

Chapter 5

Use of Indicated Laboratory Testing among People with Diabetes in Alberta



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USE OF INDICATED LABORATORY TESTING AMONG PEOPLE WITH DIABETES IN ALBERTA

KEY MESSAGES

- People with diabetes in Alberta are not obtaining the recommended laboratory tests, particularly those in younger age groups.
- Urine albumin to creatinine ratio (ACR) was the least frequently utilized among recommended tests in 2008; only 41 % of people with diabetes had an ACR.
- Many individuals, particularly those in the younger age groups, were above the target laboratory levels recommended by the Canadian Diabetes Association 2003 Clinical Practice Guidelines.

BACKGROUND

The development of macrovascular (coronary artery disease, cerebrovascular disease, and peripheral arterial disease) and microvascular (nephropathy, neuropathy, and retinopathy) complications contribute to increased morbidity and mortality in individuals with diabetes.⁽¹⁻⁶⁾ Laboratory monitoring, including measurement of glycated hemoglobin (A1C), low-density lipoprotein (LDL), and urine albumin to creatinine ratio (ACR), is an important part of the prevention and management of complications associated with diabetes.⁽¹⁾ A1C provides a measure of glycemic control over the previous three to four months, and is important because poor glycemic control increases the development of microvascular complications in people with diabetes,^(1,5,6) and therapy aimed at lowering elevated A1C has been shown to improve microvascular outcomes.^(5,6) Elevated LDL is a risk factor for cardiovascular disease, and therapies which lower LDL have been shown to improve survival and reduce cardiovascular events.^(1,7,8) Lastly, diabetes is the leading cause of end-stage renal disease, and ACR is a useful screening tool for detecting diabetic nephropathy. Screening for diabetic nephropathy is critical since kidney failure can be prevented or delayed using angiotensin blockade and control of hypertension.^(1,9)

Despite the availability of clinical practice guidelines for laboratory monitoring of people with diabetes, evidence has demonstrated that A1C and LDL testing in people with diabetes is underutilized. Woodward and colleagues found that, of 64,000 patients with diabetes in Ontario in 1999/2000, 58% had at least one A1C test done in a one year period, and of those patients, only 45% were at or below the recommended target for A1C (defined as < 7.0%).^(10,11) More recently, Klomp and colleagues used data from Saskatchewan to demonstrate that 67% of people with diabetes had at least one A1C test completed in 2005/06, and of those tested, only 48% were at or below target ($\leq 7.0\%$).^(12,13) Similarly, Wilson et al found that only 64% of people with diabetes living in Ontario had at least one A1C test conducted in 2005.⁽¹⁴⁾ In terms of LDL testing, only 50% of people with diabetes in Saskatchewan had their LDL measured, and 45% of those tested were at the recommended target of < 2.5 mmol/L in 2005.⁽¹³⁾

Screening for diabetic nephropathy in patients with diabetes in Canada seems to occur less frequently than A1C or LDL testing. Harris and colleagues reported that only 17.5% of people received an ACR test based on a national physician survey conducted in Canada from 1998 until 1999.⁽¹⁵⁾ Similarly, Ludwig and colleagues found that 16.5% of Manitobans with diabetes were screened for diabetic nephropathy in 1999/2000.⁽¹⁶⁾

The results of the above studies suggest that a significant portion of people with diabetes are not being monitored as frequently as is recommended by clinical practice guidelines, and in those who are tested, less than half are at recommended targets for LDL and A1C.

Our objective was to describe the frequency of laboratory testing for A1C, LDL, and ACR in adults with diabetes in Alberta in 2008. As well, we aimed to evaluate the proportion of individuals who achieved recommended targets for each laboratory test. The Canadian Diabetes Association (CDA) 2003 Clinical Practice Guidelines (CPGs) were available for the time period of the data used, and are therefore used to interpret the results of this chapter.⁽¹²⁾ The CDA 2003 CPGs recommend monitoring A1C every 3 months to ensure the target A1C of $\leq 7.0\%$ is met and maintained.⁽¹²⁾ The target LDL for a person with diabetes is < 2.5 mmol/L; LDL testing should occur at the time of diabetes diagnosis, and then every 1 to 3 years as clinically indicated, although individuals who are receiving pharmacotherapy for dyslipidemia should be monitored more frequently.⁽¹²⁾ ACR should be measured at the time of diagnosis and then annually for someone with type 2 diabetes, and annually in postpubertal individuals with type 1 diabetes who have had diabetes for ≥ 5 years.⁽¹²⁾ The normal range for ACR for women is < 2.8 mg/mmol, and < 2.0 mg/mmol for men.⁽¹²⁾

