Sleep Profiler Study Report Summary

Patient Name	[redacted]	**Study Ordered by**	[redacted]
Date of Night 1	28 May 2014	**Date of Birth**	27 Aug 1956
Date of Night 2	29 May 2014	**Study Type**	Diagnostic

CLINICAL HISTORY: 60 year old female with questionnaire responses that suggest moderate insomnia (Insomnia Severity Index = 17), no clinically significant daytime sleepiness (Epworth Sleepiness Score = 4), mild depression (PHQ-9 score = 6), and moderate anxiety (GAD-7 score = 12). The patient has a history of insomnia and anxiety/PTSD. She also reported having symptoms of night sweats. The patient reported that she sometimes takes the prescription sleeping aid Lunesta (Eszopiclone). The patient reported that she takes a prescription anti-anxiety/tranquilizer medication. The patient has a BMI of 25 and a 15-inch neck; and reported that she rarely wakes up choking. She has low predicted risk of having OSA.

STUDY FINDINGS: The patient underwent a two-night overnight EEG study.

NIGHT ONE - Sleep Architecture: The recording time of 7.5 hours and total sleep time of 6.0 hours resulted in a sleep efficiency of 79.7%. The patient fell asleep 31 minutes after the lights were turned off, started stage N3 42 minutes later, and entered her first REM cycle 59 minutes later. She slept 10.6% of the night in stage N1, 10.8% in light N2, 56.9% in total N2, 16.1% in slow-wave sleep (stage N3), and 16.4% in REM.

Awakenings and Arousals: The patient was awake for a total 61 minutes after initially falling asleep. She experienced an average of 4.9 awakenings ≥ 30 sec and 1.7 awakenings ≥ 90 sec per hour of sleep. She experienced an average of 26.2 cortical arousals, 31.5 autonomic activations, and 1.7 movement arousals per hour of sleep.

Sleep Diary vs. Sleep Profiler Comparisons: The patient fell asleep 89 minutes earlier than what she perceived (120 min vs. 31 min). Subsequent to sleep onset, she was awake 31 minutes more than what she perceived (30 min vs. 61 min). Once asleep, the patient recalled being awakened a total of 3 times, 9 less than the 12 detected awakenings (> 90-sec awake).

Other: She slept 51.1% of the night supine, while snoring 29.8% of the night above 40 dB and 18.3% above 50 dB.

Abnormal Sleep Patterns: The patient's percentage of time in stage N1, arousal index, and awakening index were outside age/gender-matched normative ranges.

NIGHT TWO - Sleep Architecture: The recording time of 7.2 hours and total sleep time of 6.4 hours resulted in a sleep efficiency of 89.1%. The patient fell asleep 12 minutes after the lights were turned off, started stage N3 29 minutes later, and entered her first REM cycle 59 minutes later. She slept 7.2% of the night in stage N1, 8.5% in light N2, 50.7% in total N2, 14.7% in slow-wave sleep (stage N3), and 27.4% in REM.

Awakenings and Arousals: The patient was awake for a total 35 minutes after initially falling asleep. She experienced an average of 3.9 awakenings ≥ 30 sec and 1.0 awakenings ≥ 90 sec per hour of sleep. She experienced an average of 20.1 cortical arousals, 18.3 autonomic activations, and 1.6 movement arousals per hour of sleep.

Sleep Diary vs. Sleep Profiler Comparisons: The patient reported a sleep efficiency of 69%, which was 20.1 less than the 89.1 determined by EEG. The patient fell asleep 63 minutes earlier than what she perceived (75 min vs. 12 min). Subsequent to sleep onset, she was awake 10 minutes less than what she perceived (45 min vs. 35 min). Once asleep, the patient recalled being awakened a total of 3 times, 4 less than the 7 detected awakenings (> 90-sec awake).

Other: She slept 83.9% of the night supine, while snoring 9.3% of the night above 40 dB and 1.1% above 50 dB.

