# Appendix E: Coupled sensitivity and specificity forest plots and sROC curves

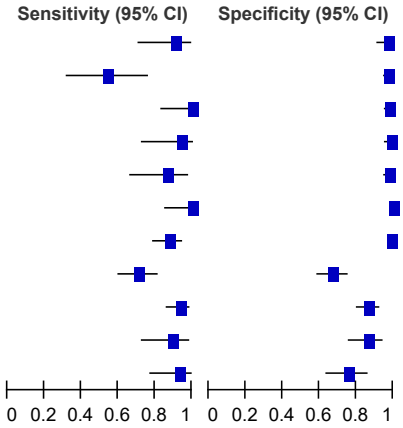
Note that Forest Plots are only available for results where raw data (i.e. TP, FP, FN, TN) were provided. It was not possible to include data in forest plots or pooled analyses where no raw data were available, even if the 95% CIs were provided. Hence some forest plots may not be present, or some forest plots may lack studies that are included in sections 1.5.6 and 1.5.7.

## STRATUM 1: 12 lead ECG as gold standard

Mobile devices

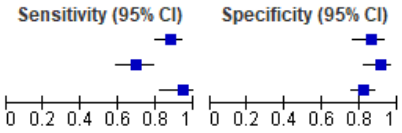
### Figure 2: AliveCor (GS = 12 lead ECG)

| Study | TP | FP | FN | TN | Sensitivity (95% CI) | Specificity (95% CI) |
|---|---|---|---|---|---|---|
| Cunha (auto), 2019 | 20 | 2 | 2 | 76 | 0.91 [0.71, 0.99] | 0.97 [0.91, 1.00] |
| Desteghe (auto), 2017 | 12 | 6 | 10 | 237 | 0.55 [0.32, 0.76] | 0.98 [0.95, 0.99] |
| Desteghe (expert), 2017 | 20 | 5 | 0 | 230 | 1.00 [0.83, 1.00] | 0.98 [0.95, 0.99] |
| Haberman (expert), 2015 | 17 | 1 | 1 | 111 | 0.94 [0.73, 1.00] | 0.99 [0.95, 1.00] |
| Himmelreich (auto), 2019 | 20 | 4 | 3 | 187 | 0.87 [0.66, 0.97] | 0.98 [0.95, 0.99] |
| Himmelreich (expert), 2019 | 23 | 0 | 0 | 191 | 1.00 [0.85, 1.00] | 1.00 [0.98, 1.00] |
| Lown (auto), 2018 | 72 | 4 | 10 | 332 | 0.88 [0.79, 0.94] | 0.99 [0.97, 1.00] |
| William (auto), 2018 | 57 | 47 | 23 | 96 | 0.71 [0.60, 0.81] | 0.67 [0.59, 0.75] |
| William (expert), 2018 | 75 | 19 | 5 | 124 | 0.94 [0.86, 0.98] | 0.87 [0.80, 0.92] |
| Williams (clin), 2015 | 26 | 9 | 3 | 57 | 0.90 [0.73, 0.98] | 0.86 [0.76, 0.94] |
| Williams (expert), 2015 | 27 | 16 | 2 | 50 | 0.93 [0.77, 0.99] | 0.76 [0.64, 0.85] |




### Figure 3: Kardia band (GS = 12 lead ECG)

| Study | TP | FP | FN | TN | Sensitivity (95% CI) | Specificity (95% CI) |
|---|---|---|---|---|---|---|
| Bumgarner (auto), 2018 | 80 | 11 | 11 | 67 | 0.88 [0.79, 0.94] | 0.86 [0.76, 0.93] |
| Bumgarner (expert), 2018 | 63 | 7 | 28 | 71 | 0.69 [0.59, 0.78] | 0.91 [0.82, 0.96] |
| Rajakariar, 2020 | 36 | 29 | 2 | 133 | 0.95 [0.82, 0.99] | 0.82 [0.75, 0.88] |




### Figure 4: Beurer ME90 device – lead I (GS = 12 lead ECG)

| Study | TP | FP | FN | TN | Sensitivity (95% CI) | Specificity (95% CI) |
|---|---|---|---|---|---|---|
| Brito (auto), 2018 | 16 | 40 | 2 | 65 | 0.89 [0.65, 0.99] | 0.62 [0.52, 0.71] |
| Brito (expert), 2018 | 16 | 0 | 3 | 107 | 0.84 [0.60, 0.97] | 1.00 [0.97, 1.00] |

