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Discussion of “Establishing modified Canadian Aerobic Fitness Test (mCAFT) cut-points to detect clustered cardiometabolic risk among Canadian children and youth aged 9 to 17 years” – The need for foundational fitness research in Canada: is there room for innovation?

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DISCUSSION

Discussion of "Establishing modified Canadian Aerobic Fitness Test (mCAFT) cut-points to detect clustered cardiometabolic risk among Canadian children and youth aged 9 to 17 years" – The need for foundational fitness research in Canada: is there room for innovation?

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In this issue, Lang et al. (2020) aimed to establish cardiorespiratory fitness (peak oxygen consumption ($\dot{V}O_{2peak}$)) cut-points to help identify clustered cardiometabolic risk among Canadian children and youth using data derived from the modified Canadian Aerobic Fitness Test (mCAFT; Canadian Society for Exercise Physiology (CSEP) 2003, 2013) administered in the Statistics Canada Canadian Health Measures Survey (CHMS; Tremblay et al. 2007). The authors suggest that these mCAFT cut-points can be used to inform national surveillance and identify children and youth at risk. While such effort is laudable, and the establishment of criterion-referenced cut-points are important and needed, the utility of such cut-points is predicated on the validity and reliability of the underlying measurements (mCAFT) within the targeted population — in this case children (aged 9–13 years) and youth (aged 14–17 years). Herein lies a long-standing and frequently disregarded deficiency in due diligence.

While the mCAFT has a robust history of development as summarized by Lang et al. (2020), there are notable limitations. First, the research informing the validity and reliability of the mCAFT for predicting maximal oxygen consumption ($\dot{V}O_{2max}$) was completed in the late 1980s (Weller 1989) with the prediction equation published a few years later (Weller et al. 1993). These results are 30–35 years old and their accuracy today needs to be verified or the equation modified. Immigration, body heights, weights, physical activity behaviours, and running shoe characteristics among other potential confounders have changed in this time period and could affect results independent of changes in cardiorespiratory fitness. Second, and somewhat related, the prediction equation used by the CSEP to estimate $\dot{V}O_{2max}$ (in the case of adults) or $\dot{V}O_{2peak}$ (in the case of children and youth) is not the equation published by Weller et al. (1993) but rather another equation derived in her thesis (Weller 1989). Consequently, the equation being widely used has not been published and few people know of its origin.

Third, the mCAFT has never been validated on children less than 15 years of age, despite the test being used for individuals as young as 6 years of age in the national CHMS survey (Tremblay et al. 2007). Authorities at Statistics Canada and the Public Health Agency of Canada have known this limitation since the start of the CHMS in 2007. Unfortunately, the research required to ensure the validity and reliability of the mCAFT for predicting $\dot{V}O_{2peak}$ for children aged less than 15 years has never been completed. Furthermore, the research from the Weller thesis (1989) included only 15 healthy youth (4 male, 11 female) aged 15–19 years, limiting confidence in the accuracy of the $\dot{V}O_{2peak}$ prediction for this age range or for those with health conditions.

Fourth, the exclusion rate for cardiorespiratory fitness testing in children in the CHMS was very high resulting in a bias towards those who are healthy and fit having a valid measure. Indeed the values reported by Lang et al. (2020) of optimal mCAFT cut-points for cardiometabolic risk for males of 49 and 46 $mL \cdot kg^{-1} \cdot min^{-1}$ and females of 46 and 37 $mL \cdot kg^{-1} \cdot min^{-1}$ among children and youth, respectively, are very high compared with global comparisons (Ruiz et al. 2016; Silva et al. 2016) and 83% of females and 71% of males met the new mCAFT cut-points. This bias likely inflated the results reported by Lang et al. (2020), resulting in a perception that Canadian children are very fit and healthy when this may not be the case. The implications of this potential inflation to decision-making and investment by governments are obvious and of serious consequence if indeed the data are inaccurate. Such bias and inaccuracies can also lead to inaccurate criterion-referenced cut-points and in turn misinform public health screening and clinical interventions.

Fifth, the background research for the mCAFT, being predominantly focussed on the adult population, did not address well-known concerns regarding ratio scaling and the use of body weight for the scaling of $\dot{V}O_{2peak}$ among children and youth (Welsman and Armstrong 2019). The exploration of appropriate ratio scaling to adjust for body mass and maturational changes in predicting $\dot{V}O_{2peak}$ among children and youth should be an important component of the required background research.

Finally, the difficulties in using the mCAFT for temporal trend surveillance are complex as illustrated by Craig et al. (2012). Indeed, they qualify their findings stating "the historical and cur-

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rent extrapolations should be viewed only as relative indicators of the change in aerobic fitness levels and not as absolute estimates of $\dot{V}O_{2max}$." These difficulties are exacerbated in children and youth because of the issues described here. Making international comparisons using the mCAFT is also difficult as few other countries use this field test. Consequently, comparisons require the calculation of a standardized metric (i.e., $\dot{V}O_{2peak}$) and results will be influenced by the validity and reliability of the prediction formula used.

While this study has many strengths, they are overshadowed by the several limitations as described above. The authors suggest "The mCAFT cut-points can help identify children and youth at risk of poor cardiometabolic health in public health surveillance and clinical and school-based settings" (Lang et al. 2020). Based on the unknowns and limitations with the mCAFT for this age group, confidence in this statement is uncertain. Rectifying these unknowns and limitations should be a priority.

Conflict of interest statement

The authors declare they have no conflict of interest.

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