This paper is an important contribution to the understanding of racial disparities in COVID-19 vaccination in Canada. Specifically, racial groups that are more likely to not receive any doses of COVID-19 vaccine compared to the White reference group. It benefits from a large, representative sample (Canadian Community Health Survey) with established methods for analysis. This information is important for policy makers, public health and health care practitioners, and communities and organizations providing services to racialized groups. Overall, the writing is clear and precise with appropriate supporting tables/figures.

Response: Thank you.

Suggested changes:
I suggest a comment in the discussion with respect to the number of doses of vaccine needing to align with the vaccine program goal(s). In this case, if we assume a goal of prevention of severe outcomes (i.e., hospitalization and death) (as per the joint Council of Chief Medical Officers of Health statement), a single COVID-19 dose is not sufficient. Overall, we don’t know from this study how many people were under-immunized and not protected against severe outcomes. I appreciate this was not in scope but believe the paper would be strengthened by some acknowledgement of this issue and that it could be a potential area of future research.

Response: This is an excellent suggestion. The purpose of the analysis was to look at inequalities in vaccination, not to directly measure the protection of the population against the COVID-19 or the prevention of severe outcomes. In addition, research has shown that one dose provided some protection against severe outcomes (https://doi.org/10.1093/cid/ciab739). Moreover, based on Canadian coverage information (https://health-infobase.canada.ca/covid-19/vaccination-coverage/), less than 3% of the Canadian population had an incomplete primary series. In the context of this analysis, a variable distinguishing those having received at least one dose is the most accurate because: a) Some people required only one dose (if they received Janssen) or more than two doses (if they were immunosuppressed, if they completed a primary series with a vaccine not approved by Health Canada) to be fully vaccinated; b) In one province representing 22% of the population (Quebec), those who had been infected by SARS-COV-2 were considered fully vaccinated with one dose of a mRNA vaccine; c) As an 8-week interval was recommended between doses, some younger adults had not had time to get two doses of vaccine at the time data collection started. This rationale was missing from the manuscript and would definitely be beneficial to readers. This explanation is now summarized in the Measurements subsection on page 5. We also acknowledge this could be a potential area for future research. Therefore, a sentence was added on page 9.

Discussion (p. 8, line 200) re: upward trend in vaccination coverage over time. I suggest including that this is expected. In the setting of vaccine availability, as long as there are no reasons people can’t access the vaccine or a significant safety concern, and assuming your dose doesn’t “expire” or become invalid as time passes, vaccine coverage always increases over time.

Response: We agree with this suggestion and have revised the text accordingly: “As expected, vaccination coverage for at least one dose increased at first and then leveled off by the end of the data collection from 87% (June to September 2021) to 95% (April to June 2022).”

Discussion (p. 8, line 232) re: trends for those SE Asian descent and influenza vaccination, consider adding that while this reference is somewhat dated (>10 years old), there are no newer data published.

Response: We appreciate this suggestion. Clarification has been added to the text on page 9.
Tables 1 and 2: In Table 1, collection periods 1 and 2 overlap in dates. Are these the correct dates? Table 2 then categorizes collection periods which do not align with Table 1. I found this confusing. Some further explanation would be helpful.

Response: Yes, the dates are correct in Table 1. There were a few days of overlap for collection periods 1 and 2. We had mistakenly labelled collection period 1 as June to August in Table 2. This has been corrected. Thank you for catching this mistake.

Table 3, population groups cell – Métis is missing the accent aigu. I noted the footnote for this cell where 4 of the observations on % not vaccinated were of marginal quality and to use with caution. I suggest including this in the Discussion description of limitations.

Response: The missing accent on Métis has been corrected. Thank you for noticing this. The revised Table 3 now has only 3 cells with estimates of marginal quality. Although this could be included in the limitations in the manuscript as noted by the reviewer, we think that this is not warranted for several reasons. First, the estimate is reported along with its 95% confidence interval, providing the readers with sufficient information to make their own judgement. In addition, the main findings of the paper are not the coverage estimates themselves, but rather the significant differences in the risks of being unvaccinated (via odds ratios) between population groups. Since the test for differences already considers the variability of the estimates, we consider that the footnote is sufficient.

There are some inconsistencies in the document (e.g., page 4, line 85) in how dates are described (June 1 or June 1st). I defer to CMAJ Open’s style guide.

Response: Thank you for noticing this. We have revised dates to make sure they are consistent throughout the manuscript.

Reviewer 2: Dr. Megan Carter

Thank you very much for such an important study. I found it clear and easy to follow, although sparse in places, perhaps due to word limit. My comments are ordered by section. Most are minor but there are a few major ones that can easily be addressed.