Abnormal Sleep Patterns: The patient's percentage of time in stage REM and N1 were outside age/gender-matched normative ranges.

CLINICIAN COMMENTS:
Diagnosis: There was a first night effect suggesting that the patient is a light sleeper. However, the overnight EEG findings are inconsistent with the patient's complaint, suggesting sleep state misperception.

Therapy: Relaxation techniques, general sleep hygiene and/or CBT-I treatment with sleep restriction can help for patients with sleep difficulties.

Other recommendations: Follow-up with the referring physician recommended to discuss the results and the next steps in the treatment plan.

Signature: [redacted] Date: 15 Feb 2017

Study Review: The overnight EEG and other signals have been reviewed by [redacted]

Normative comparison data obtained from:
Sleep and Reported Daytime Sleepiness in Normal Subjects: the Sleep Heart Health Study, Walsleben JA, Kapur VK, Newman AB et al. Sleep 2004; 27(2):293-8
A WASO Sub-Group Analysis of a 6-month Study of Eszopiclone 3mg, Krystal et al. Sleep Medicine 2012; 13:691-696.

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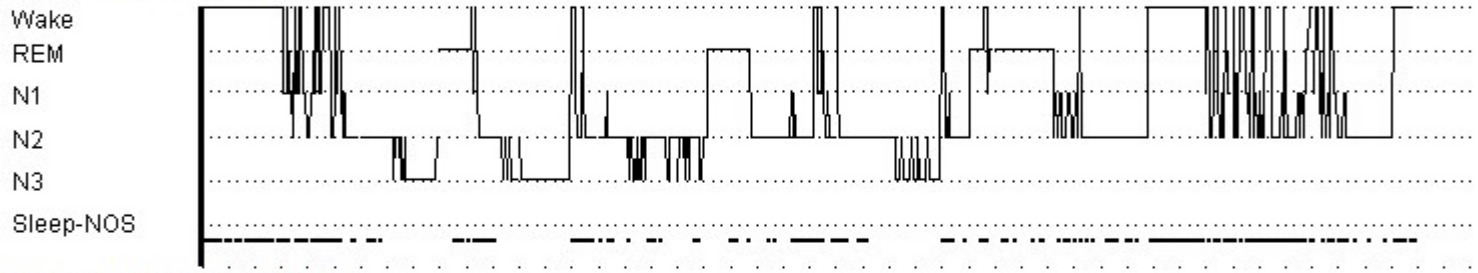
Study Results

Patient Name	State Misperception, Sleep		Ordered by	Sample Physician	
Date of Birth	[redacted]	Height (in)	63	Epworth Sleepiness (ESS)	4
Gender	Female	Weight (lbs)	140	Insomnia Severity (ISI)	17
Snoring Frequency	Never	BMI	25	Depression (PHQ-9)	6
Prescription Sleep Aids	Sometimes	Neck Size (in)	15	Anxiety (GAD-7)	12
High Blood Pressure	No	Heart Disease	No	Diabetes	No
Restless Leg Syndrome	No	Sleep Apnea	No	Insomnia	Yes
Narcolepsy	No	Depression	No	Anxiety or PTSD	Yes
A.M. Headaches	No	Stroke	No	Neurological Disorder	No

