Fully Automated Central Apnea Scoring in Home Sleep Apnea Testing using Dual Volumetric RIP and AI Analysis

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Introduction

Home Sleep Apnea Testing (HSAT) is recommended for adults with suspected obstructive sleep apnea (OSA). The American Academy of Sleep Medicine (AASM) HSAT rules recommend classifying apneas as obstructive or central when respiratory effort signals are available, although reporting the central apnea-hypopnea index (CAHI) is optional. Central scoring is challenging because necessary signals are often degraded and many automated HSAT systems require manual review and rescoring of central events, resulting in increased time and resource need. In this retrospective validation study, we **evaluated the performance of DeepRESP v2.0 (K252330), an FDA-cleared AI software-as-a-medical-device (SaMD) that provides automated central apnea scoring from HSAT data without a central-event–specific rescoring requirement beyond standard clinical review.**

Methods

We retrospectively evaluated the performance of DeepRESP v2.0 in adults using multi-center PSG studies reformatted to **include only HSAT channels**: nasal pressure airflow, dual thoracoabdominal volumetric RIP, SpO_2, and body position. Manually scored respiratory events, including central apneas, scored as per AASM rules by technologists and physicians provided a gold standard reference. The study device automatically detects and scores apneas from nasal cannula or RIP signals, classifies them as obstructive or central from thoracic and abdominal effort, and computes relevant HSAT indices. The dual-belt volumetric RIP system is designed for robust attachment and an approximately linear relation to flow, improving reliability and sensitivity versus single-belt or non-calibrated RIP. **The performance was summarized using positive, negative, and overall percent agreement (PPA, NPA, OPA) for CAHI ≥5 events/h versus the reference.**

Results

5771 sleep recordings were included in the evaluation. The **CAHI ≥5** classification showed PPA 80.7%, NPA 98.0%, and OPA 97.2% relative to the manually scored reference standard. **Overall apnea metrics** remained robust, with OPA for all apneas (obstructive and central) ≥97% and high specificity for central events, indicating that **automated scoring did not inflate central counts**. Central classification remained reliable when airflow degraded or cannula failed, relying on dual-belt RIP.

Table 1: Positive, negative and overall percentage agreement of DeepRESP HSAT configuration scoring, compared to the gold standard manual scoring, with regards to classifying CAHI ≥ 5

	PPA % [95%CI]	NPA % [95%CI]	OPA % [95%CI]
	CAHI ≥ 5		
DeepRESP nasal cannula	80.7 [75.7, 85.6]	98.0 [97.5, 98.3]	97.2 [96.8, 97.7]
DeepRESP RIP	79.5 [74.4, 84.6]	97.6 [97.2, 98.0]	96.9 [9.4, 97.3]

Table 2: Epoch level positive, negative and overall percentage agreement during sleep of overall apnea and central apnea event scoring by two different configuration of DeepRESP, compared to the gold standard manual scoring. The DeepRESP-RIP configuration only relied on RIP and oximeter signals to score events, whilst DeepRESP-Cannula used the nasal cannula signal.

	PPA % [95%CI]	NPA % [95%CI]	OPA % [95%CI]
	DeepRESP-Cannula		
All Apnea	84.5 [83.7, 85.2]	98.2 [98.1, 98.3]	97.0 [96.9, 97.2]
Central Apnea	77.5 [75.1, 79.4]	99.2 [99.2, 99.3]	99.0 [99.0, 99.1]
	DeepRESP-RIP		
All APnea	81.1 [80.1, 82.0]	95.7 [95.5, 95.9]	94.5 [94.3, 94.7]
Central Apnea	78.8 [76.5, 80.7]	99.2 [99.1, 99.2]	99.0 [98.9, 99.0]

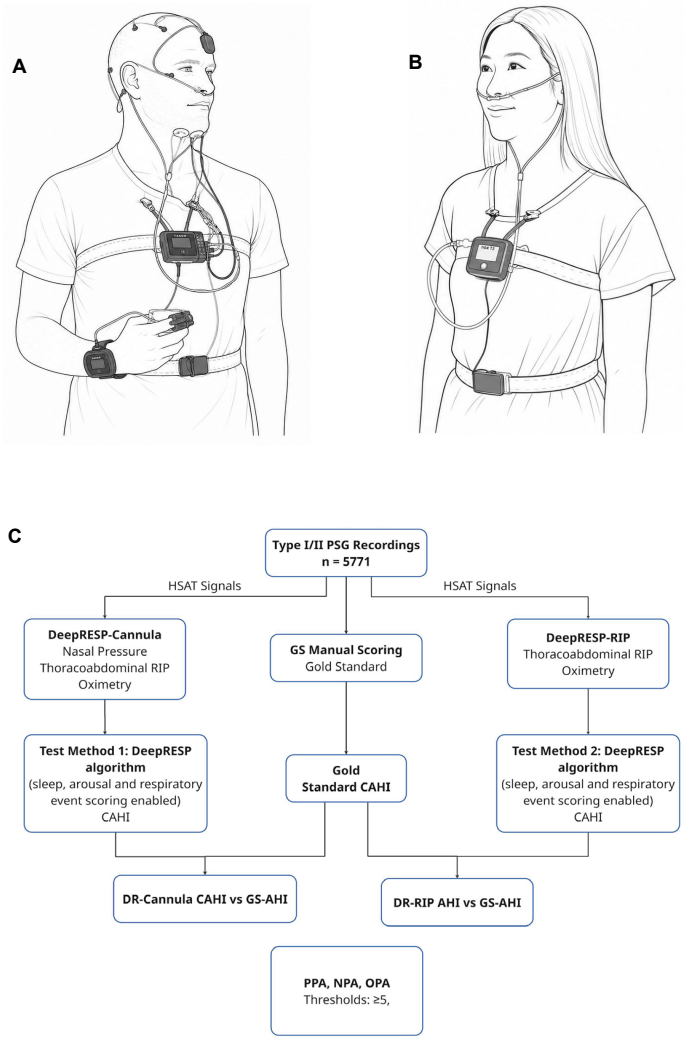

Figure 2: A flow diagram (Figure 2 C) illustrating how a reduced channel version of the original gold standard PSG set up (Figure 2 A) was used to achieve HSAT configuration (see Figure 2 B). The recordings were then utilised to achieve comparable performance results between test method 1 (standard HSAT setup using nasal cannula) and test method 2 (using RIP belts) compared to the gold standard manually scored PSG recordings to evaluate the performance of DeepRESP v2.0 with regards to scoring central apneas and estimating classification of sleep recordings based on CAHI ≥ 5.
GS: Gold Standard

Conclusions

An FDA-cleared AI SaMD delivered fully automated central apnea scoring from HSAT signals with high agreement to expert scoring, without any central-apnea–specific rescoring beyond standard clinical review. Dual thoracic and abdominal volumetric RIP supports AASM rules for distinguishing central from obstructive events and provides reliable quantification of incidental central events on HSAT to guide evaluation and treatment.