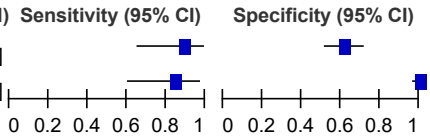


**Figure 5: Beurer ME90 device – lead I and mv4 lead (GS = 12 lead ECG)**

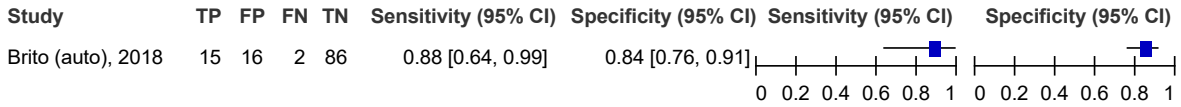



**Figure 6: Beurer ME90 device – mv4 lead (GS = 12 lead ECG)**

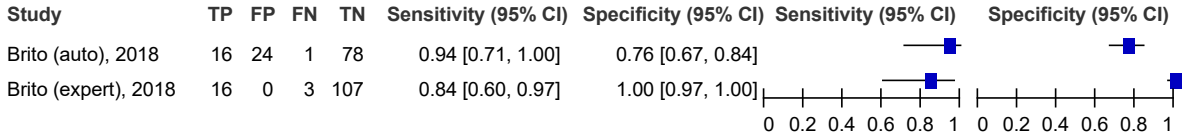



**Figure 7: Beurer ME80 device (GS = 12 lead ECG) (GS = 12 lead ECG)**

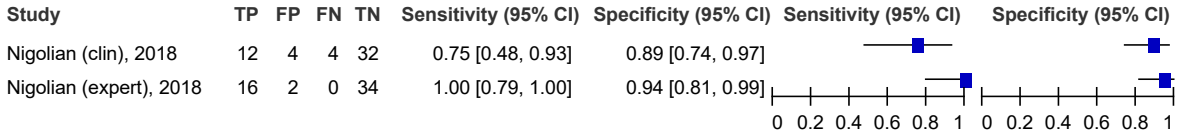



**Figure 8: ECG check (GS = 12 lead ECG)**

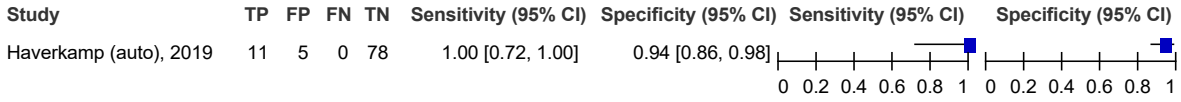



**Figure 9: Merlin (GS = 12 lead ECG)**

*Forest plot not possible to generate as no raw data available*

**Figure 10: MyDiagnostik (1 measure) (GS = 12 lead ECG)**

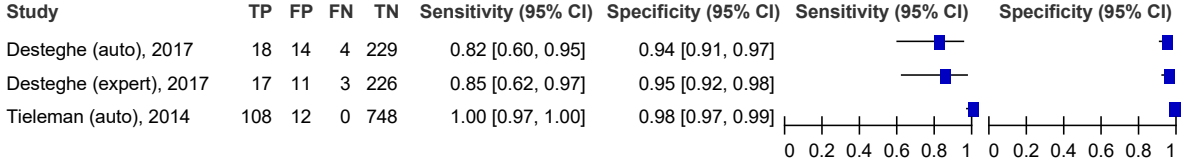


**Figure 11: MyDiagnostik (3 measures, majority rule) (GS = 12 lead ECG)**

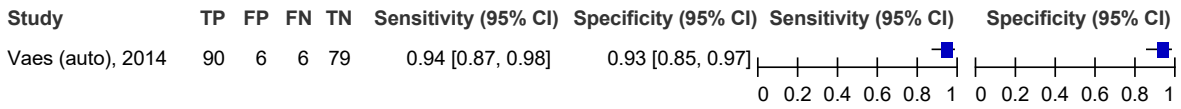



**Figure 12: MyDiagnostik (3 measures, on different occasions) (GS = 12 lead ECG)**

*Forest plot not possible to generate as no raw data available*

**Figure 13: Omron Heartscan (GS = 12 lead ECG)**

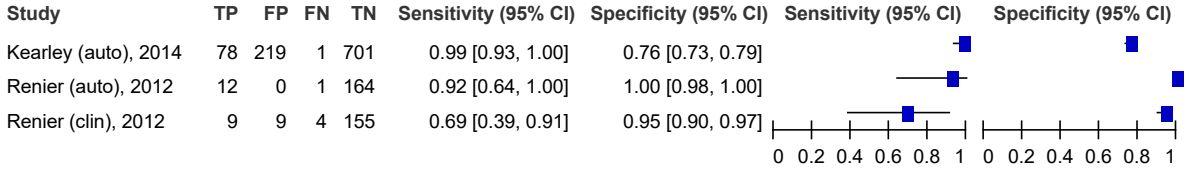



**Figure 14: ECG bone (GS = 12 lead ECG)**

*Forest plot not possible to generate as no raw data available*

**Figure 15: Zenecor ECG thumb (GS = 12 lead ECG)**

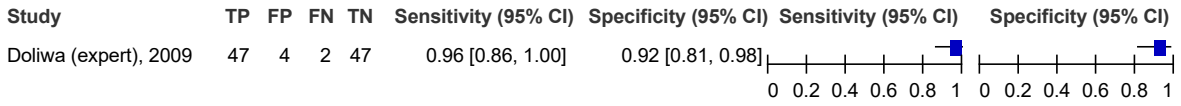



**Figure 16: Polar H7 (GS = 12 lead ECG)**

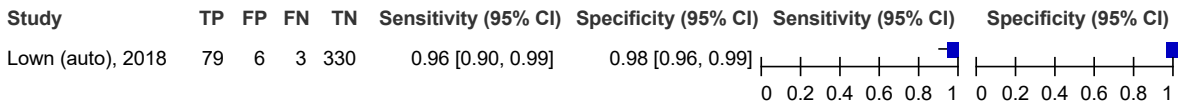


**Figure 17: Firstbeat Bodyguard 2 (GS = 12 lead ECG)**

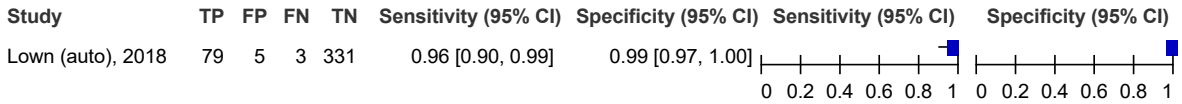



**Figure 18: Cardiobip (GS = 12 lead ECG)**

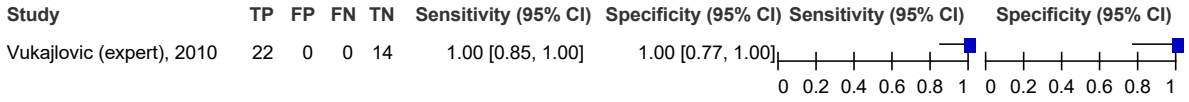



**Figure 16: RITMIA (GS = 12 lead ECG)**

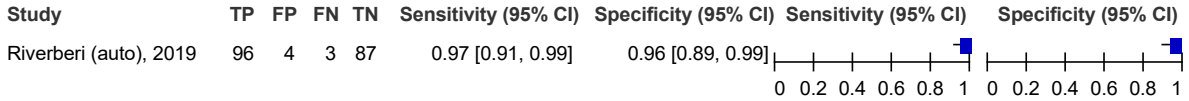



**Figure 19: Mobile ECG device ER-2000s. Mode 1 (GS = 12 lead ECG)**

*Forest plot not possible to generate as no raw data available*

**Figure 20: Mobile ECG device ER-2000s. Mode 2 (GS = 12 lead ECG)**

*Forest plot not possible to generate as no raw data available*

**Figure 21: Huawei band 2 smartband (GS = 12 lead ECG)**

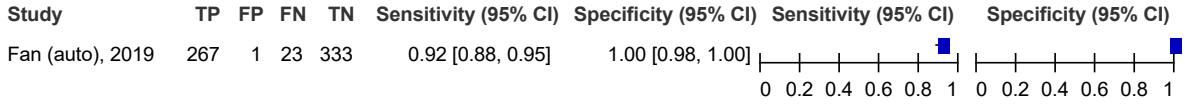



