Tobacco Use & Sleep Problems Among Active Duty Service Members

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Objective: To determine the consequences of tobacco use on a person's sleep.

Methods: Active duty service members self-disclosing their tobacco use participated in a one month study during which time they completed standardized self-assessment scales which included the Pittsburg Insomnia Rating Scale, Zung Self-Rating Depression Scale, Zung Self-Rating Anxiety Scale, the Epworth Sleepiness Scale, and the Alcohol Use Disorders Identification Test. In addition, subjects completed a baseline and one month later home sleep study.

Results: Twenty - eight active duty subjects reported their tobacco use with half (n=14, 28, 50%) denying use. When comparing the two groups of tobacco users and non-tobacco users, the independent T-Test analyses identified no statistical differences based on the BMI (p=.13) or the Alcohol Use Disorders Identification Test (p=.37). In terms of the respiratory events associated with obstructive sleep apnea significant differences emerged between tobacco users and non-tobacco users. Tobacco users had significantly higher respiratory disturbance index scores, particularly during REM sleep and less oxygen saturation, an observation present at the initial sleep study and in the one month follow-up study. In terms of the apnea/hypopnea index, tobacco users had a nearly significant difference at the initial sleep study and in the one month follow-up study, again with a trend effecting REM sleep.

Conclusion: Tobacco use is a national health concern and motivating reluctant users to quit requires pertinent, evidence based clinical persuasion relevant to the person's life. Preliminary findings in this study suggest tobacco users experience significant sleep disruptions effecting sleep respiration and architecture.

INTRODUCTION

Motivating individuals to quit tobacco use can be an uphill struggle. Even individuals receiving treatment for a different substance use disorder often resist stopping "everything "- meaning tobacco - by wrapping their reluctance in the desire to conquer one problem at a time. At this decisive moment clinicians have a choice, agree with the person's rationale and place smoking cessation on the back burner or present a counter argument that might lead to a different outcome.

It is probably safe to assume that most individuals with a tobacco use disorder are familiar with the major physical problems associated with smoking. Clinicians may not sway smokers with a lecture pointing out the likelihood of cancer and other associated physical conditions. A better approach would tailor the message to current problems in the person's life. One of the more common complaints clinicians encounter, and the focus of this article, is the myriad of sleep problems patients present with in the doctor's office. A chronic insomniac might be receptive to smoking cessation if the clinician can make an adequate clinical argument connecting the dots between tobacco use and another night of restless sleep.

Clinicians seeking guidance on the comprehensive range of sleep problems associated with tobacco use may be surprised by the paucity of published literature on the subject.[1] In a large subjective study based on participants' self-reports, investigators reported that when compared to non-tobacco users, individuals using tobacco had less than six hours sleep, took longer to fall asleep, and experienced less restful, satisfying sleep.[2] In another subjective study, subjects were queried about the sufficiency of their sleep with the investigators' reporting that users of tobacco, whether smoked, smokeless, or passively inhaled, were more likely to relate insufficient sleep when compared to non-tobacco users.[3]

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Polysomnography offers an objective contribution to the study of tobacco's influence on sleep. In one such study, the investigators reported that smokers had less total sleep time, a longer time falling asleep, more sleep related apneic events, and more restless, leg movements.[4] In another study researchers explored the impact of abstinence from tobacco with its accompanying withdrawal and reported more frequent awakenings along with the subjects' more subjective assessments of increased anxiety, irritability, and daytime fatigue.[5] Among chronic smokers, the onset of the first REM sleep is delayed, deep sleep reduced, and sleep less efficient with more arousals interrupting continuity.[6]

Nicotine's short half-life introduces another complication as its effects diminish overnight producing varying degrees of withdrawal.[7] Researchers reported that a 24-hour nicotine patch, when compared to a 16-hour nicotine patch only worn while awake, had a more favorable result in terms of less sleep disruption as evidenced by polysomnography. Interestingly, the 24 hour study group did not subjectively identify better sleep, despite the polysomnography's results.