	N1:Diagnostic	N2:Diagnostic	Normal Ranges
Study Date	28 May 2014	29 May 2014	Low / High
Study Time	7.7h	7.3h	-
Excluded Time	0.1h	0.1h	-
Recording Time	7.5h	7.2h	-
Sleep Time	6.0h	6.4h	5.1h / 7.5h
Sleep Efficiency	79.7%	89.1%	77.5% / 94.7%
Sleep Time Supine	51.1% (3.1h)	83.9% (5.4h)	-
Sleep Architecture			
Wake	20.3% (1.5h)	10.9% (0.8h)	-
Stage R (REM) Total	16.4% (1.0h)	27.4% (1.8h)	14.3% / 26.8%
Phasic	9.9% (0.6h)	17.3% (1.1h)	-
Stage N1	10.6% (0.6h)	7.2% (0.5h)	1.3% / 6.9%
Stage N2 Total	56.9% (3.4h)	50.7% (3.3h)	35.0% / 66.2%
Light	10.8% (0.7h)	8.5% (0.5h)	-
Stage N3 (SWS)	16.1% (1.0h)	14.7% (0.9h)	9.0% / 43.8%
Sleep-NOS	0.0% (0.0h)	0.0% (0.0h)	-
Latencies			
Sleep Latency	31m	12m	5.2m / 41.5m
REM Latency	59m	59m	48.7m / 150.3m
Stage N3 Latency	42m	29m	-
Wake after Sleep Onset	61m	35m	0.0m / 45.0m
Sleep Continuity			
Cortical Arousals/hr	26.2	20.1	7.5 / 23.1
Microarousals/hr - other	0.0	0.0	-
Autonomic Activations/hr Overall	31.5	18.3	-
Non-REM	27.0	13.9	-
REM	4.5	4.4	-
Movement Arousals/hr	1.7	1.6	-
Awakenings/hr ≥ 30 sec	4.9	3.9	1.8 / 4.6
≥ 90 sec	1.7	1.0	-
Spindle Duration (min)	7.8	8.9	-
Snoring			
> 40dB | > 50dB Overall	29.8% | 18.3%	9.3% | 1.1%	-
Supine	50.6% | 35.6%	10.8% | 1.3%	-
Non Supine	8.2% | 0.2%	1.6% | 0.1%	-
Cardio			
Mean ± 1 S.D. (Pulse)	64 ± 5.6	60 ± 3.5	-
Max | Min	82 | 52	78 | 51	-

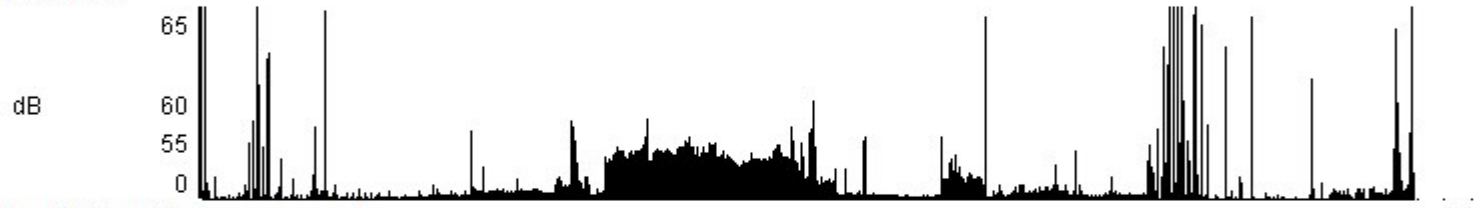
Patient Name	[redacted]	**Gender**	Female
Date of Night 1	28 May 2014	**Date of Birth**	[redacted]