**Figure 22: Amazfit (GS = 12 lead ECG)**

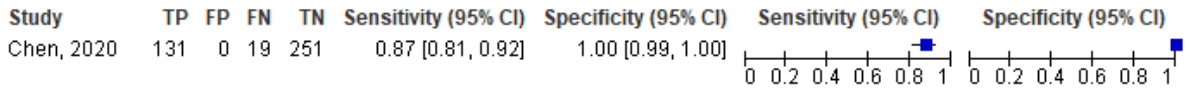



**Figure 23: Atrial Fibrillation Screening Device (GS = 12 lead ECG)**

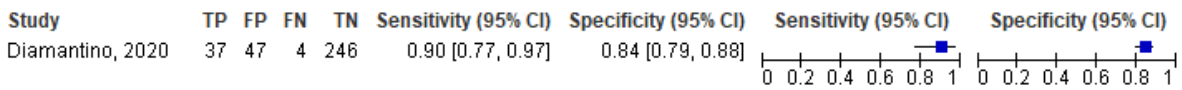



**Figure 24: Snap ECG**

*Forest plot not possible to generate as no raw data available*

**Figure 25: Rithmi heart rhythm wrist monitor - ECG**

*Forest plot not possible to generate as no raw data available*

BP devices

**Figure 26: Microlife BP3MQ1-2D (3 readings, majority rule) (GS = 12 lead ECG)**

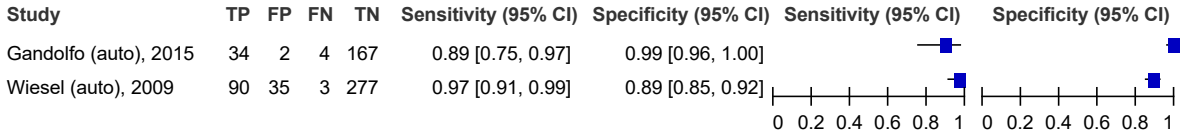



**Figure 27: Microlife BP3MQ1-2D (1 reading) (GS = 12 lead ECG)**

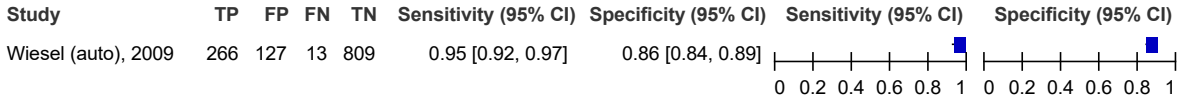



**Figure 28: Microlife BPA 200 (3 readings, majority rule) (GS = 12 lead ECG)**

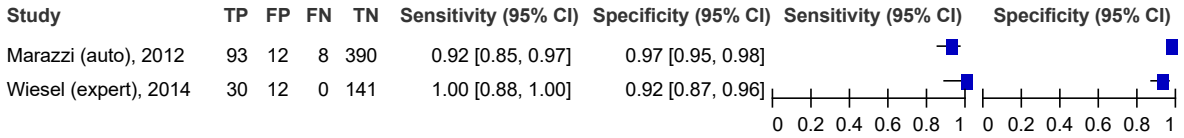



**Figure 29: Microlife BPA 100 Plus (3 readings, majority rule) (GS = 12 lead ECG)**

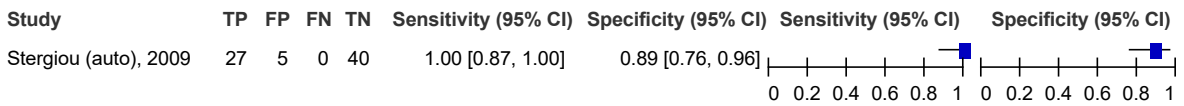


**Figure 30: Microlife BPA 100 Plus (3 readings, majority rule) (GS = 12 lead ECG)**

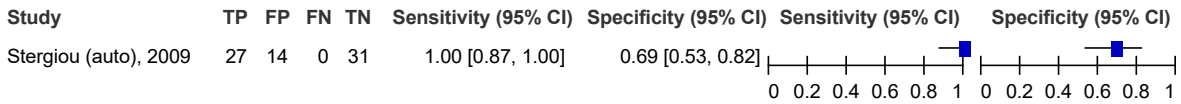



**Figure 31: Microlife BPA 100 Plus (1st reading) (GS = 12 lead ECG)**

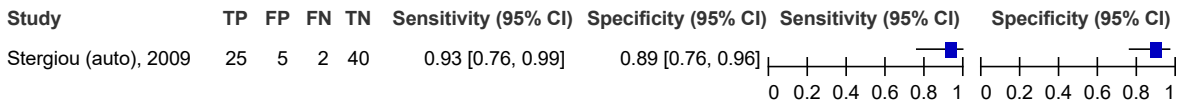



**Figure 32: Microlife BPA 100 Plus (1st 2 readings) (GS = 12 lead ECG)**

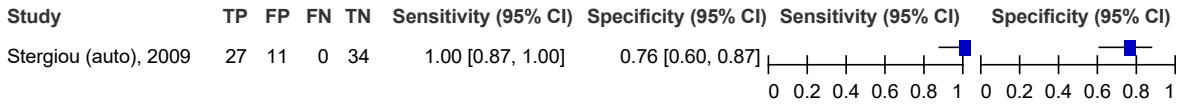



**Figure 33: Microlife Watch BP (GS = 12 lead ECG)**

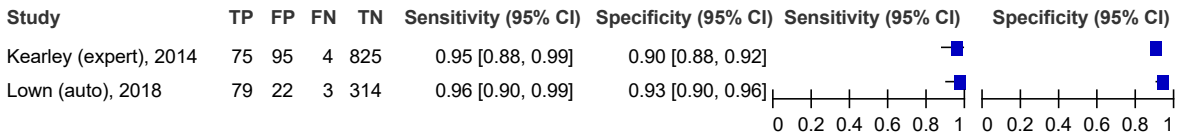



**Figure 34: Heart Spectrum BP monitor algorithm 1 (GS = 12 lead ECG)**

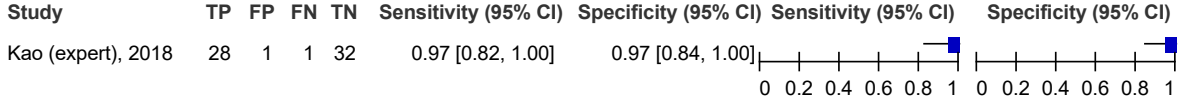


**Figure 35: Heart Spectrum BP monitor algorithm 2 (GS = 12 lead ECG)**

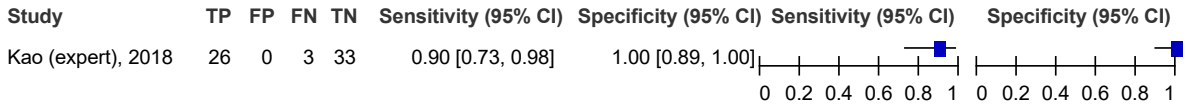



**Figure 36: Heart Spectrum BP monitor algorithm 3 (GS = 12 lead ECG)**

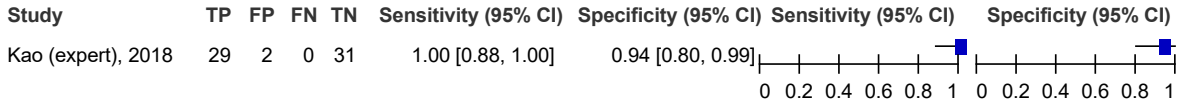



**Figure 37: Omron 712 (2 readings) (GS = 12 lead ECG)**

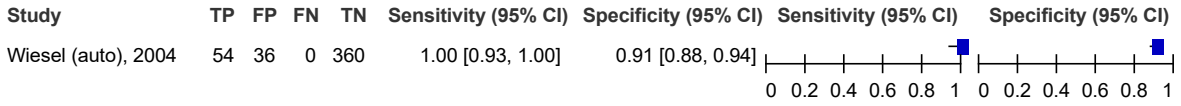
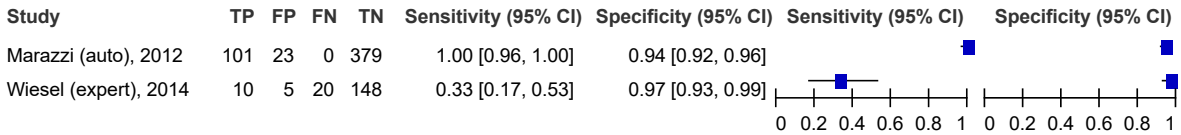
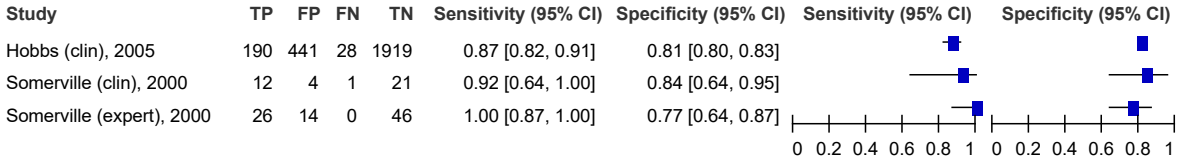



