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Chathuri Daluwatte PhD, Jose Vicente PhD, Loriano Galeotti PhD, Lars Johannesen PhD, David G. Strauss MD, PhD, Christopher G. Scully PhD

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Chathuri Daluwatte, PhD[a], Jose Vicente, PhD[b], Loriano Galeotti, PhD[c], Lars Johannesen, PhD[d], David G. Strauss, MD, PhD[d], and Christopher G. Scully, PhD[a]

[a]Office of Science and Engineering Laboratories, CDRH, US FDA, Silver Spring, MD, USA

[b]Office of New Drugs, CDER, US FDA, Silver Spring, MD, USA

[c]Office of Device Evaluation, CDRH, US FDA, Silver Spring, MD, USA

[d]Office of Clinical Pharmacology, CDER, US FDA, Silver Spring, MD, USA

Abstract

Purpose: Performance of ECG beat detectors is traditionally assessed on long intervals (e.g.: 30 min), but only incorrect detections within a short interval (e.g.: 10s) may cause incorrect (i.e., missed + false) heart rate limit alarms (tachycardia and bradycardia). We propose a novel performance metric based on distribution of incorrect beat detection over a short interval and assess its relationship with incorrect heart rate limit alarm rates.

Basic procedures: Six ECG beat detectors were assessed using performance metrics over long interval (sensitivity and positive predictive value over 30 min) and short interval (**A**rea **U**nder **e**mpirical **c**umulative **d**istribution **f**unction (AUecdf) for short interval (i.e., 10 s) sensitivity and positive predictive value) on two ECG databases. False heart rate limit and asystole alarm rates calculated using a third ECG database were then correlated (Spearman's rank correlation) with each calculated performance metric.

Main findings: False alarm rates correlated with sensitivity calculated on long interval (i.e., 30 min) (ρ = -0.8 and $p < 0.05$) and *AUecdf for sensitivity* (ρ = 0.9 and $p < 0.05$) in all assessed ECG databases. Sensitivity over 30 min grouped the two detectors with lowest false alarm rates while *AUecdf for sensitivity* provided further information to identify the two beat detectors with highest false alarm rates as well which was inseparable with sensitivity over 30 min.

Principal conclusions: Short interval performance metrics can provide insights on the potential of a beat detector to generate incorrect heart rate limit alarms.

Keywords
ECG beat detectors, heart rate limit alarms, false alarms, performance metrics