Sleep Staging by EEG with cortical arousals

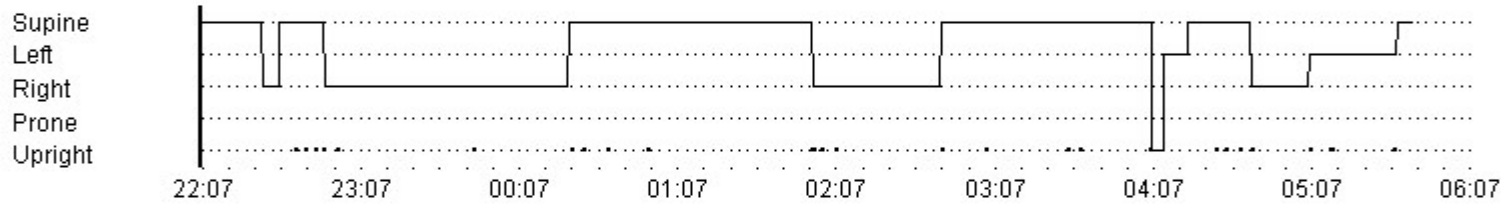


Pulse Rate with autonomic activations

Snoring Level



Head Position with movement arousals

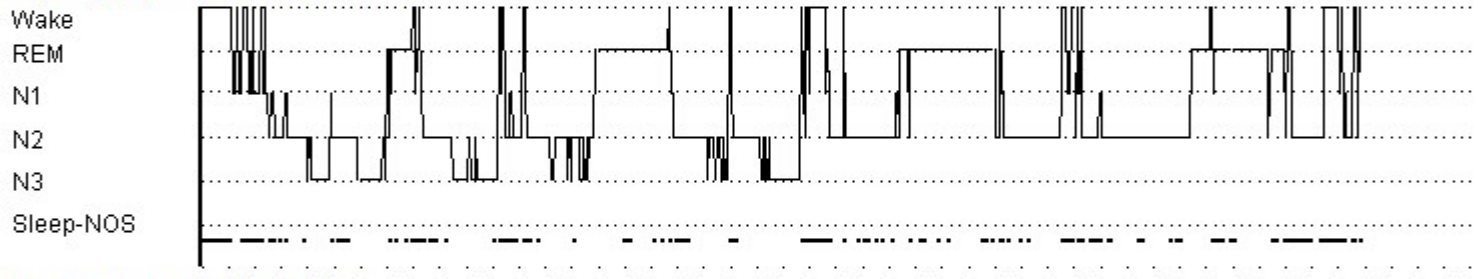


Data Quality

% Good LEOG	97%
% Good REOG	98%
% Good EEG	98%
% Good Pulse Rate	100%

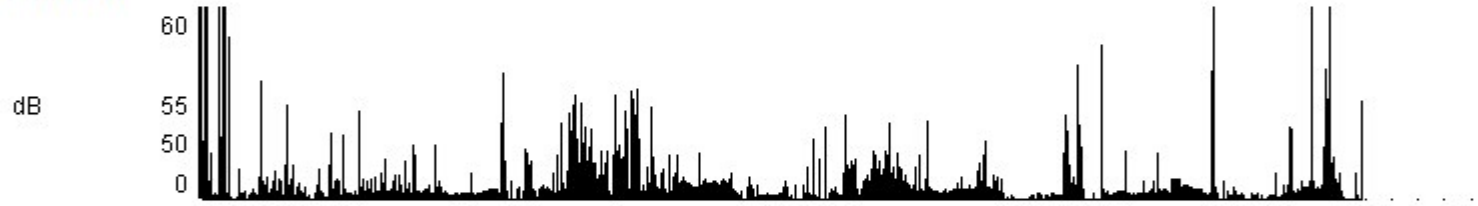
Patient Name	[redacted]	**Gender**	Female
Date of Night 2	29 May 2014	**Date of Birth**	[redacted]

Sleep Staging by EEG with cortical arousals

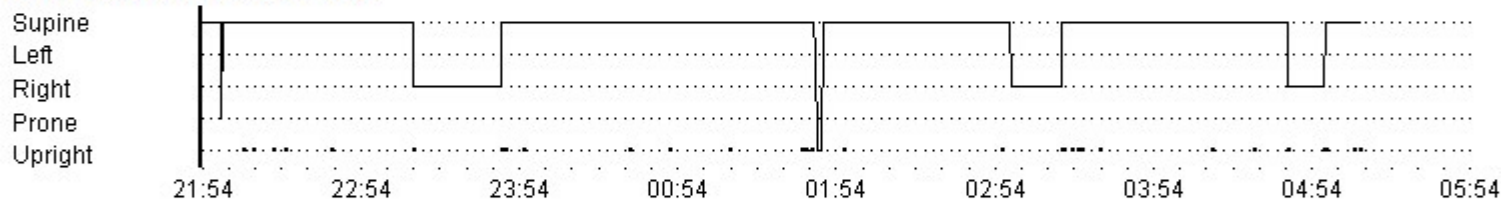


Pulse Rate with autonomic activations

Snoring Level



Head Position with movement arousals



21:54 22:54 23:54 00:54 01:54 02:54 03:54 04:54 05:54

Data Quality

% Good LEOG	99%
% Good REOG	98%
% Good EEG	98%
% Good Pulse Rate	100%

Sleep Diary and Sleep Profiler Comparison Report

Patient Name [redacted] **Gender** Female
Date of Birth [redacted]

