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Title	A cross-sectional analysis of lumbar spine CT referral rates by family physicians using routinely collected data in one health region in Newfoundland and Labrador, Canada: a brief report
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Reviewer 1	Dr. Derek Emery
Institution	Department of Radiology and Diagnostic Imaging, University of Alberta, Edmonton, Alta.
General comments (author response in bold)	<p>I read this manuscript with interest. This is an important area to study, particularly in the Canadian context where resources are limited.</p> <p>1. The background is accurate in that the Choosing Wisely Campaign has resulted in increased awareness of over testing. The authors are not accurate in stating that reducing lumbar spine CT is a top ten Choosing Wisely recommendation. The recommendation from Choosing Wisely is: "Don't do imaging for lower-back pain unless red flags are present" (https://choosingwiselycanada.org/radiology/). Lumbar spine imaging includes: X-ray, CT and MRI. CT is not the preferred imaging modality for use in low back pain. MRI has replaced CT for lumbar spine imaging in most of Canada. We have adjusted the statement to be more accurate with Choosing Wisely's recommendations. (Pg 1)</p> <p>2. The authors are clear in their explanation of why they conducted the study and what the research question is. The study design is appropriate for the most part. I am confused as to the reason why people 18 and 19 years of age were excluded. I do not think that it is valid to exclude this age group as in Canada adults are greater than or equal to 18 years of age. This comment is similar to one asked above, and we have addressed it in the manuscript.</p> <p>3. The results are reasonable in that they document the use of a single imaging modality (CT) as requested by family doctors for a specific body part (lumbar spine). The results are not surprising and there is little context for comparison. Throughout the manuscript the authors compare their study of lumbar spine CT to other studies of lumbar spine imaging. This is not a valid comparison as in most centres MRI is preferred over CT for lumbar spine imaging. Only reference 6 specifically looks at CT of the lumbar spine. The authors did not discuss the use of lumbar spine MRI nor lumbar spine X-ray. We have clarified this comparison. (Pg 6-7)</p> <p>4. Do all people in the Eastern Health Region have all of their imaging performed within the region or do people sometimes have to travel to another region for some of their imaging? Could this study be missing some of the CT scans performed on this population? Thank you for this observation. This is always a possibility. We have briefly mentioned this in the discussion. (Pg 7)</p> <p>5. Table 1 should be more comprehensive by including the raw numbers in addition to the rate ratio. Figure 1 is reasonable. We have added the raw yearly numbers as well as the rates: "The raw</p>

	<p>numbers of LS CTs performed in the EH Region are as follows: 3,118 in 2013, 3,581 in 2014, 4,042 in 2015, and 3,629 in 2016.” (Pg 5)</p> <p>6. The findings are of limited relevance to most of Canada as CT is no longer the preferred imaging modality for use in the examination of patients with suspected pathology involving the lumbar spine. The findings are of importance within the province of Newfoundland and Labrador as baseline data to be used for comparison in efforts to improve appropriateness. Thank you for your comment.</p> <p>7. In the context of the literature, it is not valid to compare a study of a single imaging modality (CT) to other studies that discuss the use of imaging as a whole. Physicians will generally use those imaging modalities that are available and that are most likely to provide the information required. This study used CT of the lumbar spine as a surrogate for all imaging of the lumbar spine. There is no discussion of the use of X-Ray nor of MRI. In most centres MRI has largely replaced CT as the preferred imaging modality of the lumbar spine. Thank you for raising this issue. We did not intend for CT use to be used as a surrogate for all imaging. CT was chosen as the imaging modality of interest for this study because of its high exposure to radiation and because it was identified that NL has twice the rate of CT use compared to the Canadian rate. We did not look at MRI rates because GPs are not allowed to order MRI and we were focused on imaging ordered by family physicians in this study. We have added in a sentence to clarify this in the introduction on page 2, it reads as follows: “This study focused on CT imaging largely in response to a report by the Canadian institute for Health information which reported Newfoundland and Labrador’s all type CT imaging rate to be to twice as high as the national average and the second highest rate of all the provinces.” (Pg 2)</p>
Reviewer 2	Dr. Jason Busse
Institution	Department of Anesthesia, McMaster University, Hamilton, Ont. (in collaboration with radiology resident Dr. Mostafa Alabousi)
General comments (author response in bold)	<p>This brief report explores rates of computed tomography (CT) for low back pain (LBP), ordered by family physicians, from 2013 to 2016, in Newfoundland and Labrador. The authors report an increase in rates from 2013 to 2015, and then a decrease from 2015 to 2016, with crude rates ranging from 1225/100,000 to 1568/100,000 (age and sex adjusted rates were very similar). This information on rates of CT scans for LBP is helpful to explore the impact of future policies designed to reduce unnecessary imaging.</p> <p>We note the following issues for consideration:</p> <p>1. The Introduction states: “Australia and the US provide population level data on LS CT utilization for their courtiers,...”. I suspect the authors meant “countries” instead of “courtiers”, which is a term referring to individuals often in attendance at the court of royal personage. Thank you for catching this mistake! We have adjusted the spelling.</p> <p>2. In the Methods, please specify if ethics was waived for the study. We have added a statement on ethics in the methods: “This study was exempt from ethical approval from the local Health Research Ethics Boards</p>

as it is a quality improvement study.” (Pg 3)

3. In the Methods, page 10, line 37: technical note, we would suggest the term “CT examination” rather than “CT image”, as any CT exam includes many images, not just one.