METHODS

Information from the Alberta Kidney Disease Network (AKDN) was used to evaluate the objectives of this chapter.⁽¹⁴⁾ The data holdings of the AKDN include laboratory data that is then linked to administrative data from Alberta Health and Wellness to provide demographic and comorbidity information on residents of Alberta. Data from January 1, 2008 until December 31, 2008 were used, and individuals 20 years and older as of January 1, 2008 were included in the analysis.

Individuals with diabetes were identified as discussed in the Methods chapter of this Atlas. The denominator was based on all adults with diabetes who were alive and had a valid postal code in Alberta as of December 31, 2007. The proportion of individuals who received at least one A1C, LDL, or ACR test was evaluated among all adults with diabetes in Alberta, and the average number of tests is also reported for these individuals. In addition, we report the descriptive statistics (mean, median, and interquartile range (IQR)) for those receiving at least one of the above lab tests in 2008. Lastly, the proportion of subjects at or below target laboratory levels based on the 2003 CPGs were evaluated for those who received at least one test. For individuals who underwent more than one test in 2008, the overall average test result was used to assess achievement of the recommended laboratory target. All laboratory testing was completed on an out-patient basis, and analyses are presented stratified by age and sex.

FINDINGS

A total of 180,120 adults 20 years of age and older were identified as having diabetes in 2008. Of these individuals, 118,296 (65.7%) had at least one A1C test, 108,386 (60.2%) had at least one LDL test, and 73,649 (40.9%) had at least one ACR test in 2008.

Frequency of Laboratory Testing

The proportion of people with diabetes who had at least one A1C test in 2008, by age and sex, is provided in Figure 5.1. Over 70% of people with diabetes aged 60 to 74 years received an A1C test in 2008, whereas just over 40% of people with diabetes aged 20 to 34 years old had their A1C tested. Males with diabetes aged 30 to 49 years underwent A1C testing more frequently than their female counterparts, whereas other age groups demonstrated a similar frequency of testing between males and females.

Approximately 60.2% of people with diabetes received at least one LDL test in 2008 (Figure 5.2). Similarly to A1C testing, LDL testing occurred most frequently in people with diabetes 60 to 74 years of age, and least frequently in those less than 30 years old. Males with diabetes aged 30 to 39 years were more likely to have their LDL tested compared to females of the same age. All other age groups were similar in terms of likelihood of receiving an LDL test in 2008 for males and females.

Figure 5.1 Percentage of individuals with at least one out-patient A1C test, Among patients with Diabetes, 2008