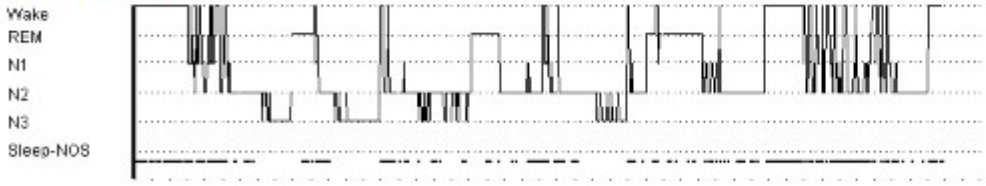
Night 1	Date: 28 May 2014	Patient	Sleep Profiler
Took a prescription medication to help fall or stay asleep		No	
Number of alcoholic beverages consumed within 4 hours of bedtime		0	
Number of caffeinated beverages consumed within 4 hours of bedtime		0	
Time the study was started – device turned on and lights out		22:00	22:07
Minutes required to fall asleep (sleep onset)		120	31
Number of awakenings during the night		3	12
Minutes awake after initially falling asleep (wake after sleep onset)		30	61
Time of final awakening / turned the device off		6:00	5:46
Total sleep time (hours:minutes)		6:00	6:00
Sleep Efficiency - % of time in bed patient was asleep		75	79.7
# times/hour brain exhibited an arousal			26.2
% of sleep time snoring was at least a mild level > 40 dB	– overall		29.8
	– on back		50.6
% of sleep time snoring was at a moderate level > 50 dB	– overall		18.3
	– on back		35.6

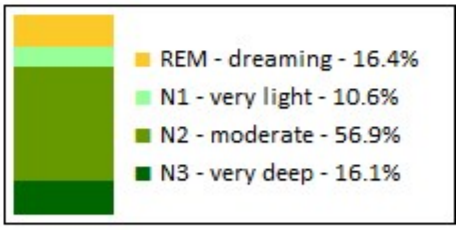
Night 2	Date: 29 May 2014	Patient	Sleep Profiler
Took a prescription medication to help fall or stay asleep		No	
Number of alcoholic beverages consumed within 4 hours of bedtime		0	
Number of caffeinated beverages consumed within 4 hours of bedtime		0	
Time the study was started – device turned on and lights out		22:00	21:54
Minutes required to fall asleep (sleep onset)		75	12
Number of awakenings during the night		3	7
Minutes awake after initially falling asleep (wake after sleep onset)		45	35
Time of final awakening / turned the device off		5:15	5:13
Total sleep time (hours:minutes)		5:00	6:24
Sleep Efficiency - % of time in bed patient was asleep		69	89.1
# times/hour brain exhibited an arousal			20.1
% of sleep time snoring was at least a mild level > 40 dB	– overall		9.3
	– on back		10.8
% of sleep time snoring was at a moderate level > 50 dB	– overall		1.1
	– on back		1.3

