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To the Editor-10-second ECG-based RMSSD as valid measure of HRV

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A 10-second ECG-based Root Mean Square of Successive Differences is a valid and reliable measure of heart rate variability

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A 10-second ECG-based Root Mean Square of Successive Differences is a valid and reliable measure of heart rate variability

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We thank Lombardi et al.¹ for highlighting the relevance of our paper² in their editorial comment, but strongly disagree with their conclusion that the results of our study based on short-term heart rate variability (HRV) are “difficult to interpret”. We initially shared the same skepticism and concerns regarding the utility of ultra-short HRV measurements based on 10-second ECGs, which is why we set out to extensively test this in a validation study³ prior to using 10-second Root Mean Square of Successive Differences (RMSSD) in our recent publication². To validate, we assessed RMSSD from three separate 10-second recordings and gold standard measurements of 4 to 5 minutes and found substantial agreement ($r=0.853$ to 0.862) with only minimal deviation from the true mean, and short-term reproducibility for the 10-second recordings ranging from $r = 0.740$ to 0.751 .³ Thus, we conclude that a single 10-second ECG recording yields a valid RMSSD measurement with good reliability.

As such we do not believe, as stated by Lombardi et al.¹, that the negative findings for psychosocial factors were mainly caused by the use of ultra-short HRV measurements.

Furthermore, in contrast to Lombardi et al.’s view, we did consider instantaneous heart rate by additionally conducting all analyses on a measure of RMSSD adjusted for heart rate by the coefficient of variation, a parsimonious correction formula². Subsequently, our very large cohort study confirmed the well-known strong cross-sectional associations between RMSSD and antidepressant medication use, type-2 diabetes, and hypertension. Increased future application of RMSSD based on 10-second ECGs in prospective epidemiological studies may yield important new findings related to the development of cardiovascular morbidity and mortality.

References

1. Lombardi F, Huikuri H, Schmidt G, Malik M: Short-term heart rate variability: Easy to measure, difficult to interpret. *Heart Rhythm* 2018;15:1559–1560.
2. Tegegne BS, Man T, van Roon AM, Riese H, Snieder H: Determinants of heart rate

variability in the general population: The Lifelines Cohort Study. *Hear Rhythm* 2018;15:1552–1558.

3. Munoz ML, Van Roon A, Riese H, Thio C, Oostenbroek E, Westrik I, De Geus EJC, Gansevoort R, Lefrandt J, Nolte IM, Snieder H: Validity of (ultra-)short recordings for heart rate variability measurements. *PLoS One* 2015;10:e0138921.