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Title	A profile of adults with diabetes mellitus in Newfoundland and Labrador: a population-based, cross-sectional analysis
Authors	Julia Lukewich RN PhD, Richard Buote BSc MSc, Shabnam Asghari MD PhD, Kris Aubrey-Bassler MSc MD, John Knight PhD, Maria Mathews PhD
Reviewer 1	David Snadden
Institution	Department of Family Practice, Faculty of Medicine, University of British Columbia, Vancouver, BC
General comments (author response in bold)	Thank you for giving me the opportunity to read this study. This is well written and is a very interesting approach to analysis of secondary data in that it examines the provincial chronic disease registry in Newfoundland which uses both the Canadian Chronic Disease Surveillance System and laboratory definitions of Diabetes. The background and introduction is succinct and relevant. The methodology is sound and the conclusions relate to the method and make sense. They emphasize and provide another set of evidence that those living in rural areas do not have as good health outcomes as those in urban areas, and the article accurately suggests that this may be due to more difficulty in accessing health services outside of urban areas. The study has ethics approval and the section on limitations and further research needed is thoughtfully written. I found the tables helpful in explaining the findings. 1. Like many studies of this nature there are many acronyms in the text, and while each is appropriately explained once, lack of familiarity with the acronyms did make for some repeated checking to know what they meant. Unfortunately, I cannot see a solution to this unless articles of this nature give a glossary for readers who are not familiar with acronyms used can refer to. This is a minor comment in the context of a well-crafted and implemented piece of research which is of interest both methodologically and with respect to the care of this particular common chronic disease as it does provide baseline information not only on health disparities but on areas for health care improvement. **Thank you for your review and positive feedback on our manuscript. We agree that there are many acronyms within our paper, but as you have said, it is difficult to find a solution to this. We have replaced all instances of 'DM' with 'diabetes' to improve the readability of our paper.**
Reviewer 2	Vanessa Brunetti
Institution	Department of Epidemiology, Biostatistics and Occupational Health, McGill University, Montréal, Que.
General comments (author response in bold)	In this study, Lukewich and colleagues examine the prevalence and demographic characteristics of individuals with Diabetes Mellitus (DM), as well as their management. The authors also explored differences between urban and rural patients. The authors develop their rationale well and are able to communicate the importance of their study. However, additional information in the methods section may be helpful. 1. In the introduction, the authors mention that "the prevalence of diabetes mellitus (DM) increases with age..". While this is true, it is important to distinguish between type 1 and type 2 diabetes mellitus. The authors discuss the different types of diabetes only in their interpretation section, where they mention that the chronic disease registry does not distinguish between type 1 and type 2 diabetes. I believe the authors should mention that they are reporting the prevalence of both types of diabetes in the methods section, to help the reader understand the results more clearly.