Patient Report Night 1

Patient Name [redacted] **Date of Night 1** 28 May 2014

SLEEP STAGE





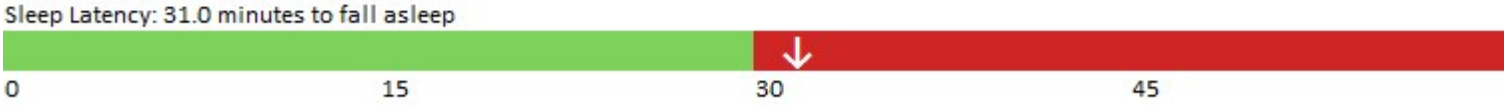
SLEEP QUALITY

Sleep Efficiency: asleep 79.7% of time in bed

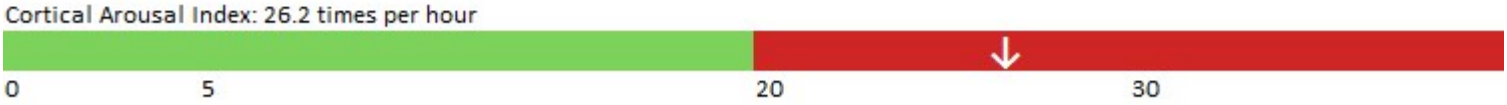
Stage N1 (very light sleep): 10.6% of sleep time

Stage N3 (deep sleep): 16.1% of sleep time

Sleep Latency: 31.0 minutes to fall asleep



Cortical Arousal Index: 26.2 times per hour



30-sec Awakening Index: 4.9 times per hour

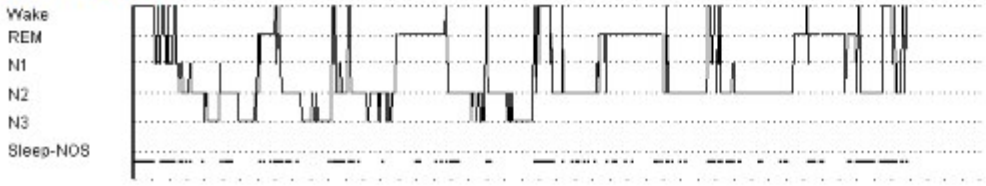
SNORING

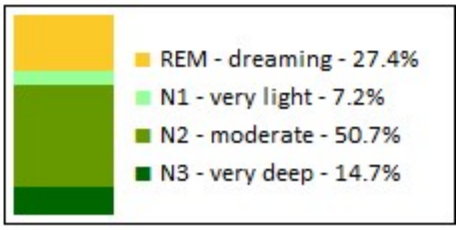
Snoring time > 40 dB:	29.8%
Snoring time > 50 dB:	18.3%

Patient Report Night 2

Patient Name [redacted] **Date of Night 2** 29 May 2014

SLEEP STAGE





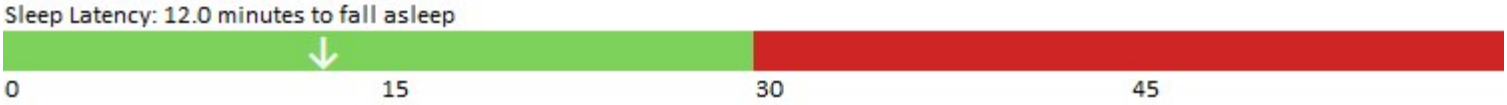
SLEEP QUALITY

Sleep Efficiency: asleep 89.1% of time in bed

Stage N1 (very light sleep): 7.2% of sleep time

Stage N3 (deep sleep): 14.7% of sleep time

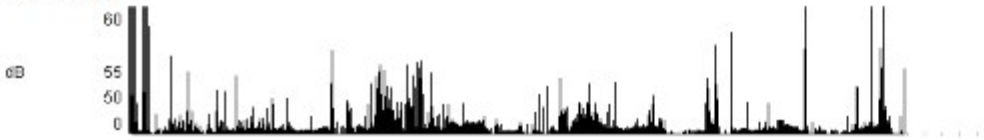
Sleep Latency: 12.0 minutes to fall asleep



Cortical Arousal Index: 20.1 times per hour

30-sec Awakening Index: 3.9 times per hour

SNORING



Snoring time > 40 dB:	9.3%
Snoring time > 50 dB:	1.1%