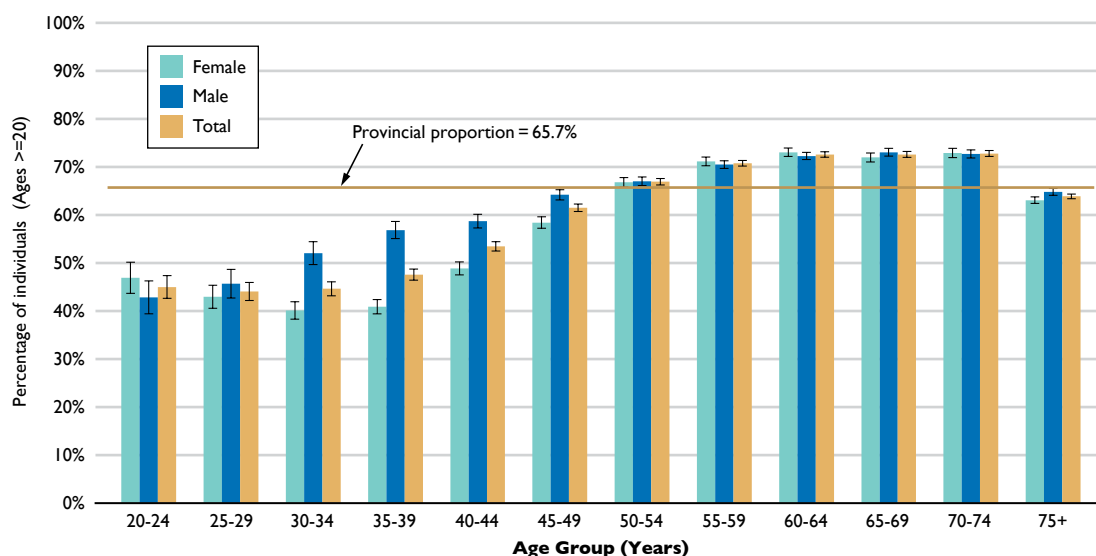
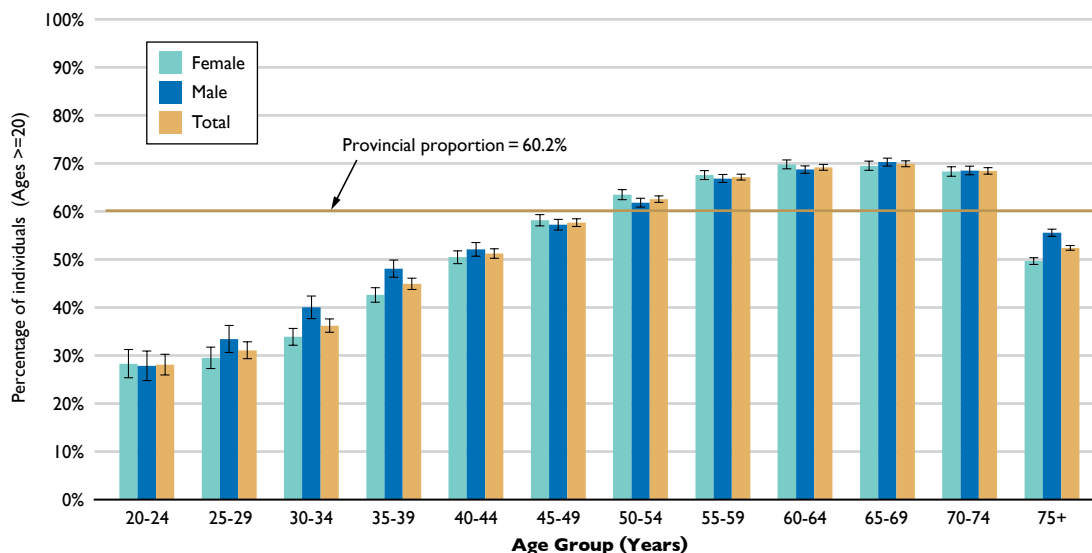


Figure 5.2 Percentage of individuals with at least one out-patient LDL test, Among patients with Diabetes, 2008



Among laboratory tests examined, ACR was the least frequently conducted test, with 40.9% of people with diabetes receiving at least one ACR test in 2008 (Figure 5.3). Individuals with diabetes under 30 years were the least likely to have an ACR completed. People with diabetes aged 60 to 64 years had the highest proportion of having an ACR, but the proportion was still less than 50%. Similarly to A1C, males with diabetes aged 25 to 49 years were more likely to undergo an ACR test relative to females of the same age.

Figure 5.3 Percentage of individuals with at least one out-patient ACR test, Among patients with Diabetes, 2008

