Association between photoplethysmography pulse upslope and cardiovascular events in over 170,000 UK Biobank participants

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Background: Photoplethysmography (PPG) is used in many wearable devices to monitor heart rate and other health parameters and it is becoming the most frequent and commonly measured cardiovascular signal. Its use for remote cardiovascular risk monitoring could have a dramatic impact on healthcare, but its association with cardiovascular events is unclear.

	Inc	OR	CI	
ACM	5.2%	0.75	0.73	0.78
MI	3.2%	0.76	0.73	0.79
HF	2.1%	0.72	0.68	0.75
AF	5.2%	0.83	0.81	0.85
STR	2.1%	0.80	0.77	0.84

Table 1: Inc: Incidence; OR: Odds Ratio; ACM: All cause mortality; AF: atrial fibrillation; MI: Myocardial Infarction; HF: Heart Failure; STR: Stroke

This study uses data from the UK Biobank to assess the association between PPG morphological features and risk of cardiovascular events.

Methods: After removing participants with prevalent cardiovascular disease, N= 175,284 individuals were included in the study (44.6% male, 56.4 ±8.1 years old). A single finger PPG waveform of 101 data points, evenly sampled between 0% and 100% of the cycle length, was available. The PPG waveforms were normalized between 0 and 1 and the maximum of the first derivative during the pulse's upslope was measured (dVdtmax). Logistic regressions adjusted for heart rate were used to assess dVdtmax interaction with risk of cardiovascular events (train/test 75%/25%).

Results: After a median follow-up period of 11.2 years, incidence of all-cause mortality (ACM), myocardial infarction (MI), heart failure (HF), atrial fibrillation (AF) and stroke (STR), ranged between 2.1% and 5.2% (Table 1). dVdtmax was inversely associated with all outcomes (Table 1). A reduction of 1 standard deviation in dVdtmax increasing the risk of an event between 17%, in the case of AF, and 28%, in the case of HF.

Conclusion: In middle-aged individuals without known cardiovascular disease, the slope of the finger PPG pulse is inversely associated with increased risk of mortality and cardiovascular events. Future studies should assess whether this association is independent of traditional risk factors.