**Figure 38: Omron M6 Comfort (1 reading) (GS = 12 lead ECG)**




## PULSE PALPATION

**Figure 39: Pulse palpation (GS=12 lead ECG)**




## PHOTOPLETHYSMOGRAPHY

**Figure 40: iPhone 4s app - 2 minute pulse waveforms with PULSESMART app (using RMSSD, ShE and Poincare thresholds) from fingertip pulse recordings (1 reading)**

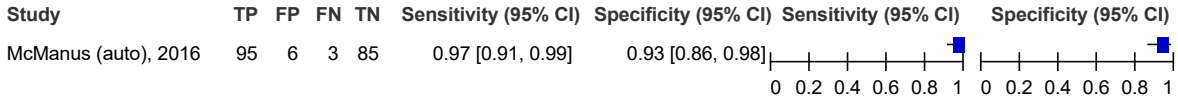



**Figure 41: iPhone 4s app - 2 minute pulse waveforms with PULSESMART app (using RMSSD and ShE thresholds) from fingertip pulse recordings (1 reading) (GS = 12 lead ECG)**

*Forest plot not possible to generate as no raw data available*

**Figure 42: iPhone 4s app - 2 minute pulse waveforms with PULSESMART app (using RMSSD threshold) from fingertip pulse recordings (1 reading) (GS = 12 lead ECG)**

*Forest plot not possible to generate as no raw data available*

**Figure 43: iPhone 4s app - 2 minute pulse waveforms with PULSESMART app (using ShE threshold) from fingertip pulse recordings (1 reading) (GS = 12 lead ECG)**

*Forest plot not possible to generate as no raw data available*

**Figure 44: Fingertip CardioRhythm 3 readings, majority rule**

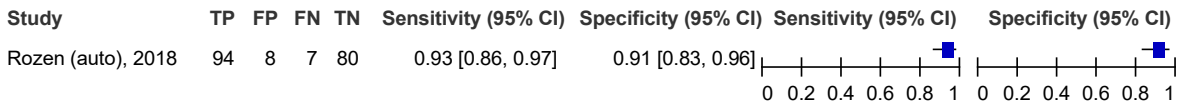



**Figure 45: Fingertip CardioRhythm 3 readings, minority rule**

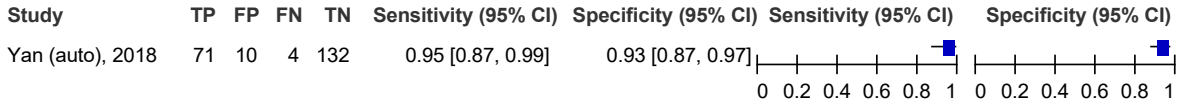



**Figure 46: Facial CardioRhythm 3 readings, minority rule**

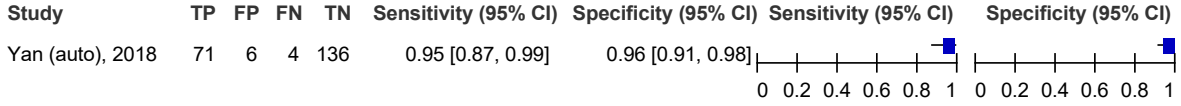


**Figure 47: Fibricheck app 3 readings**

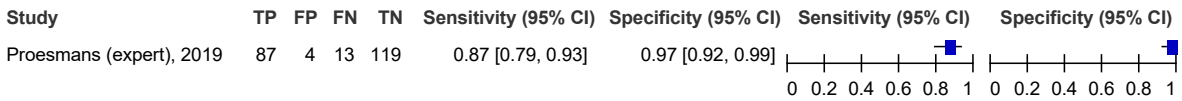



**Figure 48: Huawei Honor 7A fingertip/LED device (GS = 12 lead ECG)**

*Forest plot not possible to generate as no raw data available*

**Figure 49: Huawei Mate 9 fingertip/LED device (GS = 12 lead ECG)**

*Forest plot not possible to generate as no raw data available*

**Figure 50: The screening technique involves a finger-probe instrument (as used in pulse oximetry) that utilises the principle of photoplethysmography. (GS = 12 lead ECG)**

