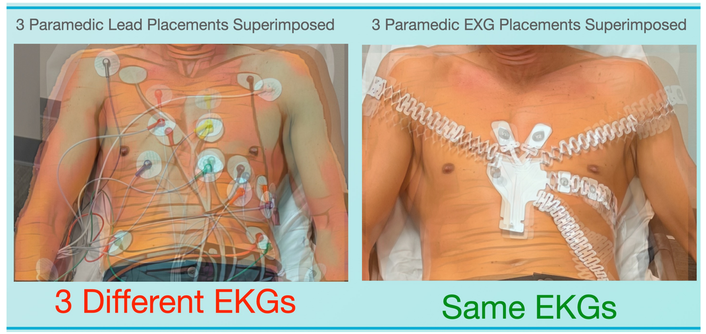
A Before and After Comparison of a Novel Device for ECG

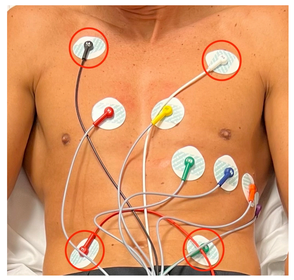
Christian McClung MD MPhil, Stephen Dunphy MD, Arya Nahavandi

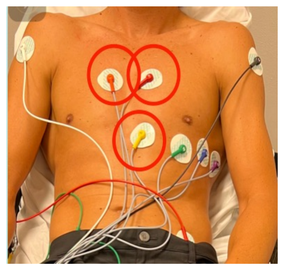
Objectives: Accurate interpretation of ECGs is crucial for diagnosing and managing cardiac conditions. However, errors in ECG acquisition, particularly electrode misplacement, can lead to incorrect interpretations and impact patient care. We present data on the comparison of a novel device that is utilized to obtain diagnostic 12 Lead ECGs. The device is screen printed and uses anatomical markers to ensure proper alignment and has a single connection terminal.

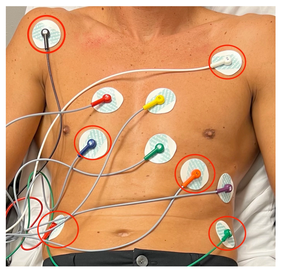
Methods: This is a case-control study of utilizing a novel 12 lead electrode system with licensed paramedics and emergency nurses. This is a human factors study evaluating the utility of the novel device. Participants volunteered to perform a traditional 12 lead ECG with the same subject and then utilize the novel device to perform another 12 lead ECG. We used a 7-point Likert survey (ranging from strongly disagree to strongly agree) to measure the participant preference for using the device and characteristics related to ease of use, reduced mental effort, improved patient safety, and confidence with placing electrodes correctly. Still photos were analyzed for the positioning of electrodes. We used STATA, College Station TX for all statical analyses of intra- and inter-operator agreements.

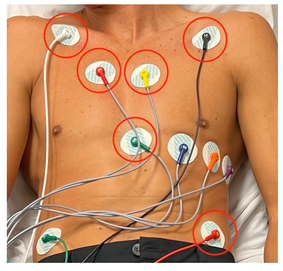
Results: N22 licensed and active EMTs and RNs. There were 60 misplaced electrodes vs 3 misplaced electrodes with the novel system (p<0.001). The participants reported significantly high agreement regarding the novel system (reported in medians and interquartile range): ease of use (7, 7-7), reduced mental effort (7, 7-7), improves patient safety (7, 7-7), improved positioning of electrodes (7, 7-7), made their workday better (7, 7-7) and reported they correctly place traditional electrodes (7, 5-7). The inter-rater agreement between electrode placement between participants versus with the novel device differed significantly with correlation coefficients for accurate placement of all 10 electrodes of kappa (0.82) novel device vs kappa (0.24) traditional electrodes, p<0.001).



