

**Smartphone 12-lead ECG—Exciting but must be handled with care**

We appreciate the interest in our recent publication shown by Drs Lindow and Pahlm, and thank them for their thoughtful evaluation and recommendations for future possible improvements to our proposed mobile smartphone ECG technology. In general, we agree with their observations and recommendations. We provide some specific comments below.

We thank you for your elegant discussion and proposal to increase the similarity between our smartphone “12-lead equivalent” ECG, based on data obtained from a serial set of 2-wire-based single-lead ECGs, and a standard 12-lead ECG by using data from the existing serial 2-wire ECGs and calculating a virtual Wilson central terminal. We will consider incorporating this recommendation into future iterations of our device. At present, we think a better long-term answer may come from the use of a 3-, instead of just 2-, wire system. By so doing, we could use both arms as the central terminal for the precordial leads (and then provide all data as raw data rather than averaged beats). However, if 2 wires were used, such as with an Apple Watch-based setup, adding aVR and aVL into the creation of the generated precordial leads should be very reasonable and potentially helpful. It could also make for an easier acquisition because all grounding could theoretically be done from one arm, and then, by using the augmented leads, we would get potentially even better data.

We acknowledge that the expected positive predictive value of our smartphone device will differ based on the population studied. Also, we agree that including the diagnosis of left bundle-branch block as a positive test result will certainly have affected our results.

We agree that the fairly simplistic smartphone device used in our project can be associated with a significant risk of lead misplacement. Indeed, this was the case in our ST LEUIS study. Our device, in its present form, is probably too complicated to be released for use in the lay population, and significant modifications to the device will need to be done and appropriate user instructions will need to be provided before the device is ready for sale. As noted above, at present, we think increasing the number of wires to 3 will be the first big step in further development.

Finally, we believe the major finding to come from the ST LEUIS study is that, in the appropriate clinical setting of a possible acute ST-elevation myocardial infarction, it is feasible to obtain a clinically useful and reasonably diagnostic 12-lead ECG from mobile smartphone technology.

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