*Forest plot not possible to generate as no raw data available*

**Figure 51: Wrist-type photoplethysmographic (PPG) device. Using inter-beat interval (IBI) features (mean, SD, median, IQR, min, max and RMSSD. (GS = 12 lead ECG)**

*Forest plot not possible to generate as no raw data available*

**Figure 52: Wrist-type photoplethysmographic (PPG) device. Using 'wave' features (Adaptive organisation Index, variance of the slope of the phase difference, permutation entropy, fractional spectral radius and spectral purity index) (GS = 12 lead ECG)**

*Forest plot not possible to generate as no raw data available*

**Figure 53: Wrist-type photoplethysmographic (PPG) device. Using BOTH IBI and wave features (GS = 12 lead ECG)**

*Forest plot not possible to generate as no raw data available*

**Figure 54: Amazfit (PPG) device. (GS = 12 lead ECG)**

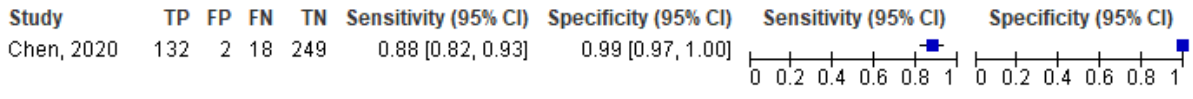


**Figure 55: Rithmi heart rhythm wrist monitor - PPG**

*Forest plot not possible to generate as no raw data available*

3 LEAD TELE ECG

**Figure 56: CG 7100 3 lead Tele-ECG**

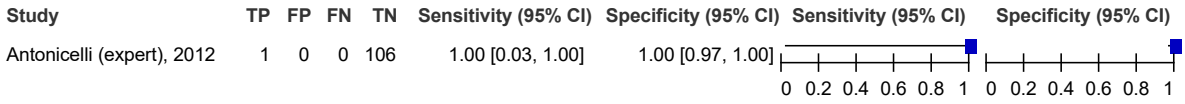



**Figure 57: Handheld tele ECG device with dry electrodes that records 3 lead ECG. (GS = 12 lead ECG)**

*Forest plot not possible to generate as no raw data available*

**Figure 58: Portable ECG monitor (PEM) – 3 lead ECG, 1 reading**

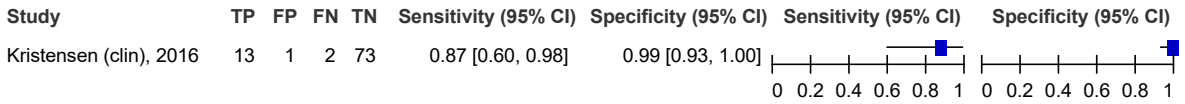



**Figure 59: Medi-Trace 3 lead ECG algorithm 1, 1 reading**

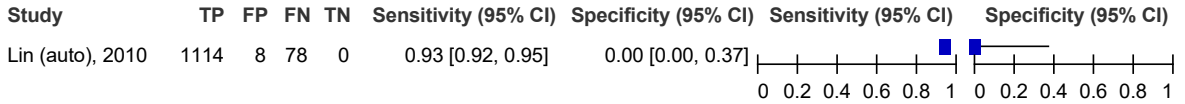



**Figure 60: Medi-Trace 3 lead ECG algorithm 2, 1 reading**

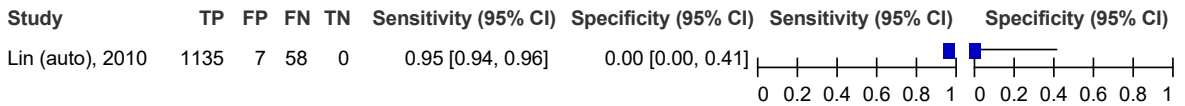


**Figure 61: 6 lead ECG with prototype recorder placed on thorax/abdomen in sitting, 1 measure**

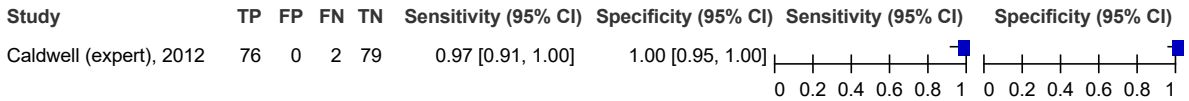



**Figure 62: 6 lead ECG with prototype recorder placed on thorax/abdomen in supine, 1 measure**

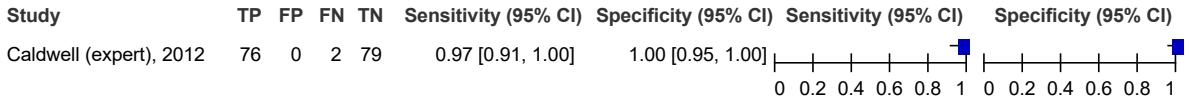



**Figure 63: 6 lead ECG with prototype recorder placed on standard positions, 1 measure**

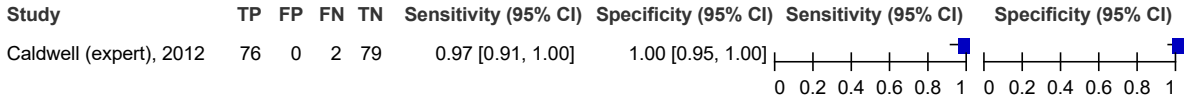
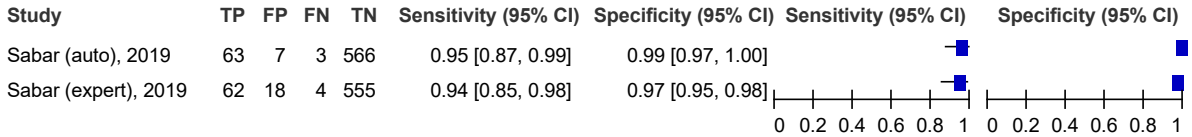
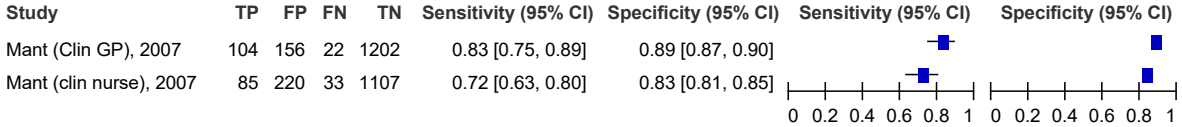