In this article, the investigators report the results of tobacco use on sleep, using both self-assessment measures and the objective results obtained from home sleep studies. The investigators pursued this study in an effort to better understand the relationships between tobacco use and sleep problems, both of which seem to mutually reinforce each other. Objective data based literature on the subject is limited, particularly among active duty service members.

METHODS

The investigators collected these data as a convenience sample from active duty military subjects participating in a prospective pilot study approved by the Walter Reed Institutional Review Board (IRB). All subjects were enrolled in a substance abuse treatment program at Walter Reed National Military Medical Center in Bethesda, Maryland. All subjects simply reported their use or nonuse of tobacco products. Participants agreed to complete three home sleep studies evenly spaced over a one month period along with standardized self-assessment instruments examining alcohol use, sleep, and mood.

The standard of care for service members' enrolled in the substance abuse treatment program requires urine drug screening. The urine drug screen includes amphetamines, barbiturates, benzodiazepines, cocaine, morphine, methadone, phencyclidine, and tetrahydrocannabinol. Service member's testing positive for any of these substances were excluded from the study.

At baseline and at one month the subjects completed the Pittsburg Insomnia Rating Scale (PIRS), Zung Self-Rating Depression Scale (SDS), Zung Self-Rating Anxiety Scale (SAS), and Epworth Sleepiness Scale (ESS). Subjects completed the Alcohol Use Disorders Identification Test (AUDIT) and the Post Traumatic Stress Disorder Checklist (PTSD) – Military Version (PCL-M) only at baseline.

The AUDIT consists of ten questions and five responses per item. Typical questions include, "How often do you have a drink containing alcohol" and "How often do you have six or more drinks on one occasion?" Scores exceeding seven are associated with harmful drinking.[8] In response to the questions, subjects could choose from:

- Never (which scored zero for that scale item)
- Monthly or less
- 2-4 times a month
- 2-3 times a week
- 4 or more times a week (which earned the maximum score for that scale question of four)

The PIRS is a 20-item self-report instrument assessing sleep over the preceding 7-day period.[9] The range of scores on the PIRS is from 0-60 with scores above 20 suggesting insomnia. Typical questions on the PIRS include: "From the time you tried to go to sleep, how long did it take to fall asleep on most nights?" and "If you woke up during the night, how long did it take to fall back to sleep on most nights?"

The SDS is a 20-item self-report instrument in which respondents choose among four descriptions (i.e., "a little of the time," which scored one for that scale item, "some of the time," "good part of the time," and "most of the time", which earned the maximum score for that item of four) in answering questions regarding depression. Typical questions include: "I feel down - hearted and blue" and "Morning is when I feel the best." Scores above 50 suggest clinically significant depression.[10,11]

 The SAS is a 20-item self-report instrument in which respondents choose among four descriptions (i.e., "a little of the time," which scored one for that scale item, "some of the time," "good part of the time," and "most of the time," which earned the maximum score for that item of four) in answering questions regarding anxiety. Typical questions include, "I feel more nervous and anxious than usual" and "I fall asleep easily and get a good night's rest". Scores exceeding 45 suggest clinically significant anxiety.[12]

The ESS consists of eight questions which are answered by subjects on a four point scale ranging from 0 "No chance of dozing" to 3 for "definitely would doze."[13] Typical questions that subjects would answer would involve situations such as "sitting and reading, watching TV or sitting inactive. Scores of 10 or greater suggest daytime sleepiness.

The PCL-M is a 17- item self-report instrument assessing military centric symptoms associated with a traumatic event that allows respondents to identify problems that vary from 1 (not at all) to 5 (extremely).[14] For purposes of this study, the investigators used a cut-off score of 50 or greater as suggesting PTSD.

Investigators used the WatchPat 200 (Itamar Medical Ltd., Caesarea, Israel) for the home sleep studies. This wrist worn device includes an actigraph, peripheral arterial tonometer, a pulse oximeter, and an integrated body position and snoring sensor. Proprietary software analyzes these data collected from the home sleep study.

