High accuracy of automated respiratory rate readings in a novel, non-contact home monitor

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Introduction

- **Albus Home RD** (Research Device) is a CE-marked **contactless** bedside device that captures nocturnal respiratory and environmental information (including respiratory rate, coughing, temperature and humidity amongst others).
- Existing tools for collecting nocturnal data are not suitable for long-term monitoring. Symptom diaries are limited by subjectivity and bias, whereas wearables are poorly tolerated beyond a short period.
- Albus Home RD works **passively** using wireless sensors, and is suitable for use by **all age-groups** and demographics **in real-world settings**, without requiring patients to do or wear anything.
- This work focuses on validation of continuous nocturnal respiratory rate ("RR") monitoring using the Albus Home system compared to manual clinician counts of polysomnography data.

Methods

Fig. 1: Monitoring setup comparing contactless Albus Home RD device against polysomnography.

- Participants were simultaneously monitored overnight in usual bedroom environments using two devices: **Albus Home RD** and a **polysomnography** device with thoraco-abdominal respiratory effort belts (Somnotouch Respiratory by Somnomedics).
- RR readings from the Albus Home system were automatically reported using proprietary algorithms; polysomnography required manual counts by a clinician to derive RR.
- RR readings were reported every 30 seconds in breaths per minute.
- Albus Home RD reported RR for the entire night. For polysomnography, the lengthy time needed to report manual RR counts limited the amount of data that could be compared.
- Thus, for each participant, the first 120 minutes of reported RR from Albus Home RD were compared to polysomnography. Accuracy was defined as the percentage (%) of RR readings within ±2 breaths/minute of polysomnography (Ben-Ari et al, 2010).

Results

- In total, **2545 RR readings were compared** for 11 participants (7 adults, 4 children; ages 6-59; BMI 13-25) during continuous home RR monitoring.
- Of these, **95.6% were within ±2 breaths/min** of clinician-counted polysomnography output.
- Bland-Altman analysis demonstrated strong agreement in RR readings between Albus Home RD and polysomnography (Figs. 2-3)
- The Albus Home system took **less than 1 minute to output RR data** compared to **880 minutes for polysomnography** manual counts.

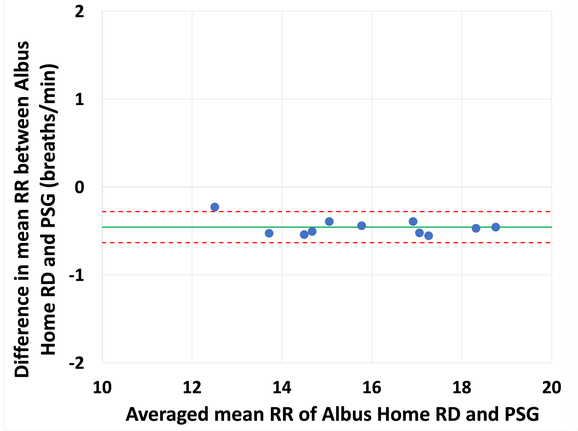

Fig. 2. Bland-Altman plot showing agreement in mean RR results for 11 participants between Albus Home RD and polysomnography. Red lines show 95% limits of agreement (1.96x inter-subject SD). The mean RR for each participant ranged from 12.4 to 18.5 breaths/min.

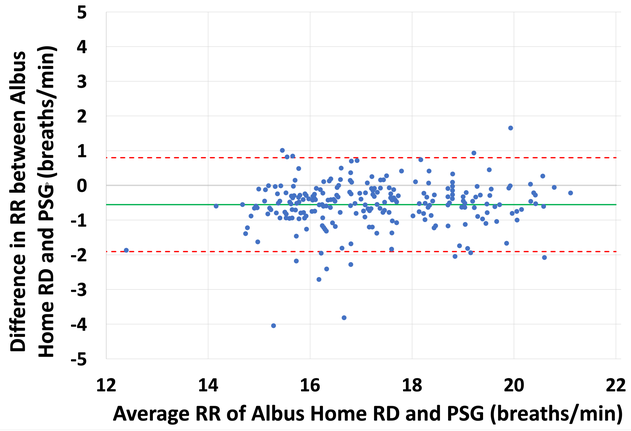

Fig. 3a. Bland-Altman plot showing agreement between Albus Home RD and polysomnography for 238 individual RR comparisons in representative participant (with **median accuracy of 96.7%).** Red lines show 95% limits of agreement (1.96x intra-subject SD).

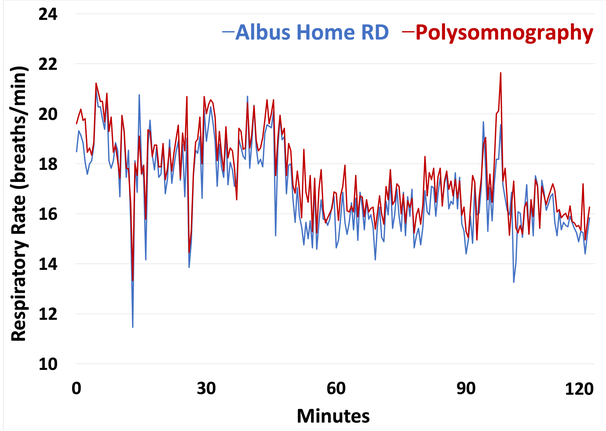

Fig. 3b. Chart plotting RR readings from Albus Home RD and polysomnography for representative participant (with median accuracy of 96.7%).

Conclusions

- We have validated the RR monitoring performance of **Albus Home RD**, a CE-marked contactless and automated bedside monitor.
- RR readings had high agreement with polysomnography and clinician counting, and were obtained about 1000 times faster.
- This presents a reliable method of collecting continuous, long-term and objective evidence in clinical research, with assurance of high adherence.
- High-quality granular data enables novel insights, predictive analytics and identification of clinical events at night which could otherwise be missed.
- Albus Home RD has utility as a remote monitoring tool for collecting real world evidence from participants without any disruption to their daily life.

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