**Figure 64: 6 lead ECG Rhythm pad**

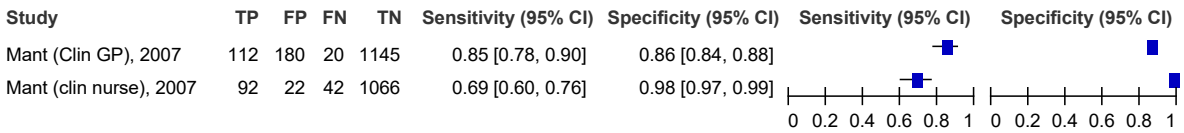



OTHER non- 12 LEAD ECG

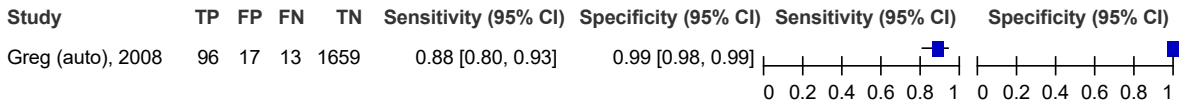
**Figure 65: Limb lead ECG, 1 measure**



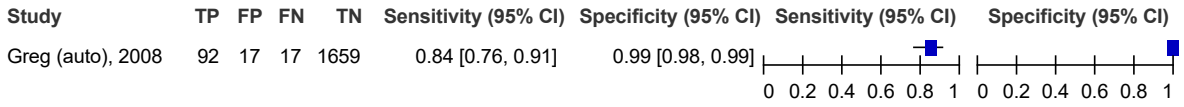
### Figure 66: Chest lead ECG, 1 measure



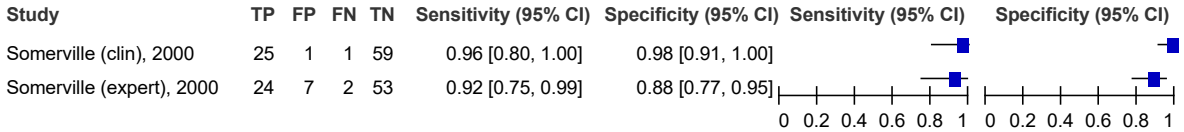

### Figure 67: V1, V4 leads, 1 measure




### Figure 68: V2, V5 leads, 1 measure




### Figure 69: Bipolar lead ECG, 1 measure




## 12 LEAD ECG (non expert)

### Figure 70: 12 lead ECG interpreted by non-expert interpreter, 1 measure

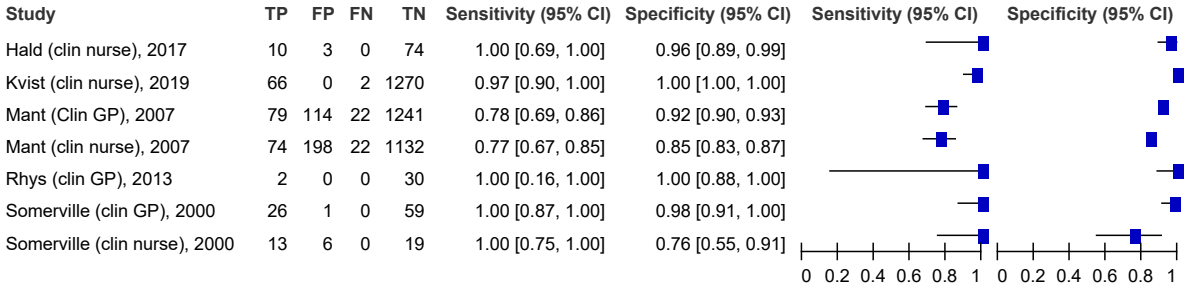


**Figure 71: 12 lead ECG interpreted by non-expert interpreter combined with algorithm interpretation, 1 measure**

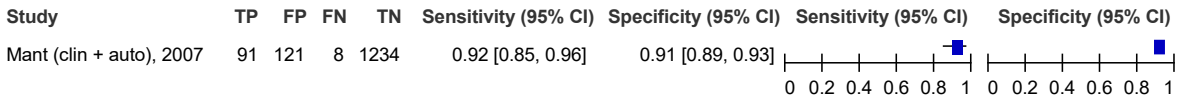



**Figure 72: 12 lead ECG detection algorithm based on a co-efficient of variation of the beat intervals (CV). Threshold set at 0.12 (GS = 12 lead ECG)**

*Forest plot not possible to generate as no raw data available*

**Figure 73: 12 lead ECG detection algorithm based on the co-efficient of sample entropy (COSEn). Threshold set at -1.19 (GS = 12 lead ECG)**

*Forest plot not possible to generate as no raw data available*

**Figure 74: 12 lead ECG detection algorithm based on the mean successive beat interval difference (defined as the mean absolute successive beat interval difference divided by the mean beat interval (Delta). Threshold set at 0.11 (GS = 12 lead ECG)**