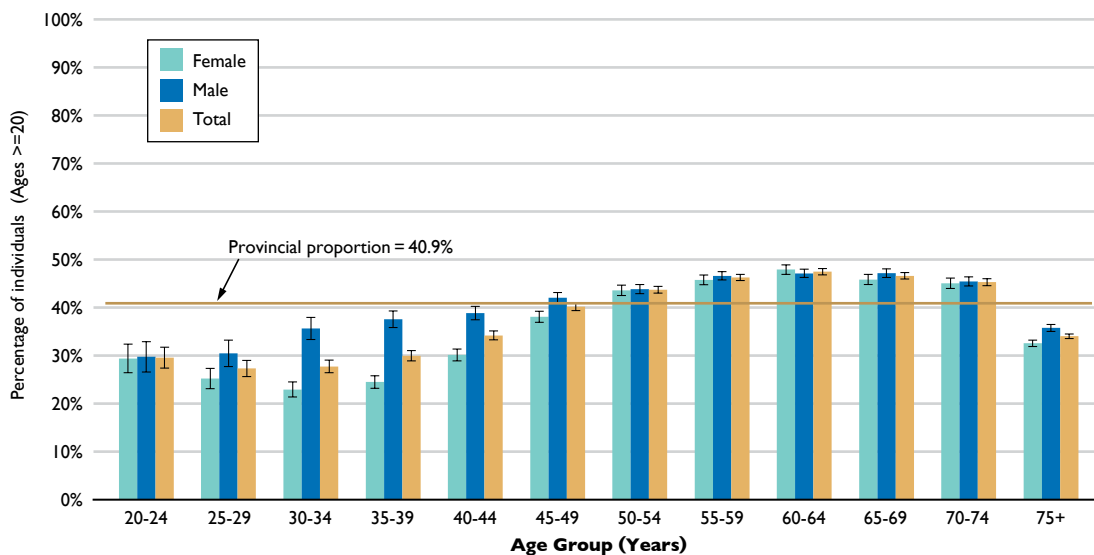


Figure 5.4 demonstrates the proportion of people who underwent 0, 1, 2, 3, or 4 or more tests in 2008. The figure demonstrates that laboratory testing for the majority of people with diabetes in Alberta was underutilized based on the 2003 CPG recommendations. Excess testing, however, did occur in a small number of individuals.

Figure 5.4 Percentage of individuals by Frequency of out-patient A1C, LDL and/or ACR tests, Among patients with Diabetes, 2008

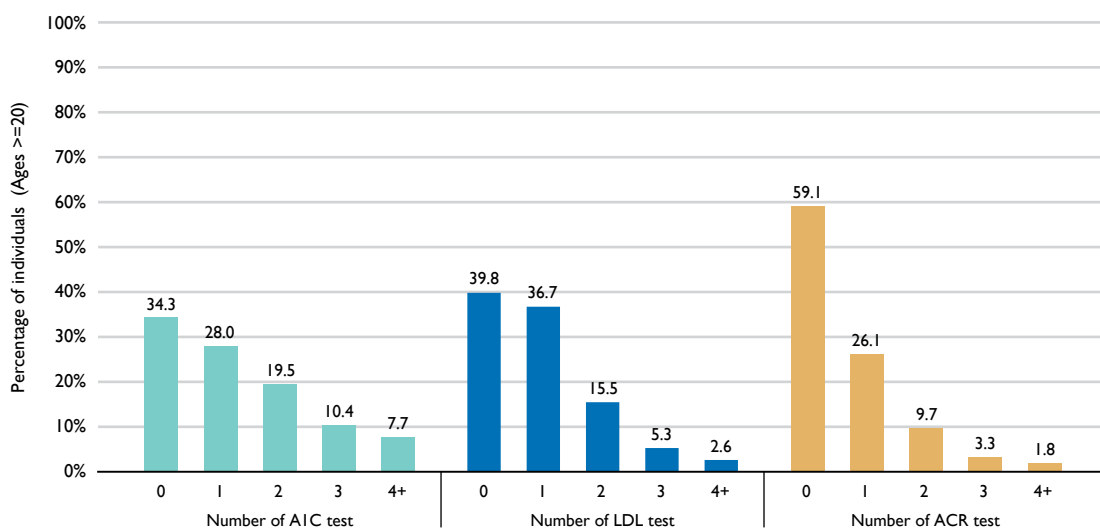


Table 5.1 reports the descriptive statistics relating to A1C testing, among people with at least one A1C test. The mean number of A1C tests in females with diabetes ranged from 1.86 to 2.29 between age groups, and from 1.62 to 2.18 in males in 2008.

