

Correction: Normative data on cardiovascular autonomic function in Greenlandic Inuit

Christensen MMB, Hansen CS, Fleischer J, *et al.* Normative data on cardiovascular autonomic function in Greenlandic Inuit. *BMJ Open Diabetes Res Care*, 2021;9:e002121. doi: 10.1136/bmjdr-2021-002121.

This article was previously published with an error.

The original paper presented normative thresholds of cardiovascular autonomic function in Greenlanders without diabetes. The levels of the normative thresholds were relatively low, and authors discussed in the paper, that they could only speculate on the reason for the seemingly reduced level of cardiovascular autonomic function in healthy Greenlanders. The thresholds were derived from analyses based on a Greenlandic study population for which they lacked extensive descriptive details. Meanwhile, authors have received information indicating that some of the participants previously have been identified with diabetes in a different study. Likewise, authors obtained information on medication taken by some of the participants when they were examined. This new information has led to substantial amendments in the study population, requiring the exclusion of 99 individuals. These adjustments have impacted the normative thresholds, causing them to rise despite remaining relatively modest. It is highly relevant to adjust the normative thresholds as they may be applied to diagnose cardiovascular autonomic dysfunction in Greenlanders.

The adjustments have required corrections in the main paper, the tables, the figures and the supplemental appendix.

The specific corrections by the authors are described as follows:

RESEARCH DESIGN AND METHODS

Study Population

As we have acquired additional information about the participants, we have expanded the exclusion criteria. In addition to pregnancy, atrial fibrillation or the presence of an implanted pacemaker, participants were excluded if they had a history of ischemic heart disease or were undergoing treatment with medications (such as beta-blockers, tricyclic antidepressants, opioids, etc) that could potentially influence heart rate during the examinations.

Statistics

In our models predicting heart rate variability (HRV) outcomes (SDNN, RMSSD, low-frequency power, high-frequency power and total power), with age as an independent determinant and with adjustment for sex, we now also adjust for resting heart rate (HR). To avoid the estimated normative limits to exhibit negative values when adjusting for HR, as it is not biologically plausible, we applied a log-transformation to the outcome variables of the HRV measures. Subsequently, we back-transformed the coefficients to the original scale. Therefore we are presenting age- and HR-specific normative thresholds for the HRV outcomes. Consequently, due to this added dimension, visualizing the HRV measure thresholds in a two-dimensional table is no longer feasible however, instead, we are providing the equations to calculate the specific normative thresholds for each outcome in the main paper.

Results

Study population

In the updated analyses, instead of excluding only 10 participants, a total of 99 participants were excluded. Twenty-eight participants did not meet the inclusion

criteria of whom 18 participants were categorised with diabetes. An additional 71 participants were excluded due to medication that could affect HR. Like in the original analyses, 11 participants were excluded due to their age being below 20 years or above 80 years. Therefore, the final study population comprised 383 participants, with 242 participants from the Greenlandic Population Study 2018 and 141 participants from Qasigiannuguit 2020. The additional participant information also included a prior evaluation of diabetes and pre-diabetes diagnoses, allowing us to categorize participants differently according to their glycaemic status. After the adjustments, 56.7% were categorized as having pre-diabetes and 28.1% as having normoglycemia. Glycaemic status was not evaluated in 14.6%. These amendments in the study population have affected the characteristics reported in the text, table 1 and table 2.

Associations to demographic variables

In the revised analyses, despite changes in the p-values, age continued to exhibit a significant and inverse association with the three cardiovascular autonomic reflex tests (CARTs) and HRV measures. Furthermore, higher HR was significantly associated with lower HRV measures. Notably, there remained no significant association between sex and any of the outcomes.

Final models

The levels of the updated predicted age-dependent normative thresholds for all outcomes generally trended higher when compared with the original thresholds presented. Besides that, there were no modifications to the final trajectories of the CARTs. Before adjusting for HR, linear models and piecewise linear models yielded the best fit for the final trajectories of HRV outcomes. Following the adjustment for HR, the predicted normative limits for the HRV measures, tended to assume negative values in instances where both age and HR were elevated. Thus, models with log-transformed outcome variables demonstrated the best fit for the HRV measures (figure 1).

We have chosen to present the outcome-specific formulas in the main paper. In that way, it is convenient for the reader to calculate the age-specific normative thresholds for the CARTs and age- and HR-specific normative thresholds for the HRV measures.

Discussion and conclusion

Despite changes in the study population leading to a general increase in normative thresholds, the presented thresholds, when compared with similar studies based on other nationalities, remain relatively low. Thus, no substantial corrections have been made to the Discussion and Conclusion sections.

Tables and supplemental appendix

There have been revisions to the information in tables 1–3 due to the alterations in the study population. For example, in table 1, which outlines the characteristics of the study population, the mean age has been modified from 53.9 years (SD 13.1) to 52.3 years (SD 12.9). The percentage of current smokers, previously at 54.5%, has been updated to 59.3% after the revision. Additionally, HbA1c has shifted from 41 mmol/mol (IQR 38;43) to 40 mmol/mol (IQR 37;43). More characteristics can be found in table 1.

The updated median values of the outcomes presented in table 2 are not notably different from the previous. For instance, the median values for the CARTs remain consistent with the values before the revision. However, the revised medians of the HRV measures exhibit a slight increase compared with the previous values.

Table 4, which initially contained normative thresholds for HRV measures, has been removed because the models predicting these thresholds have been adjusted for HR. This introduces an additional dimension to the data, making it impractical to present in a two-dimensional table. Instead, we provide the equations for calculating age- and HR-specific normative thresholds in the main paper.

The appendix has been edited to remove sections of coding in order to offer readers a clearer overview.

We are no longer able to present the distribution and overlap of diagnostic tests as information related to glycemc status is obtained from various assessments. Therefore, the Venn Diagram in the supplemental appendix 1, section 6, has been eliminated and information concerning diagnostic tests in table 1 has also been withdrawn.



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BMJ Open Diab Res Care 2024;**12**:e002121corr1. doi:10.1136/bmjdr-2021-002121corr1