*Forest plot not possible to generate as no raw data available*

**Figure 75: 12 lead ECG algorithm interpreted by Cardioview, 1 measure**

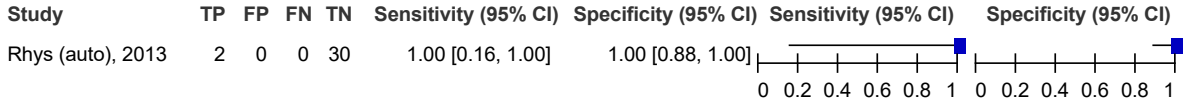



**Figure 76: 12 lead ECG algorithm interpreted by MUSE software, 1 measure**

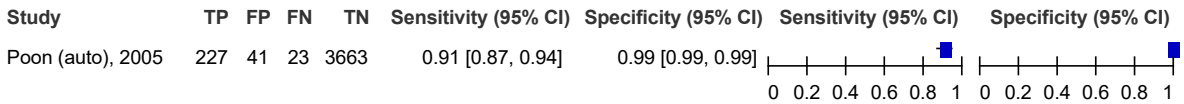


**Figure 77: 12 lead ECG algorithm interpreted by Mant algorithm, 1 measure**

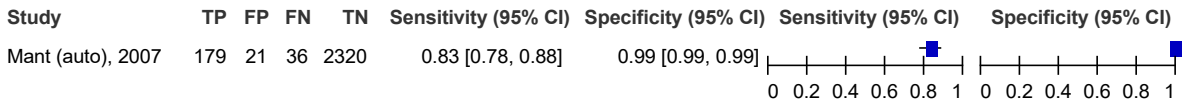



**Figure 78: 12 lead ECG algorithm interpreted by Slocum algorithm, 1 measure**

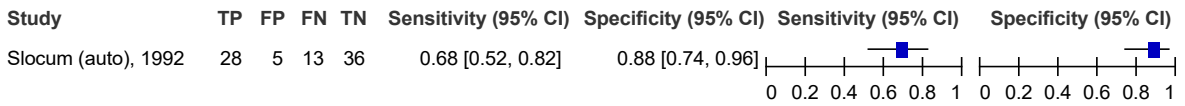
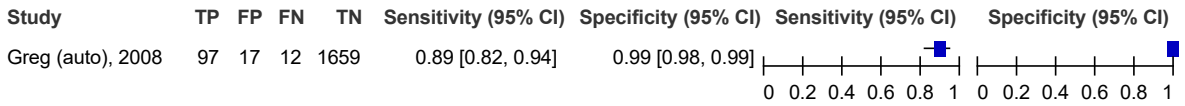



**Figure 79: Computer interpretation of full 12 lead ECG V1-V6**




## STRATUM 2: >24 hour ambulatory monitoring [such as Holter] as gold standard

### BP MONITORS

**Figure 80: 24 hour ambulatory Microlife Afib Watch BP**

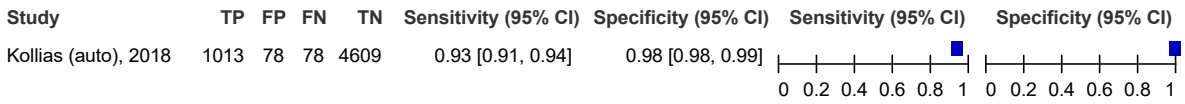
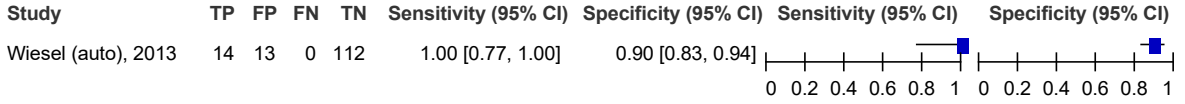
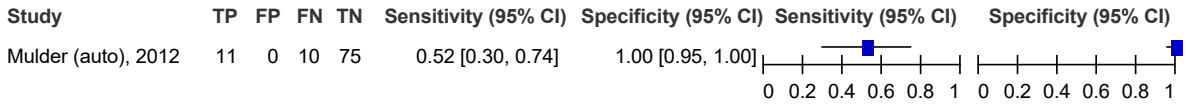