Response: Thank you for the kind words.

Abstract
Line 33 - I’ve never seen the distinction between Indigenous peoples as separate from racialized peoples. I think it would be best if the authors spelled out specifically the names of those other racialized groups (also, because whites is specifically named as a group).

Response: Thank you for this valid suggestion. In the original submission, listing all racialized groups was left out of the abstract due to word limit. Following revisions to the abstract, it appears that word count permits such clarification. Thus, the sentence was revised accordingly. On the other hand, Indigenous people are inherently separate and always considered distinct from racialized people and other settlers that came afterwards. This is a common practice in Canada to exclude Indigenous people from racialized people, including Statistics Canada.

I would shorten ‘racial and ethnic.’ to ‘racialized groups’ since in methods (line 38) the authors refer to the exposure as race anyway. Later in Measurements (line 119) it appears that it is race that is being asked, not ethnicity. Then be consistent throughout the paper.

Response: The reviewer is correct, it’s race that is measured in the survey and reported in the manuscript. We have diligently revised the manuscript and ensured that any sentence related to our study did not mention ethnicity. However, other studies have looked at and reported racial and/or ethnic disparities. Therefore, we think that it is appropriate to use “racial and ethnic” in the background/introduction and in the discussion when referring to the research or specific studies
that looked at both measures.

Introduction
I’m sure word limits are a factor here, but the intro dives right into it without giving the reader a sense of what disparities are and why they should care i.e., bring into context health equity. I understand the reasoning for using ‘inequality/ies’ throughout but I think equity and inequities needs to be drawn out, so it doesn’t get lost.

Response: The reviewer is right that word limit and guidelines limited our ability to bring in the context of health equity in the introduction. However, we appreciate the importance of providing the health equity context to readers. Hence, a few sentences have been added in the first paragraph of the introduction on page 3.

Line 61 - “Therefore, it is crucial to understand the existing barriers to vaccine uptake in ethnic and racialized groups...” while important, it is not what the authors are proposing to do in the paper, so is a bit misleading. To make this rationale clearer, I would link this early on to measuring and monitoring inequities in vaccine coverage to be able to do this (which the authors do a little later but comes off as disjointed).

Response: We agree that this sentence could mislead readers about what is intended in the paper. The sentence has been revised accordingly: “Therefore, it is crucial to understand the existing barriers to vaccine uptake in ethnic and racialized groups by measuring and monitoring the possible structural and systemic disparities in vaccination coverage to inform the development of equitable targeting programs for vaccination across all populations.”

Study sample/measurements
Can you assure the reader that 12–17-year-olds were eligible to receive the vaccine by June 1st, 2021, in all 10 provinces? You should also comment that eligibility requirements for vaccination were needed to manage supply and demand of vaccines and largely depended on age.

Response: Given their late eligibility for COVID-19 vaccination, we agree that children aged 12-17 would have had limited time to get vaccinated during the first few months of data collection starting in June 2021. Therefore, children aged 12-17 were removed from the analysis. The updated analysis covers adults aged 18 and older living in the 10 provinces. As suggested, a “Settings” subsection was added to the Methods to provide additional context (page 4) highlighting prioritization of certain groups.

However, we did not emphasize this since by the time data collection started in June 2021, all adults 18 years and older were eligible to receive their first dose. In addition, the proportion of adults with at least one dose by June 2022 is now reported.

It should be made clear that this is not vaccination coverage or status, as for most age groups the primary series is 3 mRNA doses. The variable should be called something different – “Never received COVID-19 vaccine dose” or “unvaccinated”, or something similar.

Response: It should be noted that the primary series is 2 mRNA doses for most of the population. Nonetheless, we acknowledge that the primary outcome used in this analysis and the rationale beyond this decision was not properly conveyed to readers. To that effect, a paragraph has been added to the measurements subsection.

What was the rationale for using education instead of income level or why not both? There is usually a rural/urban variable in the CCHS – in my previous work this has been found to relate to vaccine coverage – was this explored in this analysis?

Response: Unfortunately, we only have access to provisional files provided by Statistics Canada to conduct the analysis. Since the start of the COVID-19 pandemic, Statistics Canada issues CCHS provisional files throughout the year to allow timely dissemination of relevant health data. However, given the amount of work and verifications involved, linkage to tax data and the PCCF+ files is only performed on an annual basis for dissemination of the CCHS annual file. As a results, these provisional files unfortunately do no contain the income and community size (which is used to derive urban/rural) variables.
When did most 12-17 y olds respond? I am just wondering if this could have artificially increased the unvaccinated percentage because they would have had less time than other age groups to get their first dose. Were racialized individuals more likely to be younger or respond in earlier time periods? This could also have biased results.