 Sleep study results include such measures as the total sleep time, oxygen saturation levels, pulse rate, and a detailed hypnogram. The device also calculates the apnea/hypopnea index (AHI), oxygen desaturation index (ODI), and the respiratory disturbance index (RDI), which are the commonly accepted respiratory diagnostic determinants of OSA.[15]

Researchers comparing the accuracy of this device in measuring the respiratory parameters and sleep architecture with traditional poly-somnography (PSG) report strong correlations between the two procedures.[16-19]

RESULTS

After obtaining the subjects' written research consent, twenty-eight active duty subjects reported their tobacco use with half (n=14/ 28, 50%) denying use. Among the total group most were enlisted service members (n=22/28, 79%), male (n=23/28, 86%), between the ages of 21-35 (n=21/28, 75%), and had been deployed to an area of combat operations (n=18/28, 64%) (See Table 1). The average BMI for the group was 26.9 (n=28, SD 5.0). The average PCL-M (n=28, M=48.9, SD 20.48) score fell below the screening threshold.

When comparing the two groups of tobacco users and non-tobacco users, the independent T-Test analyses identified no statistical differences based on the BMI (p=.13), AUDIT (p=.37), SDS (p=.11), PIRS (p=.18), and the Epworth (p=.1). While the difference between the PIRS scores between tobacco users (n=14, M=41.3, SD 10) and non-tobacco users (n=14, M=34.2, SD 16.3) was insignificant both groups reported scores that exceeded the threshold of 20 suggesting the presence of insomnia. The same analysis did identify a significant difference (p=.05) among the two groups with tobacco users reporting higher anxiety scores on the SAS (See Table 2).

TABLE 1:

Characteristics of Military Subjects (n=28)

AGE	n (%)
21-25	7 (25.0)
26-30	8 (28.6)
31-35	6 (21.4)
36-40	3 (10.7)
>41	4 (14.3)
GENDER	
Male	24 (85.7)
Female	4 (14.3)
RANK*	
E1-E4	12 (42.9)
E5-E9	10 (35.7)
O1-O3	3 (10.7)
O4-O6	3 (10.7)
MARITAL	
Single	7 (25)
Married	12 (42.9)
Separated	5 (17.9)
Divorced	3 (10.7)
Widowed	1 (3.6)
DEPLOYED	
Yes	18 (64.3)
No	10 (35.7)

*E1-E4 = Junior enlisted rank
E5-E9 = Noncommissioned officers
O1-O3 = Junior commissioned officers
O4-O6 = Senior commissioned officers

TABLE 2:

Initial Group Test Results

Test	Tobacco Use / n	Mean	SD	Sig (2-Tailed)
AUDIT	Yes / 14	15.4	9.6	3.7
	No / 14	12.3	8.0	
SDS	Yes / 14	54.6	9.6	.11
	No / 13	46.0	16.2	
SAS	Yes / 14	42.2	9.5	.05*
	No / 13	32.2	14.9	
PIRS	Yes / 14	41.3	10.0	.18
	No / 14	34.2	16.3	
Epworth	Yes / 14	12.2	6.3	.10
	No / 14	8.4	5.6	
BMI	Yes / 14	28.3	5.9	.13
	No / 14	25.4	3.5	

*Significant at the 0.05 level (2-tailed)

AUDIT – Alcohol Use Disorders Identification Test
SDS – Zung Depression Scale
SAS – Zung Anxiety Scale
PIRS – Pittsburgh Insomnia Rating Scale
Epworth – Epworth Sleepiness Scale
BMI – Body Mass Index

An analysis of individual SAS and SDS questions produced interesting results. Tobacco users were significantly more likely to report losing weight, feeling tired, restless, irritable, experiencing numbness and tingling, and frequent urination (See Table 3). One month later subjects completed the SAS and SDS again and reported roughly similar results with tobacco users feeling restless, panicky, tired, and experiencing trembling, a fast heart rate, dizziness, numbness, and dry hands (See Table 4).