**Figure 81: AF-BP monitor device (daily use for 30 days)**

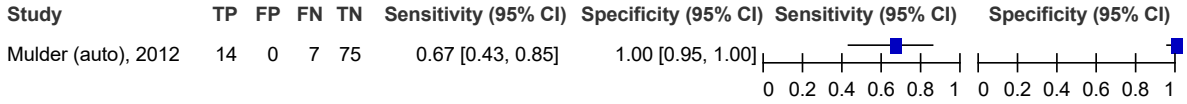



### HOLTER <7 DAYS

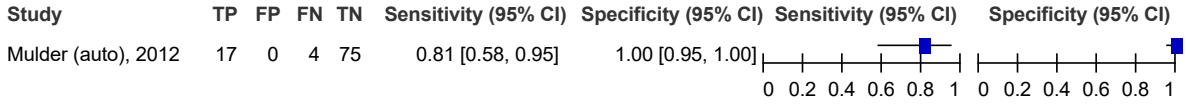
## Figure 82: Holter 1 day



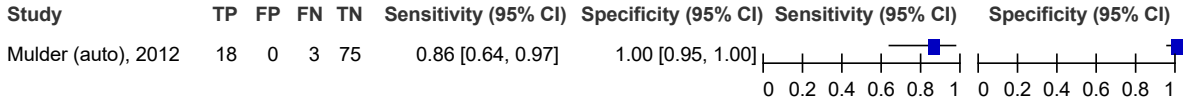

## Figure 83: Holter 2 day



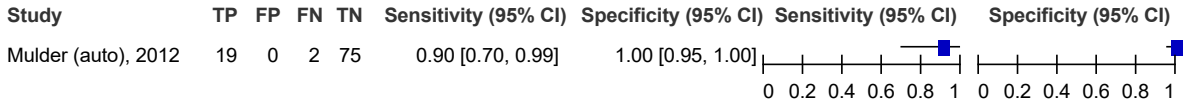

## Figure 84: Holter 3 day



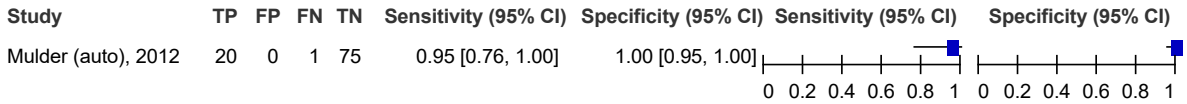

## Figure 85: Holter 4 day




## Figure 86: Holter 5 day




## Figure 87: Holter 6 day



OTHER LONGER TERM DEVICES

**Figure 88: R test evolution 3 triggered ECG (48 hrs)**

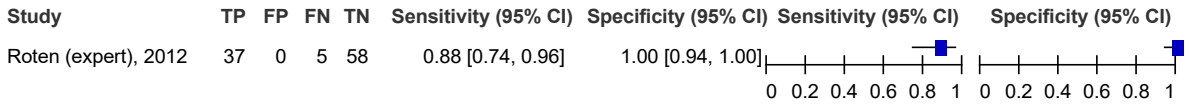



**Figure 89: R test evolution 3 triggered ECG (24 hrs)**

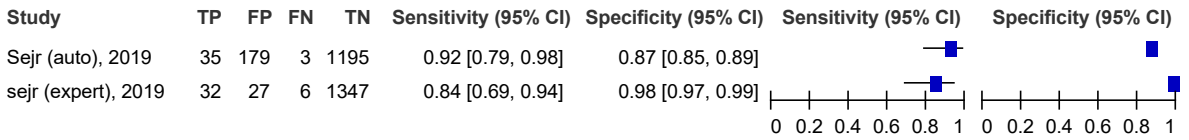



**Figure 90: Vitaphone 3100 BT external loop recorder (24 hrs)**

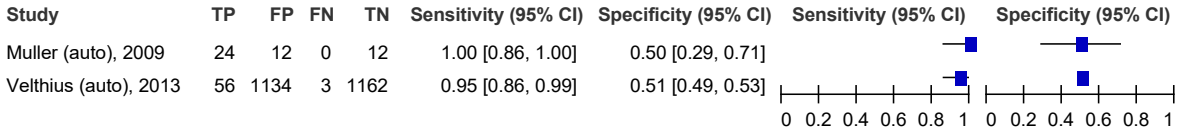


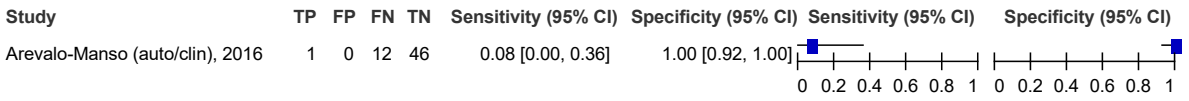

**Figure 91: SRAclinic, Apoplex Medical Technologies. Stroke Risk Analysis (SRA) – software analysis of every hourly ECG snippet of continuous (non 12 lead) ECG monitoring, and report sent daily to stroke unit.(automated) threshold of 0-1=SR and 2 or more =AF**

*Forest plot not possible to generate as no raw data available*

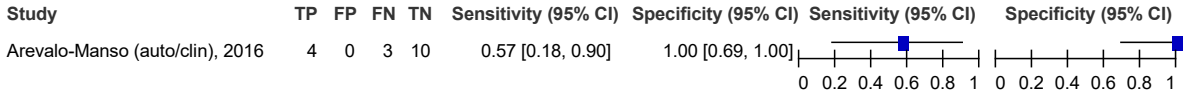
**Figure 92: SRAclinic, Apoplex medical Technologies. Stroke Risk Analysis (SRA) – software analysis of every hourly ECG snippet of continuous (non 12 lead) ECG monitoring, and report sent daily to stroke unit.(automated) threshold of 0-2=SR and 3 or more =AF**

*Forest plot not possible to generate as no raw data available*

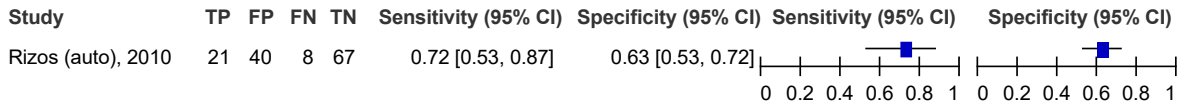
**Figure 93: 48 hr ECG without AFRS**



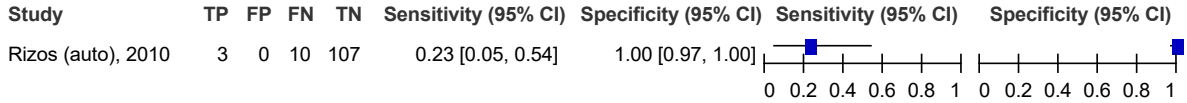
## Figure 94: 48 hrs AGC with AFRS



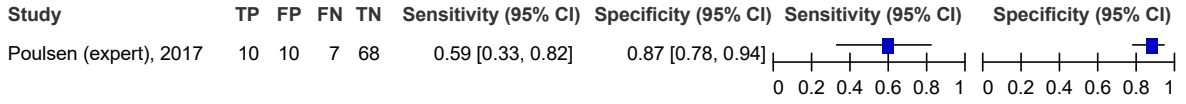

## Figure 95: 12 bit resolution ECG 1-2 hrs




## Figure 96: 6 Channel Holter




## Figure 97: Zenecor thumb ECG twice daily for 30days




## Figure 98: Kardia-Band

*Forest plot not possible to generate as no raw data available*

## Figure 99: Cardiomatrix with telemetry for median 46 hours

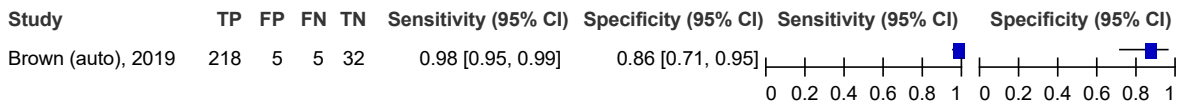


**Figure 100: WiPatch for 24 hours**

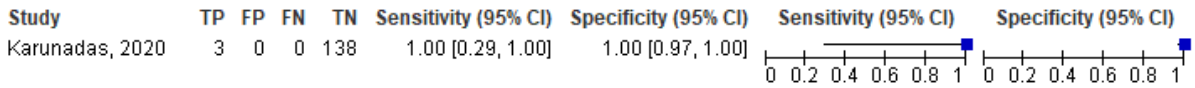



**Figure 101: One-off 12 lead ECG**

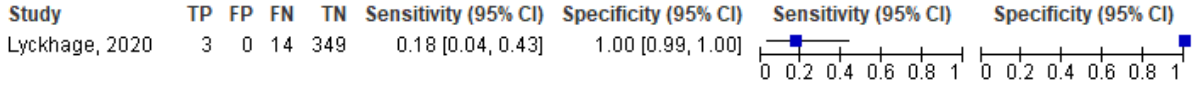



**Figure 102: One-off pulse palpation**

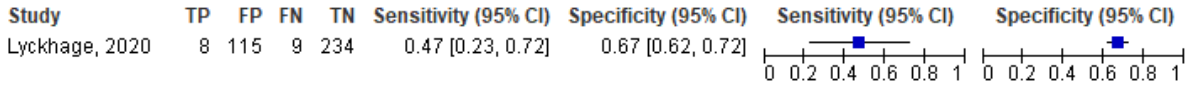



**Figure 103: Single lead (MP1*) patch-based ambulatory ECG monitor**

*Forest plot not possible to generate as no raw data available*