Response: Given their late eligibility for COVID-19 vaccination, we agree that children aged 12-17 would have had limited time to get vaccinated during the first few months of data collection starting in June 2021. Therefore, children aged 12-17 were removed from the analysis. The updated analysis covers adults aged 18 and older living in the 10 provinces. While it might be true that some population groups could tend to have younger individuals, it’s important to keep in mind that multiple logistic regression models are adjusted for age groups. Therefore, significant differences observed in the adjusted models are those that are still present after adjusting for differences in age. Finally, the sample for each collection period was selected and weights were applied to ensure representativeness of the population. This process guarantees a similar representation of population groups across all collection periods.

Results
Table 3. title -change ‘vaccination status’ to ‘odds of being unvaccinated’ or “odds of receiving no vaccine dose received”. Add ‘weighted’ somewhere.

Response: Thank you for this relevant comment. The title of Table 3 has been revised to convey the information about presenting the odds of being unvaccinated and the word weighted was added for clarity.

Table 3- So, if proportion not vaccinated is of marginal quality for some racialized groups, how does this affect the overall model results?

Response: The revised Table 3 now has 3 cells with estimates of marginal quality. Although this could be included in the limitations in the manuscript, we think that this is not warranted for several reasons since it has a very limited impact on the main findings. First, the estimate is reported along with its 95% confidence interval, providing the readers with sufficient information to make their own judgement. In addition, the main findings of the paper are not the coverage estimates themselves, but rather the significant differences in the risks of being unvaccinated (via odds ratios) between population groups. Since the test for differences already considers the variability of the estimates, we consider that the footnote is sufficient.

Figure 1 is mislabeled and missing labels – perhaps something went awry when formatted to pdf?

Response: Maybe it was an issue with the PDF conversion since the files were submitted as Word documents. Figure 1 was revised according to some comments and we made sure no labels were missing in the revised Word document.

Throughout the paper - is capitalizing People a stylistic thing? If not, should this be lowercase? Response: Out of respect, we chose to capitalize People when referring to specific population groups such as Indigenous and racialized Peoples. This is becoming more and more a standard practice (see this CMAJ manuscript for example (https://doi.org/10.1503/cmaj.212147). We have therefore chosen to keep the text as is.

Lines 181 to 195, change language of ‘risk’ to ‘odds’

Response: Change made, thank you.

Discussion
Line 198 – this is not considered coverage, please change the language here and throughout the document. Receiving a first dose depended on eligibility requirements in the provinces and logistics of mass vaccination (this is why it was essential to control for time period of CCHS response and age group – this should probably be mentioned somewhere explicitly in the paper).

Response: The abstract and the statistical analysis section clearly state that the multiple regression model and hence the OR estimates are adjusted for collection period (time), region of
residence and age group. Nevertheless, we agree that the rationale behind controlling for these variables was missing therefore we have revised the language used in the statistical analysis on page 6 to clarify it. The language of the abstract, intro, methods and discussion sections have been revised to clarify that in this analysis we looked at vaccination coverage for at least one dose.

Line 207 – what could this do to results if racialized individuals were less likely to respond to the CCHS than white people? Could this mean the bias may have made associations smaller than they might have been? This could be expanded upon in terms of the paragraph starting on line 245.

Response: A lower response rate in one category, e.g., in racialized vs white, would bias the coverage estimates, not the association between race and vaccination, which is the main objective and finding of this analysis. However, due to word count limitations, we could not discuss this in the limitation section.

Line 216 – I think the authors need to explain and/or reference this as Ontario, for example, prioritized all Indigenous people (regardless of on/off reserve) – they were among the first to be eligible. This also contradicts the beginning of line 215.

Response: Indigenous people were prioritized for early vaccination against COVID-19. Some provinces prioritized Indigenous communities, other prioritized Indigenous people regardless of where they lived. The word count limit does not allow a detailed description of jurisdiction-specific priorities. However, minor changes were made to these sentences in an attempt to address this: “As a result, many of these populations were prioritized for access to COVID-19 vaccine in most provinces.” Possible explanations for the higher odds of being unvaccinated in off-reserve First Nations, despite the prioritization of this group, include provincial policies that delayed access to vaccination among First Nations, Inuit and Métis living in cities compared with First Nations living on reserve, as well as mistrust in vaccines and the health care.”

Line 217 – “lower vaccination coverage” change to “higher odds of being unvaccinated”

Response: Change made, thank you.