Table 5.1 **Descriptive statistics for number of A1C tests, Among patients with Diabetes who had at least one A1C test, by age, 2008**

	Number of patients	Statistics for number of A1C tests		
		Mean	Median	IQR [†]
Female				
20-24	421	1.99	2	1
25-29	688	2.29	2	2
30-34	1,110	2.00	1	1
35-39	1,687	1.95	1	1
40-44	2,626	1.86	2	1
45-49	3,910	1.93	2	1
50-54	5,546	1.99	2	2
55-59	6,820	2.01	2	2
60-64	6,969	2.05	2	2
65-69	6,369	2.10	2	2
70-74	6,041	2.14	2	2
75+	12,329	2.07	2	2
Male				
20-24	344	1.62	1	1
25-29	490	1.62	1	1
30-34	876	1.80	1	1
35-39	1,691	1.89	2	1
40-44	2,750	1.89	2	1
45-49	4,875	1.96	2	2
50-54	7,163	2.00	2	2
55-59	8,991	2.04	2	2
60-64	9,483	2.08	2	2
65-69	8,629	2.13	2	2
70-74	7,445	2.18	2	2
75+	11,043	2.13	2	2

[†] IQR is the difference between the third quartile and the first quartile.

Descriptive statistics for LDL testing in people with diabetes, among those with at least one LDL measurement, is provided in Table 5.2. The mean number of LDL tests in 2008 ranged from 1.28 to 1.62 in females with diabetes and 1.26 to 1.64 in males.

Table 5.2 **Descriptive statistics for number of LDL tests, Among patients with Diabetes who had at least one LDL out-patient test, by age, 2008**

	Number of patients	Statistics of number of LDL tests		
		Mean	Median	IQR [†]
Female				
20-24	254	1.28		0
25-29	473	1.33		0
30-34	939	1.36		
35-39	1,759	1.36		
40-44	2,714	1.42		
45-49	3,894	1.49		
50-54	5,273	1.61		
55-59	6,479	1.59		
60-64	6,657	1.61		
65-69	6,151	1.62		
70-74	5,661	1.62		
75+	9,711	1.54		
Male				
20-24	224	1.26		0
25-29	359	1.34		0
30-34	674	1.44		
35-39	1,431	1.52		
40-44	2,441	1.53		
45-49	4,346	1.55		
50-54	6,609	1.59		
55-59	8,530	1.62		
60-64	9,018	1.64		
65-69	8,302	1.64		
70-74	7,016	1.64		
75+	9,471	1.57		

[†] IQR is the difference between the third quartile and the first quartile.

Table 5.3 provides descriptive information regarding frequency of ACR testing in people with diabetes, among those having at least one ACR test in 2008. Males and females underwent ACR testing to a similar extent.

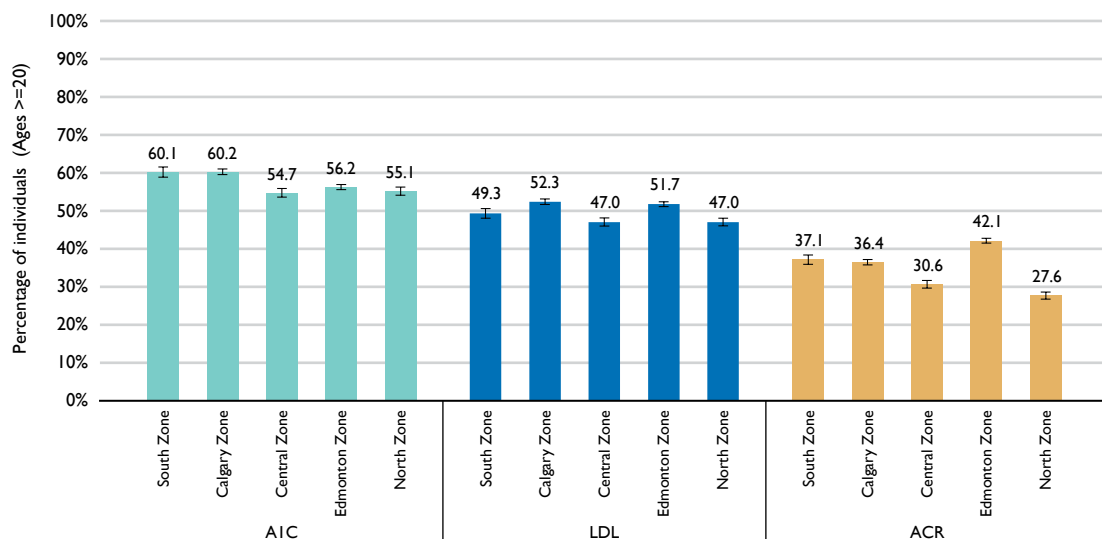
Table 5.3 **Descriptive statistics for number of ACR tests, Among patients with Diabetes who had at least one ACR out-patient test, by age, 2008**