In terms of the respiratory measures associated with OSA significant differences emerged between tobacco users and non-tobacco users. Tobacco users had significantly higher RDI scores, particularly during REM sleep and less oxygen saturation, an observation present at the initial sleep study and in the one month follow-up study. In terms of the AHI, tobacco users had a nearly significant difference at the initial sleep study and in the one month follow-up study, again with a trend towards REM sleep (See Table 5, page 14).

TABLE 3:

Initial Zung Depression & Zung Anxiety Questions Related to Tobacco Use

Test Question	Tobacco Use / n	Mean	SD	Sig (2-Tailed)
Q7: Losing Weight[1]	Yes / 14 No / 12	1.71 2.67	1.07 1.07	0.03*
Q10: Tired[1]	Yes / 14 No / 12	3.14 2.33	.95 .98	0.04*
Q13: Restless[1]	Yes / 14 No / 12	3.07 2.33	.83 .78	0.03*
Q15: Irritable[1]	Yes / 14 No / 13	2.93 2.15	1.0 .99	0.05*
Q8: Tired[2]	Yes / 14 No / 13	3.07 1.92	.83 1.38	0.01**
Q14: Numbness[2]	Yes / 14 No / 13	2.21 1.08	1.19 1.32	0.03*
Q16: Frequent[2] Urination	Yes / 14 No / 13	2.21 1.08	1.25 .95	0.01**

*Significant at the 0.05 level (2-tailed)
** Significant at the 0.01 level (2-tailed)

[1]Zung Depression
Qv7: I notice that I am losing weight
Q10: I get tired for no reason
Q13: I am restless and can't keep still.
Q15: I am more irritable than usual

[2]Zung Anxiety
Q8: I feel weak and get tired easily
Q14: I get feelings of numbness and tingling in my fingers & toes
Q16: I have to empty my bladder often

TABLE 4:

One Month Follow-Up Zung Depression & Anxiety Questions Related to Tobacco Use

Test Question	Tobacco Use / n	Mean	SD	Sig (2-Tailed)
Q9: Fast Heart Rate[1]	Yes / 7 No / 8	2.0 1.3	.82 .46	.04*
Q13: Restless[1]	Yes / 7 No / 10	2.29 1.5	.49 .71	.02*
Q3: Panicky[2]	Yes / 8 No / 9	2.25 .89	1.04 .93	.01**
Q4: Falling Apart[2]	Yes / 8 No / 8	1.63 .38	1.06 .52	.01**
Q6: Tremble[2]	Yes / 8 No / 9	1.88 .33	1.25 .71	.01**
Q8: Tired[2]	Yes / 8 No / 9	2.13 1.0	1.36 .87	.06
Q10: Fast Heart Rate[2]	Yes / 8 No / 9	1.75 1.08	1.25 .89	.03*
Q11: Dizzy[2]	Yes / 8 No / 8	.88 .00	1.13 .00	.03*
Q14: Numbness[2]	Yes / 8 No / 9	1.88 .13	1.13 .35	.00**
Q17: Dry Hands[2]	Yes / 8 No / 9	2.63 .78	1.30 .83	.00**

*Significant at the 0.05 level (2-tailed)
** Significant at the 0.01 level (2-tailed)

[1]Zung Depression
Q9: My heart beats faster than usual
Q13: I am restless and can't keep still

[2]Zung Anxiety
Q3: I get upset easily or feel panicky
Q4: I feel like I'm falling apart and going to pieces
Q6: My arms and legs shake and tremble
Q8: I feel weak and get tired easily
Q10: I can feel my heart beating fast
Q11: I am bothered by dizzy spells
Q14: I Get feelings of numbness and tingling in my fingers and toes
Q17: My hands are unusually dry and warm

TABLE 5:

Relationships Between Tobacco Use & Respiratory Measures

Sleep Variable	Tobacco Use / n	Mean	SD	Sig (2-Tailed)
AHI[1]	Yes / 13 No / 12	11.7 3.4	13.7 4.8	.06
RDI[1]	Yes / 13 No / 12	19.2 9.4	11.4 5.6	.01**
RDI REM[1]	Yes / 11 No / 8	25.6 14.7	8.7 4.5	.01**
Oxygen Saturation[1]	Yes / 13 No / 12	94.5 95.9	1.7 1.4	.04*
RDI REM[2]	Yes / 5 No / 12	25.5 13.5	14.2 8.8	.05*
AHI REM[2]	Yes / 5 No / 12	16.7 5.8	15.4 6.9	.06
Oxygen Saturation[2]	Yes / 8 No / 13	94.5 95.7	1.5 .85	.03*

*Significant at the 0.05 level (2-tailed)
** Significant at the 0.01 level (2-tailed)

[1]Initial Sleep Study Results
[2]One Month Follow -Up Sleep Study Results

AHI = apnea-hypopnea index
RDI = respiratory disturbance index
RDI REM = respiratory disturbance index during REM
AHI REM = Apnea Hypopnea Index during REM

COMMENT

Motivating tobacco users to quit is generally an uphill struggle. Even among patients receiving intensive treatment for other substance use disorders a reluctance to quit tobacco commonly arises. Most patients are familiar with the long term physical risks associated with tobacco use and are usually unresponsive to a clinician's appeal along this line. On the other hand, tobacco users may be receptive to quitting if current problems will be alleviated. One of the more common clinical complaints that falls into that category would be sleep problems.[20]

As this preliminary study suggests, even among a cohort of individuals reporting insomnia, tobacco users experience a different set of problems. Perhaps most important is this study's finding pointing towards a higher rate of OSA among self-identified tobacco users. Drilling down a bit further into the sleep study results also seems to suggest that the breathing problems are more likely to occur during REM sleep. Tobacco users' breathing problems were fairly constant based on the results of the two sleep studies subjects completed during the course of the one month study.

Fractured REM sleep may have important clinical consequences by disrupting a key component of the sleep architecture. In one example, REM sleep appears to play an important role in memory consolidation which in turn may affect recovery from post-traumatic stress disorder (PTSD).[21] Chronic sleep disorders that habitually impact REM sleep may be a modifiable risk factor promoting recovery from PTSD.[22] As this study suggests, quitting tobacco could be a modifiable risk factor that would contribute not only to a better night's sleep but might also help individuals with PTSD.

Tobacco users also subjectively report more somatic symptoms than non-tobacco users such as feeling tired, restless, irritable, and numb; all of which constitute common components of many psychiatric disorders which can only can confuse and complicate their treatment. Again, the findings were replicated one month after the subject's completed their initial self-assessments instruments. Clinicians might consider the negative contributions of tobacco use when managing treatment resistant cases.

This study does have limitations, perhaps chief among these being the investigators' reliance on the subjects' self-disclosure of tobacco use without quantifying type, frequency of use, or how recently the subjects quit using tobacco. Another factor that may limit the study's generalizability is the military sample that may not be representative of America's population. Future research could address these limitations as well as including a more heterogeneous sample. In defense of these obvious limitations the investigators would suggest that typical clinical practice may not extend beyond asking the screening question regarding tobacco use, a clinical scenario incorporated in this study. The fairly consistent results the investigators obtained over the one-month study period also bolsters the findings.

Clinicians counseling patients to quit tobacco often face substantial resistance. One possible way clinicians can breech that barrier is by connecting tobacco use with sleep problems. Everyone wants a restful night's sleep and tobacco users rarely have one. The findings in this study suggest the reasons why as tobacco users subjectively report more somatic symptoms and objectively demonstrate REM based breathing problems.

CONCLUSION

Motivating reluctant patients to quit tobacco can be a challenging task. One way, and the focus of this research is for Osteopathic physicians, as part of a holistic approach, is to explain the negative relationship between tobacco consumption and sleep problems. Aside from that, the root cause of a chronic sleep problem that is resistant to interventions, may suggest that tobacco use is the confounding variable preventing relief, and until that is addressed, a restful night's sleep will remain just a dream.

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