestational diabetes cases were excluded). A small number of clinically confirmed diabetes cases (N=35) present in the DCPNS Registry were not identified as diabetes cases by the CCDSS case definition.

An LEA was defined as any procedure with a code denoting an amputation of the lower limb (pelvis to toe, non-traumatic or traumatic) during an acute in-patient hospital admission (see p. 37 for specific codes). Individuals can have one or more LEA procedures during a single admission and/or can have multiple LEA admissions.

The following demographic information was used to provide context about the burden of LEAs in NS:

- **Zone** – Health management zone of residence
  - Western
  - Northern
  - Eastern
  - Central

- **Age group at fiscal year-end** – Age as of March 31 for a given year (cases under 20 years were excluded):
  - 20-59 years
  - 60-69 years
  - 70-79 years
  - 80 years or older

- **Age at time of first LEA** – Age in years as of the date of discharge for the first LEA admission in the period – same groups as above

- **Duration of diabetes at time of first LEA** – Number of years between the date of diabetes diagnosis and the date of discharge for the first LEA admission in the period (can be negative if diabetes was diagnosed after the first LEA in the period)

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8 In 2007/08, it became mandatory to code diabetes, regardless of its impact on length of stay. Before that time, diabetes was usually coded if it impacted length of stay; otherwise, it was coded at the discretion of the institution.
The following clinical information was used to describe the nature and burden of LEAs in NS:

**Level of LEA**[^9] – The most proximal LEA procedure (i.e., closest to the pelvis) recorded for a given admission:

- toe/foot/ankle
- below knee
- knee and above

**Length of stay** – Number of days between the date of admission and the date of discharge for an LEA admission:

- up to 7 days
- 8-14 days
- 15-30 days
- 31 or more days

**Median length of stay** – The longest time spent in hospital for half of the admissions (i.e., if the median length of stay is 16 days, it means that half of the admissions required up to 16 days in hospital)

**LEA admission rate** – Average number of adults with one or more LEA admissions in a given 3-year period (sum of LEAs divided by 3) divided by the average population for that 3-year period (sum of population divided by 3) – individuals with multiple admission in a year were counted only once in that year while individuals with admissions in multiple years were counted once is each of those years

**LEA admission rate ratio** – The rate of LEAs among those with diabetes divided by the rate among those without diabetes

**Survival time** – Number of years between date of discharge for the first LEA admission in the period and date of death or the end of the study period, whichever came first

**Median survival time** – Number of years by which only half the population of interest remains alive (i.e., if the median survival time post-LEA is 4 years, it means that only half of the individuals who had an LEA were living 4 years after their procedure)

The number and percentage of LEA admissions among those with and without diabetes were examined by: sex, age group, number of procedures, health management zone, level of LEA, length of stay, and year. LEA admission rates were calculated by: year (as a 3-year average), sex, age group, and zone of residence. LEA rate ratios were calculated by year (as a 3-year average) and age group. Given the low number of LEAs per year, age and sex standardised rates were not calculated.

Adults with one or more LEA admissions who attended an NS Diabetes Centre were described in terms of sex, number of LEA admissions, and level of LEA. Age and duration of diabetes at the time of the first LEA in the period and survival time post-LEA were calculated by diabetes type and level of LEA.

[^9]: Not specified for 3 admissions
**DIAGNOSTIC AND PROCEDURE CODES**

*Table A1: Diagnostic codes*

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>ICD-9-CM</th>
<th>ICD-10-CA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes</td>
<td>250</td>
<td>E10, E11, E13, E14</td>
</tr>
</tbody>
</table>

*Table A2: Procedure codes*

<table>
<thead>
<tr>
<th>Procedure</th>
<th>ICD-9-CM</th>
<th>CCI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toes / foot / ankle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Toes</td>
<td>8411 (Amputation of toe) – surgical removal of a portion of the toe</td>
<td>1WK93 (Amputation, first phalanx of foot)</td>
</tr>
<tr>
<td></td>
<td>8412 (Amputation through foot) – surgical removal of a portion of the foot</td>
<td>1WL93 (Amputation, other phalanx of foot)</td>
</tr>
<tr>
<td></td>
<td>8413 (Disarticulation of ankle)</td>
<td>1WM93 (Amputation, other interphalangeal joints of toe)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1WN93 (Amputation, first interphalangeal joint of toe)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1WE93 (Amputation, tarsal bones and intertarsal joints [hindfoot, midfoot])</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1WI93 (Amputation, first metatarsal bone and first metatarsophalangeal joint)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1WJ93 (Amputation, tarsometatarsal joints, other metatarsal bones and other metatarsophalangeal joints [forefoot])</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1WA93 (Amputation, ankle joint)</td>
</tr>
<tr>
<td>Below Knee</td>
<td>8414 (Amputation of ankle through malleoli of tibia and fibula)</td>
<td>1VQ93 (Amputation, tibia and fibula)</td>
</tr>
<tr>
<td></td>
<td>8415 (Other amputation below knee)</td>
<td></td>
</tr>
<tr>
<td>Knee &amp; Above</td>
<td>8416 (Disarticulation of knee)</td>
<td>1VG93 (Amputation, knee joint)</td>
</tr>
<tr>
<td></td>
<td>8417 (Amputation above knee)</td>
<td>1VC93 (Amputation, femur)</td>
</tr>
<tr>
<td></td>
<td>8418 (Disarticulation of hip)</td>
<td>1VA93 (Amputation, hip joint)</td>
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<tr>
<td></td>
<td>8419 (Abdominopelvic amputation)</td>
<td>1SQ93 (Amputation, pelvis)</td>
</tr>
<tr>
<td>Not otherwise specified</td>
<td>8410 (Lower limb amputation, not otherwise specified)</td>
<td></td>
</tr>
</tbody>
</table>