	Number of patients	Statistics of number of ACR tests		
		Mean	Median	IQR [†]
Female				
20-24	264	1.48		
25-29	404	1.46		
30-34	635	1.46		
35-39	1,011	1.48		
40-44	1,620	1.45		
45-49	2,548	1.45		
50-54	3,619	1.53		
55-59	4,387	1.52		
60-64	4,571	1.54		
65-69	4,057	1.58		
70-74	3,733	1.59		
75+	6,364	1.57		
Male				
20-24	229	1.22		0
25-29	327	1.24		0
30-34	600	1.45		
35-39	1,118	1.48		
40-44	1,821	1.45		
45-49	3,192	1.49		
50-54	4,686	1.53		
55-59	5,947	1.54		
60-64	6,184	1.57		
65-69	5,573	1.61		
70-74	4,655	1.61		
75+	6,094	1.62		

[†] IQR is the difference between the third quartile and the first quartile.

In terms of regional variation, the proportion of people with diabetes receiving laboratory testing did not significantly differ between Alberta Health Zones, with the exception that more people in the Edmonton zone underwent ACR testing relative to other health zones (Figure 5.5).

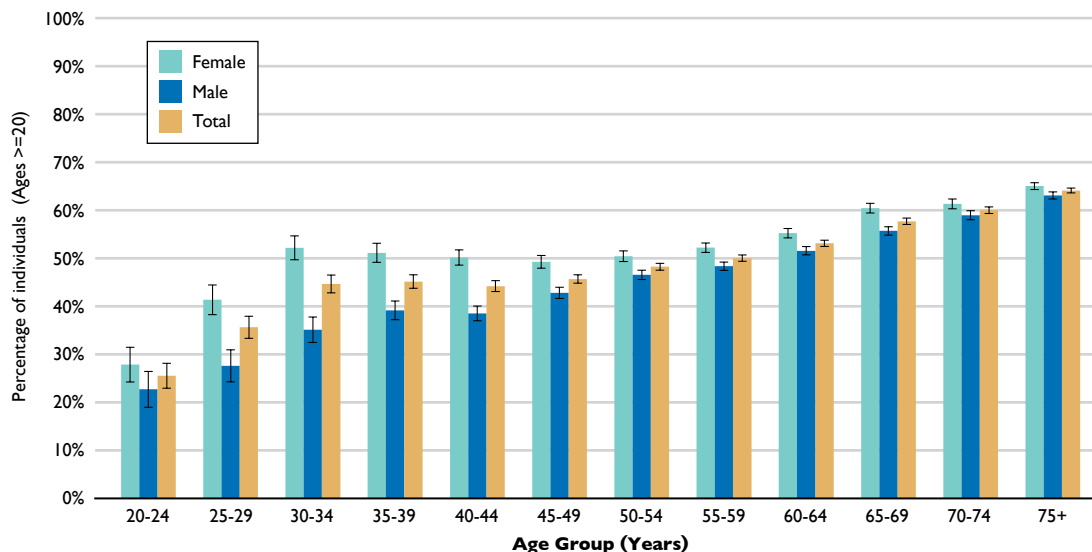
Figure 5.5 **Age- and sex-adjusted percentage of individuals with at least one out-patient A1C, LDL and/or ACR lab test, Among patients with Diabetes, by Zone, 2008**