	Thank you for this important suggestion. We have clarified this statement within our Introduction. Page 4, lines 5-8 now read: **"The relationship between age and diabetes prevalence is primarily due to type 2 diabetes, which makes up the majority of diabetes cases in Canada and is most often diagnosed among individuals aged 30-40 years old (4)."** **Within our methods section, we have clarified that we are examining type 1 and type 2 diabetes within the methods section. Page 4, 31-33 now read:** **"We included individuals with type 1 or type 2 diabetes aged 20 years or older identified from the provincial Chronic Disease Registry. Although the registry identifies individuals with both type 1 and type 2 diabetes, it does not distinguish between the two types."** **In addition, page 5, lines 18-23 now read:** **"The CCDSS case definition for diabetes is ≥1 hospitalization(s) or ≥2 physician visits with a diabetes diagnosis code (i.e., ICD-9, 250; ICD-10, E10-E14) within a two-year period (9). ICD-9 codes are used within the physician billing database and are unable to distinguish between type 1 and type 2 diabetes, therefore, the Chronic Disease Registry does not differentiate between type 1 and type 2 diabetes."** 2. The authors identified patients with diabetes according to the presence of diagnostic codes for diabetes within a two-year period. However, they included individuals with DM identified from the provincial chronic disease registry from April 1st 2015 – March 31st 2016. It is unclear when this two-year assessment period is situated in time. More information on the look-back period that was used to identify individuals with DM may be helpful. **We cross-sectionally analyzed laboratory and hospitalization data from the 2015/16 fiscal year (April 1st 2015 – March 31st, 2016) for all prevalent cases of diabetes in NL, as of March 31st, 2016. For prevalence, the assessment period was not only for two years, but is from 1994 onward. We have clarified this within the methods section. Page 5, lines 7-13 now read:** **"The Chronic Disease Registry replaced and includes data from the Provincial Diabetes Database. The Chronic Disease Registry includes all cases of diabetes in NL, with a lookback period to 1994. The Chronic Disease Registry includes data from the Provincial Meditech Database (e.g. lab test data), the Provincial Discharge Abstract Database (e.g. hospitalization data), the Medical Care Plan (MCP) Claims Database, the MCP Beneficiary Registration Database, and the Provincial Mortality System. Data from 1994 onward are included within the Chronic Disease Registry, although laboratory data were not added to the Registry until 2009."** **To provide additional clarification, page 4, lines 28-29 now read:** **"Laboratory and hospitalization data from the 2015 fiscal year (April 1st, 2015 – March 31st, 2016) were used in this cross-sectional analysis."** 3. The provincial chronic disease registry was established in 2015, the same year as the present study. I am unfortunately unfamiliar with this registry. Is there a possibility that the registry does not capture all the cases present in 2015, due to issues of reporting delays? What is the first date of data availability with the registry? **Thank you for this comment. The Chronic Disease Registry replaced the Provincial Diabetes Database. The Provincial Diabetes Database was created**

	in 1994. Chronic Disease Registry was created in 2015 but it includes data from the Provincial Diabetes Database from 1994 onward. We obtained these data in 2017, so we do not expect there to be an issue of reporting delay. We have clarified this within the manuscript (page 5, lines 12-13). These lines now read: **"Data from 1994 onward are included within the Chronic Disease Registry, although laboratory data were not added to the Registry until 2009."** 4. The diagnostic codes, and types of codes (e.g. ICD-10) used for the identification of diabetes mellitus should be listed in an appendix. **Thank you for this suggestion. The diagnosis codes can be briefly described, so we have added them into the manuscript. Page 5, lines 18-23 now read:** **"The CCDSS case definition for diabetes is ≥1 hospitalization(s) or ≥2 physician visits with a diabetes diagnosis code (i.e., ICD-9, 250; ICD-10, E10-E14) within a two-year period (9). ICD-9 codes are used within the physician billing database and are unable to distinguish between type 1 and type 2 diabetes, therefore, the Chronic Disease Registry does not differentiate between type 1 and type 2 diabetes."** 5. Although the difference in proportion of rural and urban citizens having an HbA1c test in 2015-2016 is statistically significant, it may not be clinically significant, as there is only a 1.2% difference between both groups. **We agree with this point. We have updated the Tables to include standardized differences and discussed this in the results section. For example, page 7, lines 4-9 now read:** **"The mean HbA1c was higher among individuals residing in rural communities and the percentage of individuals meeting the recommended HbA1c target established by Diabetes Canada was significantly lower for individuals residing in rural regions (HbA1c 7.41±1.487 vs. 7.26±1.497; HbA1C on-target 49.4% vs. 53.8%). However, the standardized difference for these relationships was small (approx. 