Response to Letter Regarding Article, “Physical Activity and Heart Rate Variability in Older Adults: The Cardiovascular Health Study”

We are pleased to address the suggestion of Monfredi and colleagues that further consideration of resting heart rate (HR) might provide insight into the relationship between physical activity and heart rate variability (HRV) reported in our article. As we have previously discussed, influences on HRV are complex and multifactorial. Although HR influences HRV, HRV indices are not merely linear nor nonlinear surrogates of HR, but independent measures influenced by numerous other physiological pathways. Although we agree that HRV indices such as 24-hour standard-deviation-of-all-normal-to-normal-intervals (SDNN) cannot directly characterize vagal activity, HRV indices can provide insights into autonomic influences on and responsiveness of the heart. We also note that we made no statements about the physiological determinants of resting bradycardia, which was not an outcome in our analysis.

Previous studies have also demonstrated that associations of HRV with outcomes such as mortality are independent of resting HR. In response to Monfredi and colleagues, we have performed detailed additional analyses with further adjustment for resting HR, including HR as continuous variable and HR logarithmic transformed. All findings were very similar to our original reported findings, with no appreciable changes in the relationships between physical activity and any of the HRV indices. For example, after further adjustment for HR logarithmic transformed, greater leisure-time activity and walking distance each remained prospectively associated with higher 24-hour SDNN: across quintiles, 105.2 versus 116.0 for leisure-time activity, \( P \text{ trend} = 0.018 \); 104.3 versus 119.2 for walking distance, \( P \text{ trend} = 0.025 \). These findings confirm our original analyses that physical activity is independently associated with specific indices of HRV, and that such associations are not mediated by differences in resting HR.

Direct numeric comparisons should not be made between HRV indices derived from 24-hour Holter monitoring, as in our study, and HRV indices derived from shorter-term (eg, \( \leq 2 \) hours) recordings, such as those\(^{4,5} \) used by Mondredi et al in their calculations. As also described in those cited articles, “SDNN is affected by processed time: the longer the recording, the greater the fluctuations in heart rate and the larger the value of SDNN.” The duration of available data should be considered in the interpretation of SDNN. Consequently, the magnitude of differences in SDNN for shorter-term recordings cannot be compared with a 24-hour assessment. In addition, we note that our analyses and inference on the influence of physical activity on HRV were not based on 1 metric such as SDNN, but on a diverse range of time-domain, frequency-domain, and nonlinear HRV indices.

Disclosures

None.

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