Achievement of Target Laboratory Levels

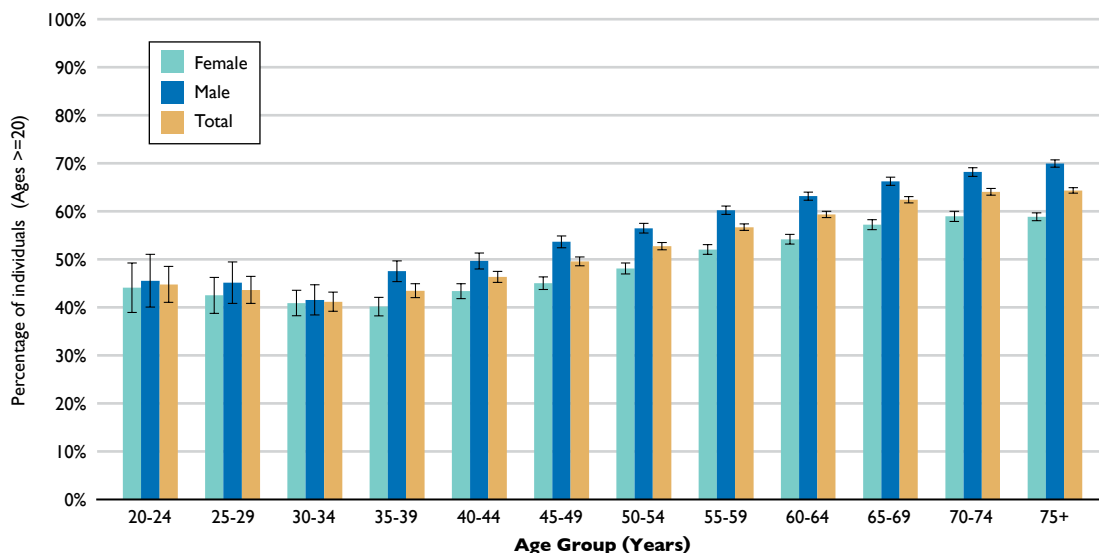
Of people with diabetes who underwent at least one A1C test in 2008, the majority were higher than the target of $\leq 7.0\%$ as recommended by the 2003 CPGs, particularly those in the younger age groups (Figure 5.6).⁽¹²⁾ These results must be interpreted with caution, however, as the proportion of subjects aged 20 to 24 years who underwent at least one A1C test was less than 50% of people with diabetes in that age group and this subset may represent a sicker population. In addition, for many of the age group comparisons, a higher proportion of females were more likely to be at the target A1C of $\leq 7.0\%$ compared to males. The overall mean A1C for people with diabetes in 2008 was 7.31% (standard deviation (SD): 1.51).

Figure 5.6 Percentage of individuals with a mean A1C $\leq 7.0\%$ who had at least one out-patient A1C lab test, Among patients with Diabetes, 2008



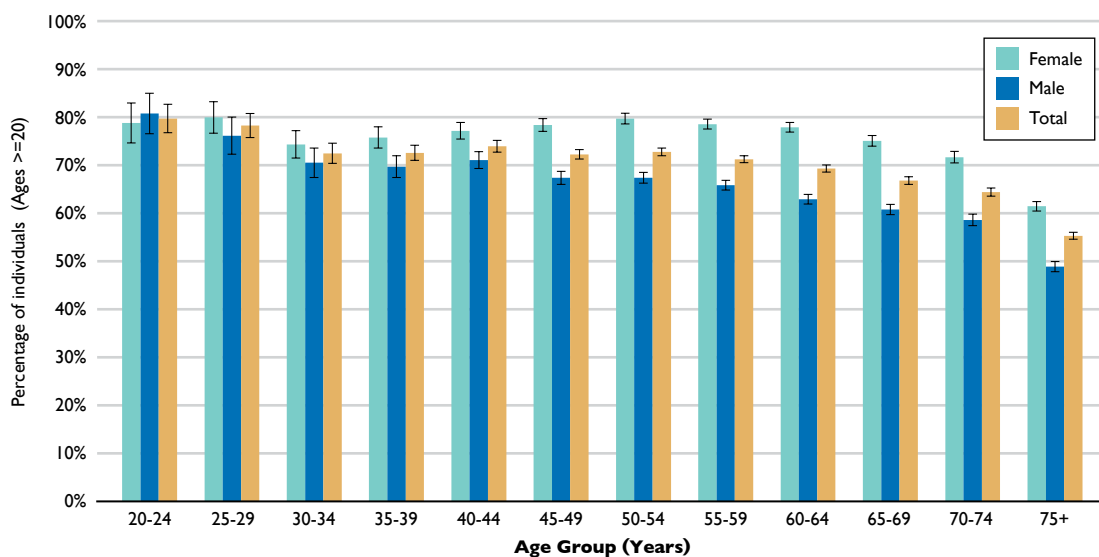
The proportion of people with diabetes who were at or below the LDL target of < 2.5 mmol/L are included in Figure 5.7. Similar to the A1C results, younger individuals were less likely to have an LDL of < 2.5 mmol/L relative to older individuals. These results must also be interpreted with caution given the low proportion of people receiving at least one LDL test in the younger age groups. Males with diabetes aged 35 years and older were more likely to have an LDL of less than 2.5 mmol/L compared to their female counterparts. The overall mean LDL for the population with diabetes was 2.42 mmol/L (SD: 0.83) in 2008.