0.10)."** 6. The results of the HbA1c tests should be interpreted with caution; an HbA1c test result of ≥7 does not necessarily imply that the management of these patients is at fault. As diabetes is a disease that progresses with time, many patients must intensify their treatment in order to continue to achieve the target HbA1c. Therefore, a HbA1c above targeted values may simply imply that the patient is at the stage of their disease where they would need to intensify their treatment. **We agree with this point; an HbA1c test ≥7 should not imply that the patient is at fault. We have used 7.0% because it is the target value set by Diabetes Canada within the Clinical Practice Guidelines. We have tried to emphasize that the data simply indicates whether the individual is meeting the target, not whether they (or their provider) is at fault. Additionally, we recognize that patients may have personalized targets that are higher than 7.0%. We have clarified this on page 6, lines 3-6. These lines read:** **"For most patients with diabetes, Diabetes Canada recommends that these tests are performed at least once a year (more frequently if targets are not being met). The HbA1c target is ≤7.0% for most patients (16), LDL-C target is <2.0mmol/L, and the UACR target is <2.0mg/mmol (17,18)."**

	Additionally, our discussion of this topic suggests that the reason individuals are not meeting the 7.0% target may be due to access to health services. Page 8, line 33 to page 9, line 9 read: **"The findings from this study demonstrate the opportunity for better management of diabetes, in accordance with Diabetes Canada Clinical Practice Guidelines across the province, especially within rural regions. The majority of individuals with diabetes are not meeting recommended targets. For example, only half of the individuals in this study had an HbA1C of less than 7.0% and the percentage meeting the LDL-C target was even lower (~38%). Findings suggest that a greater proportion of rural residents have diabetes and that these individuals have worse clinical test outcomes, specifically with respect to HbA1C and LDL-C. A higher prevalence of diabetes may be a result of poorer access to health services (29,30). Previous research conducted by the study authors identified the breadth of variability that exists in primary healthcare services across NL and the limited delivery of some of these services (31). In recent years, there have been a number of initiatives to develop and strengthen existing supports, such as the 2017 Chronic Disease Action Plan (32). This action plan is part of a broader framework which establishes goals/objectives to guide the reform of primary healthcare in the province (33). Despite these recent initiatives, continuing research is needed to examine how the availability of primary healthcare services may be contributing to the differences in the management of diabetes across rural/urban regions in the province."** 7. MCP is not defined (page 5 line 27) **Thank you for your thorough review. MCP has been defined (Page 5, lines 10-11).** 8. The authors may want to consider reporting standardized differences with confidence intervals for tables 1-3. **We agree with this suggestion. Tables 1-3 now include standardized differences.**
Reviewer 3	Baiju Shah
Institution	Institute for Clinical Evaluative Sciences, Toronto, Ont.
General comments (author response in bold)	This paper describes the number of cases of diabetes in Newfoundland and Labrador in 2015, examines their achievement of treatment targets and hospitalization rates. The paper is well written. The first paragraph provides a useful set-up to explain the importance and novelty of the manuscript. 1. One issue about which the methodology is unclear is the lookback periods used to identify diabetes cases for both the CCDSS and laboratory-based case definitions. In particular, diabetes cases identified from the laboratory-based case definition is a potential source of bias, as diabetes patients with excellent glycemic control (HbA1c <6.5%) will be systematically excluded from the study cohort. If the authors have used many years' worth of laboratory lookback, this is less of a concern, but if there are only limited laboratory data then this bias is potentially important. **The Chronic Disease Registry was established in 2015, but includes data from the Provincial Diabetes Database, which was established in 1994. Laboratory data were added to the Provincial Diabetes Database (and**