We have adjusted the terminology. Thank you for pointing that out.

4. Please ensure that all abbreviations are defined on first use (e.g. CT, LBP).

We have double-checked all use of abbreviations to ensure they are defined.

5. Minor style point: if you use a comma when using numbers >1,000, this should be standardized throughout; we see some cases where a comma is used and some cases where it is not.

We have changed the numbers so that they are consistent.

6. Consider reporting annual rates of CT scans for men vs women in addition to the overall rates, and providing the age distribution of individuals undergoing CT scans if available, to further describe this population.

We have added some basic demographic information to help readers understand the population. (Pg 5)

7. The Results conclude that changes in rates of CT for LBP are statistically significant but “likely clinically irrelevant”; however, this statement should be informed by the following data if possible:

a. The absolute number of CT scans for LBP for each year of the study (2013-2016)

Thank you for this suggestion. We have added raw numbers to the text of the results as previously mentioned. (Pg 5)

b. The estimated financial cost associated with the total number of LBP CT scans each year

Estimating cost is beyond the scope of this paper as publically available costs CT imaging are difficult to find in the Canadian public healthcare systems and it is challenging to tease out the true cost without performing an economic evaluation.

c. The estimated proportion of unnecessary CT scans (perhaps drawing from other literature), and the associated cost-saving if eliminated

Providing estimates of appropriateness is also beyond the scope of this brief report. However, we have conducted a separate study that we are currently finishing up and will aim to publish on its own.

8. The authors correctly note that rates of CT scans they found were much higher than rates in Ontario and Manitoba as per the CIHR report by Busse et al., but there are caveats that should be noted:

a. The CIHR report looked at rates of CT scans for all axial imaging, not only lumbar spine, and all CT scans ordered not only those arranged by family physicians, which indicates the difference is even greater

We have adjusted the discussion to properly reflect these clarifications. (Pg 6)

b. The CIHR report last explored data from fiscal year 2010/2011, which is earlier than the years explored in the current study.

We have adjusted the discussion to properly reflect these clarifications. (Pg 6)

9. We are not certain that comparison to imaging data from the US and Australia is helpful, given the extremely wide range each country reports (e.g. 209/100,000 to 2,464/100,000 in the US), and the differences in healthcare systems between these countries and Canada. These data may be helpful to highlight variability in imaging practices in these countries, suggesting opportunities for optimization, but the data from Ontario and Manitoba is more helpful for comparing their data.

Thank you for your comment. We agree that the Canadian comparison is most important. We will still maintain the discussion with other countries, though we have changed the wording to be more conservative in our comparison. (Pg 7)

10. The age and sex-adjusted rate of CT scans in Ontario, from the CIHR report, was 600/100,000 – not 660 – and the data referred to all axial CT scans performed among adults, not only lumbar spine complaints ordered by FPs.

We have adjusted the discussion to properly reflect these clarifications.

11. The age and sex-adjusted rate of CT scans in Manitoba, from the CIHR report, was 967/100,000 – not 1000 – and the data referred to all axial CT scans performed among adults, not only lumbar spine complaints ordered by FPs.

We have adjusted the discussion to properly reflect these clarifications.

12. Please acknowledge in the limitations section that inclusion of CT scans for LBP ordered by specialists would further increase estimates. Also, that there was 6% missing data that reduced the total number of CT LS scans available for analysis. Further, that repeat imaging of the same individual is not accounted for.

Thank you for these suggested limitations. We have addressed them in the limitation section of the discussion of this brief report. (Pg 7)

13. We're unclear on the meaning of this statement in the Discussion section: "...lack of clinical utility of CTs for providing conservative care to patients with LBP." Used appropriately, a negative CT scan may rule a patient in for conservative (vs. surgical) care.

We have rephrased this sentence to be more clear to our meaning. (Pg 8)

14. The authors note significantly increased rates of CT scans for the LS from 2013 to 2015, and then a decrease from 2015 to 2016. Were there any policy changes that may have influenced this reversal in trend?

To our knowledge there were no policy changes that took place, and the Choosing Wisely campaign was not launched until late 2016.