Figure 5.7 Percentage of individuals with a mean LDL of <2.5 mmol/L who had at least one out-patient LDL lab test, Among patients with Diabetes, 2008



Of individuals who underwent an ACR test in 2008, the majority were within the targeted range as defined above (Figure 5.8).⁽¹²⁾ The proportion of people with diabetes below the recommended target for ACR declined with age. In addition, women with diabetes aged 35 years and older were more likely to be below target compared to men in the same age group. The median ACR was 1.12 mg/mmol (IQR: 3.67) for men and 1.10 mg/mmol (IQR: 2.3) for women with diabetes in 2008.

Figure 5.8 Percentage of individuals with a mean ACR of <2.0 mg/mmol for men and <2.8 mg/mmol for women, who had at least one out-patient ACR lab test, Among patients with Diabetes, 2008



DISCUSSION

Based on CDA Clinical Practice Guideline recommendations available in 2003,⁽¹²⁾ and consistent with the results of previously published studies,^(10,13-16) laboratory tests in individuals with diabetes in 2008 were underutilized. A1C was the most common test conducted, with 66% of people receiving at least one A1C test, whereas only 41% had an ACR test in 2008. In addition, although 66% of individuals with diabetes had their A1C tested in 2008, the majority of people only had 2 tests per year, which is less than the four tests per year recommended by the CDA 2003 CPGs.⁽¹²⁾

Treating patients to achieve target levels of an A1C of $\leq 7.0\%$, hypercholesterolemia, and an ACR of < 2.0 mg/mmol for men and < 2.8 mg/mmol for women, has been shown to improve outcomes in those with diabetes.⁽⁴⁻⁹⁾ The results from this chapter demonstrate that, of individuals who underwent out-patient laboratory testing in 2008, many had A1C and LDL levels which were above the recommended targets. This is particularly worrisome in the younger population, where, although a small proportion of individuals with diabetes in younger age groups underwent A1C and LDL testing, of those tested, many were not at target. For example, only 25% of individuals with diabetes aged 20 to 24 years were at or below target for A1C, increasing the likelihood of developing microvascular complications.⁽⁴⁻⁶⁾ Also, while the target LDL from the 2003 CPGs was less than 2.5 mmol/L,⁽¹²⁾ the updated target was reduced in the CDA 2008 CPGs to less than 2.0 mmol/L.⁽¹⁾ Given the results of our analysis and the more aggressive target of < 2.0 mmol/L, it is likely that an even greater proportion of people are currently not at LDL target.

In summary, use of recommended laboratory testing in people with diabetes was underutilized, and of those who did undergo testing, many were not at recommended targets for LDL and A1C. Given the increased risk of micro- and macrovascular complications associated with elevated A1C, LDL, and ACR, and the availability of effective therapies for patients with these characteristics, strategies to increase appropriate lab monitoring in these individuals is warranted. In addition, policy and health care interventions are needed to ensure those who are not at target laboratory values are closely monitored and appropriately treated to prevent the onset or delay the progression of complications associated with diabetes.

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