	subsequently the Chronic Disease Registry) from 2009 onward. The Chronic Disease Registry identifies individuals with diabetes and they remain within the Registry until they move out of the province or die. We have clarified this within the manuscript. Page 5, lines 7-13 now read: **"The Chronic Disease Registry replaced and includes data from the Provincial Diabetes Database. The Chronic Disease Registry includes all cases of diabetes in NL, with a lookback period to 1994. The Chronic Disease Registry includes data from the Provincial Meditech Database (e.g. lab test data), the Provincial Discharge Abstract Database (e.g. hospitalization data), the Medical Care Plan (MCP) Claims Database, the MCP Beneficiary Registration Database, and the Provincial Mortality System. Data from 1994 onward are included within the Chronic Disease Registry, although laboratory data were not added to the Registry until 2009."** **Additionally, page 5, lines 30-31 now read:** **"Individuals remain in the Chronic Disease Registry until they leave the province or die."** 2. In a related question, given that diabetes is defined based on laboratory abnormalities, how could someone enter the cohort based on the CCDSS definition alone, without meeting the laboratory case definition? **Thank you for this question. The Chronic Disease Registry was established in 2015. It was developed to replace the Provincial Diabetes Database, which included data from 1994 onward. Laboratory data were not included in the Provincial Diabetes Database until 2009. There are individuals with a prevalent case of diabetes from the 1990's or early 2000's who met the CCDSS definition of diabetes but did not meet the laboratory diabetes definition due to good glucose control from 2009 onward. As a result, these individuals have been identified in the Registry as having diabetes by the CCDSS definition alone.** 3. The authors note important differences in patient demographics between rural and urban people with diabetes. But how many of these are representative of rural and urban residents of NL overall? For example, I would assume that there is a higher proportion of young people in urban areas; therefore, it is unclear whether the higher number of young people with diabetes in urban areas is disproportionate or not. It would be preferable to present diabetes prevalence as a proportion of the overall population, not just as absolute numbers. **You are correct in your assumption that there is a greater number of older people in rural areas in NL. To address this comment, we have presented crude prevalence by age group for the total population of NL and rural and urban areas in Table 1. We have used provincial Census data as the denominator for these calculations.** 4. While there are some quality measures that are statistically significantly difference between groups, their clinical significance is questionable. For example, 77.4% vs 76.2% having an HbA1c completed is not a clinically relevant difference. The authors should be careful not to overinterpret or overemphasize trivial differences between groups. **We agree with this suggestion and have added standardized differences to Tables 1-3. These differences are discussed within the results section. For**

	example, page 7, lines 4-9 now read: **"The mean HbA1c was higher among individuals residing in rural communities and the percentage of individuals meeting the recommended HbA1c target established by Diabetes Canada was significantly lower for individuals residing in rural regions (HbA1c 7.41±1.487 vs. 7.26±1.497; HbA1C on-target 49.4% vs. 53.8%). However, the standardized difference for these relationships was small (approx. 0.10)."** 5. In Table 2, the authors report mean UACR. However, UACR frequently cannot be calculated, when the numerator of the ratio (albumin) is reported as undetectable (e.g., "<8 mg/L"). Thus, how can a mean and standard deviation for this value be determined? In this situation, it would be more appropriate to report a median. **Thank you for your thorough review and this thoughtful comment. We have replaced the mean values for UACR with median values.** 6. In the limitations section, the authors note that individuals who were diagnosed with diabetes during the 2015/16 year may not have had time to have all of the recommended testing done. Would it not be better to exclude these patients from the study, and only include those who had been diagnosed with diabetes before the start of the observation period? **We appreciate this comment and discussed excluding these individuals from the study. We have decided to retain these individuals within our study population. By retaining these individuals, we can offer an accurate estimation of the number of individuals with diabetes in NL at the end of the observation period. Although there are some tests the individual may not have had, we would expect that they would have received, at minimum, a single HbA1c test to confirm their diagnosis. Given this, we do not expect that the inclusion of these individuals would have greatly skewed the proportions of individuals receiving laboratory tests.** 7. The authors should use the terms "type 1" and "type 2" to refer to types of diabetes, rather than with Roman numerals. **Thank you for your thorough review. We have made this change throughout the manuscript.** 8. The authors should mention that many other important quality indicators for diabetes (e.g., blood pressure control, foot examinations, eye examinations) could not be ascertained using the available data. **Thank you for this suggestion, we have incorporated it into the limitations section. Page 9, lines 28-31 now read:** **"Although clinical tests and hospitalizations are important indicators of diabetes management, other important indicators, such as blood pressure control and frequency of eye and foot examinations could not be ascertained using the available data."**