

## Investigation of EEG Markers of Disturbed Sleep in World Trade Center (WTC) Rescue and Recovery Workers and Volunteers

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**Rationale:** Sleep disturbance symptoms are very prevalent amongst World Trade Center rescue and recovery workers and volunteers (WTCRRWV). Previous work indicates that chronic rhinosinusitis (CRS), unlike obstructive sleep apnea (OSA), is a significant risk factor for poor sleep-related Quality of Life (QOL), sleepiness, sleep quality and insomnia symptoms<sup>1</sup>. Here we investigate this further and test whether the Odds Ratio Product (ORP), an EEG measure of wakefulness propensity from polysomnography (PSG)<sup>2</sup>, is associated with insomnia symptoms.  
**Methods:** We used the Michele Sleep Scoring (MSS) system (Cerebra Health, Winnipeg, Canada) to digitally analyze in-laboratory PSG data from 83 WTC first responders with available CRS and Insomnia Severity Index (ISI) scores. C3-M2 and C4-M1 EEG derivations were used to generate NREM ORP-9 and Wake ORP (average values). The relationship between insomnia scores and CRS was investigated using Spearman's rho. Kruskal-Willis tests were used to compare ORP values by levels of insomnia based on Insomnia Severity Index (ISI) scores.  
**Results:** Ages ranged 42-70 years, 72(86.7%) were male and median (interquartile range (IQR)) body mass index (BMI) was 30.5(5.6). 49(59%) of participants were CRS positive and 48(58%) had OSA by AHI4%>5. Median (IQR) AHI for the group was 6.6(0.9)/hr and total sleep time was 5.8(1.9) hours. ISI scores revealed clinical and subclinical insomnia in 25(30.1%), 36 (43.4%), and no significant insomnia in 22 (26.5%) WTCRRWV respectively. CRS and ISI scores were weakly correlated (rho=0.25, p=0.02) but not significantly after controlling for age. There were no significant differences in EEG-ORP measures, OSA severity, period limb movements or sleep architecture among insomnia severity groups.  
**Conclusion:** Symptoms of chronic rhinosinusitis and insomnia are highly prevalent and co-existent amongst WTCRRWV. Novel EEG measures of wakefulness propensity such as the ORP do not differ according to insomnia symptom severity. These findings suggest that insomnia as defined by ISI may be more reflective of sleep related quality of life rather than EEG measures of wakefulness propensity. Future work investigating insomnia in this cohort will include a non-WTC comparison group plus consideration of psychiatric co-morbidities and medication use. <sup>1</sup>Ayappa et al. (2019) International Journal of Environmental Research and Public Health, 16: 1229 <sup>2</sup>Younes et al. (2015) Sleep, 38: 641-54.

	No Insomnia (ISI≤8) N=22	Sub Clinical (ISI 8>15) N=36	Insomnia (ISI≥15) N=25	p-value
Age	59.0(7.3)	54.5(8.3)	53.0(12.0)	0.038
Chronic Rhinosinusitis Score (CRS)	1.5(3)	3(2.3)	4(3)	0.048
NREM ORP-9	1.0(0.4)	1.0(0.4)	1.0(0.3)	ns
Wake ORP	2.0(0.2)	2.0(0.2)	2.0(0.2)	ns
AHI4%	6.2 (9.0)	6.6(8.3)	6.1(12.6)	ns
Sleep Latency (minutes)	20.1(20.1)	10.1(17.8)	16.0(32.3)	ns
Sleep Efficiency (%)	82.3(13.1)	82.1(17.0)	78.8(19.2)	ns

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