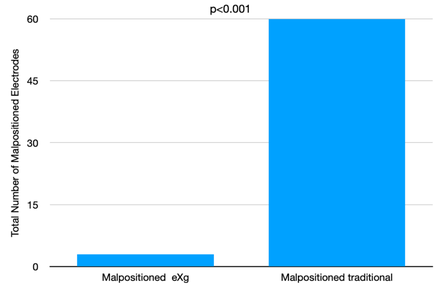


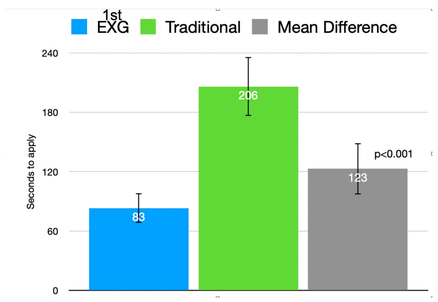


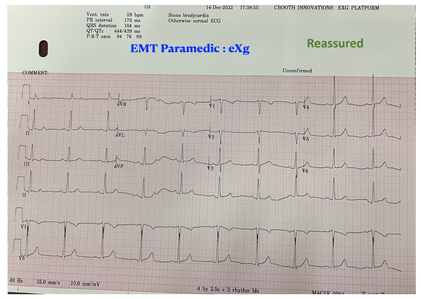


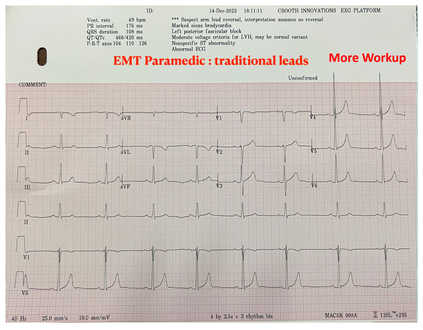


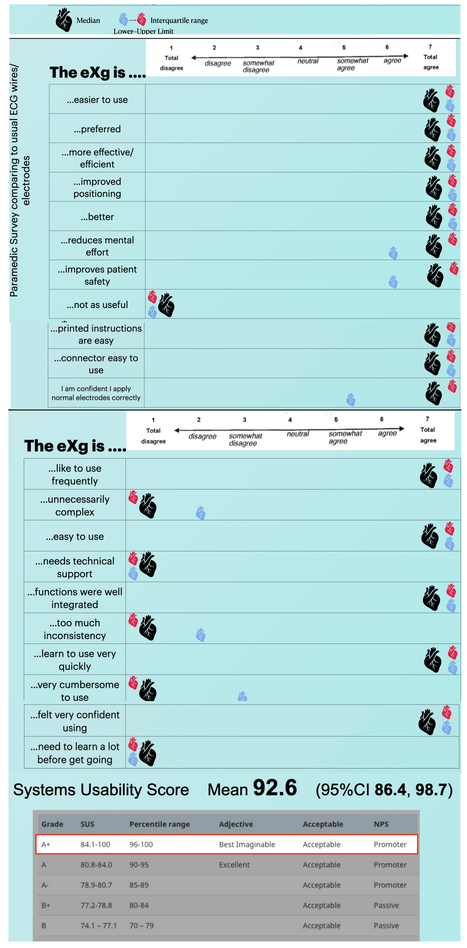
60 misplaced electrodes with traditional vs 3 with eXg











Systems Usability Score Mean **92.6** (95%CI **86.4**, **98.7**)

Grade	SUS	Percentile range	Adjective	Acceptable	NPS
A+	84.1-100	96-100	Best Imaginable	Acceptable	Promoter
A	80.8-84.0	90-95	Excellent	Acceptable	Promoter
A-	78.9-80.7	85-89		Acceptable	Promoter
B+	77.2-78.8	80-84		Acceptable	Passive
B	74.1 – 77.1	70 – 79		Acceptable	Passive

Conclusions: This study demonstrated that the novel device had more reliable placement of electrodes with greater inter-rater agreement in comparison to traditional electrodes and that the providers reported strong agreement that they found it easier to use, improves patient safety and reduces mental effort. Subjects reported a higher level of confidence with placement of traditional electrodes than was observed. Further inquiry into the factors that reflect that misplacement of electrodes may be unappreciated by the user is an important concern.

Authors Disclose Financial Interest in CB Innovations LLC, Carlsbad , California