Line 257-258 I don’t understand what is being said here. Are the authors saying that because sample sizes are so small in the models, that we can’t be sure of the results (e.g., in response to my question about the quality of the estimates in Table 3?). Please clarify.

Response: The message conveyed in these sentences is that beyond simple comparisons of vaccination coverage for at least one dose between population groups, additional analysis such as factors influencing uptake and/or determinants of non-vaccination in Indigenous and racialized populations are precluded due to small sample sizes. See response to comment #11 above for explanations on the impact of the small sample sizes for certain population groups on the main results and findings.

If space allows, the authors could expand on the results of other studies, including effect sizes, which would be helpful for the reader.

Response: We agree that this could be of interest to readers. Unfortunately, the word count limitations preclude additional comparisons to other studies beyond what is already included in the manuscript.

Reviewer 3: Dr. Sanjay Beesoon, Alberta Health Services, University of Alberta Faculty of Medicine and Dentistry

The study design and methodology can be improved to allow unbiased interpretation and targeted vaccination policies for specific sections of the Canadian society.

Response: The purpose of the analysis was to assess and measure inequalities in COVID-19 vaccination by racial group in Canada. Given that immunization registries in Canada do not collect
Information on race and ethnicity, survey data are one of the only sources for this kind of information and analysis. As a general health survey conducted on an ongoing basis by Statistics Canada, the CCHS data was already collected and unfortunately the study design and methodology cannot be changed to fit specific needs. The strength of the CCHS is that it is representative of the population (albeit target population exclusions), it has a large sample size, and is using a stratified multi-stage design based on the excellent Labour Force Survey frame.

Manuscript requirements:

Please include study type in your title.

Response: The words “cross-sectional” were added to the title to clarify that this is a cross-sectional survey.

Introduction: Please ensure this is no longer than 2 paragraphs. A statement of the study aim and research question should be included at the end of the introduction.

Response: The introduction consists of 2 paragraphs. The second paragraph clearly states the aim of the study. Note that minor clarifications have been made based on relevant reviewers’ suggestions.

Methods: Subheadings (e.g., setting, design, sources of data, statistical analysis) are helpful for readers; these will vary depending on the study type.

Response: We added a setting subsection as per a reviewer’s suggestion to provide additional context. In addition, the methods section contains the following headings: Study Sample, Measurements, Statistical Analysis and Ethics approval.

Please ensure your final word count is below 2500 words.

Response: As per an agreement with the editor, in order to address reviewers’ comments adequately, we have been authorized to exceed the 2500-word limit. A limit of 3000 words was granted and we made sure to respect this.

Data-sharing statement: Please supply a statement that indicates (1) whether any, all or portions of the data are available to others; (2) where, through whom, when and on what terms data will be available; and (3) how data may be accessed.

Response: We apologized for not including this statement in the original submission as we mistakenly thought it was required for clinical trials only. This statement has now been added to the title page.

Abbreviations: For only the most standard abbreviations (i.e., 95% CI, SD, OR, RR, HR), please spell out at first mention and include the abbreviation in parentheses. The abbreviations may be used throughout the remainder of the manuscript. Please remove all other abbreviations.

Response: All non standard abbreviations have been removed and we spelled out at first mention for the standard ones.

Please include a reporting guideline checklist (if applicable for your study type) from the appropriate reporting guideline. For more information, see the Equator Network (https://can01.safelinks.protection.outlook.com/?url=http%3A%2F%2Fwww.equator-network.org%2Fdata=05%7C7C01%7Caubreymaquiling%40phac-aspc.gc.ca%7C7C8946a78d9e4a4ab3508db2a57cd60%7C42fd9015de4d4223a368baecacab48927%7C0%7C638150385490389%7CUnknown%7CTWFpbGZsb3d8eyJWljoiMC4wLjAwMDAiLCJQIjoiV2luMVJQIiwiWBVzIiwiTiIrMC4wLjAwMDAifSwiWlIjoidalYTQ%3D%3D&reserved=0)

Response: After a careful assessment, the STROBE reporting checklist for cross-sectional studies was deemed the most suitable and relevant for this study. It was completed and submitted.
along with the manuscript. We have considered the CHERRIES checklist as per reviewers’ suggestions. However, this checklist is specifically designed for e-surveys (web or email) and the items on the list are very specific to e-survey design, methodology and data collection. Several items of the CHERRIES checklist do not apply to our study since the CCHS in not an Internet e-survey based on a convenience sample. The CCHS is a sample survey with a stratified sample and cross-sectional design. Consequently, we think that the STROBE checklist for cross-sectional studies appears to be the best fit.