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## **WHITE PAPER: Commercial Driver Perspectives on Obstructive Sleep Apnea**

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## LIST OF ACRONYMS

AHI	Apnea Hypopnea Index
ATRI	American Transportation Research Institute
ANPRM	Advanced Notice of Proposed Rulemaking
BMI	Body Mass Index
CDL	Commercial Driver's License
CME	Certified Medical Examiner
CMV	Commercial Motor Vehicle
CPAP	Continuous Positive Airway Pressure
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
I-C	Independent Contractors
MATS	Mid-America Trucking Show
MCSAC	Motor Carrier Safety Advisory Committee
MRB	Medical Review Board
O-O	Owner-Operators
OSA	Obstructive Sleep Apnea
RAC	Research Advisory Committee
RIA	Regulatory Impact Analysis
USDOT	United States Department of Transportation

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## **1.0 BACKGROUND**

Obstructive sleep apnea (OSA) is a disorder wherein throat muscles relax intermittently, blocking the airway and causing breathing cessation during sleep. OSA is classified by the Federal Motor Carrier Administration (FMCSA) as a respiratory disorder, and is addressed in 49 CFR 391.41(b)5 – the physical qualifications for drivers.<sup>1</sup> Certified medical examiner (CME) sleep study referrals are currently based primarily on a CME's discretion.<sup>2</sup>

In 2012, FMCSA's Motor Carrier Safety Advisory Committee (MCSAC) and Medical Review Board (MRB) released guidelines for sleep apnea screening as part of U.S. Department of Transportation (USDOT) medical examinations.<sup>3</sup> These guidelines were primarily based on expert panel recommendations presented to FMCSA in 2008.<sup>4</sup>

Subsequently, H.R. 3095, referred to as the "Sleep Apnea Bill," was signed into law in 2013. It requires FMCSA to go through a formal rulemaking process prior to implementing sleep disorder regulations, in particular focusing on OSA.<sup>5</sup> This formal rulemaking process will ensure that driver OSA regulation benefits exceed costs, that industry stakeholder input is considered, and that specific standards for drivers, motor carriers, and CMEs are created.

In March 2016, FMCSA and the Federal Railroad Administration (FRA) jointly released an Advanced Notice of Proposed Rulemaking (ANPRM) to solicit public input on OSA costs, prevalence, and safety outcomes for workers in safety-sensitive occupations.<sup>6</sup> At the time of publication of this report, the comment period on the ANPRM closes June 8, 2016.

At its 2016 annual meeting, the American Transportation Research Institute's (ATRI's) Research Advisory Committee (RAC) ranked investigating potential impacts of the proposed commercial driver sleep apnea rulemaking among the top ten research priorities.<sup>7</sup> As a first task in this research, ATRI surveyed commercial drivers on a number of OSA-related issues.

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<sup>1</sup> See the Advanced Notice of Proposed Rulemaking Docket ID FMCSA-2015-0419 for more details on how the FMCSA classifies OSA as a respiratory disease. Available Online: <https://www.regulations.gov/#!documentDetail;D=FMCSA-2015-0419-0001>

<sup>2</sup> *FMCSA Bulletin to Medical Examiners and Training Organizations Regarding Obstructive Sleep Apnea* states "Medical examiners may exercise their medical judgment and expertise in determining whether a driver exhibits risk factors for having OSA and in determining whether additional information is needed before making a decision whether to issue the driver a medical certificate and the duration of that medical certification." Available Online: <https://nationalregistry.fmcsa.dot.gov/NRPublicUI/documents/OSA%20Bulletin%20to%20MEs%20and%20Training%20Organizations-01122015.pdf>

<sup>3</sup> Motor Carrier Safety Advisory Committee and Medical Review Board. (February 2012). *MCSAC-MRB Task 11-05 Report*. Available Online: <https://www.fmcsa.dot.gov/february-6-2012-mcsac-and-mrb-task-11-05-final-report-obstructive-sleep-apnea-osa>

<sup>4</sup> ECRI Institute and Manila Consulting Group, Inc. (January 2008). *Expert Panel Recommendations Obstructive Sleep Apnea and Commercial Motor Vehicle Driver Safety*. Available Online: <https://www.fmcsa.dot.gov/sites/fmcsa.dot.gov/files/docs/Sleep-MEP-Panel-Recommendations-508.pdf>

<sup>5</sup> Available Online: <https://www.congress.gov/bill/113th-congress/house-bill/3095>

<sup>6</sup> Advanced Notice of Proposed Rulemaking Docket ID FMCSA-2015-0419. Available Online: <https://www.regulations.gov/#!documentDetail;D=FMCSA-2015-0419-0001>

<sup>7</sup> ATRI's RAC is comprised of industry stakeholders representing motor carriers, trucking industry suppliers, labor and driver groups, law enforcement, federal government and academia. The RAC is charged with annually recommending a research agenda for the Institute.

## **2.0 METHODOLOGY**

ATRI developed two separate surveys focusing on OSA – one for commercial motor vehicle (CMV) drivers who have had a sleep study (also known as polysomnography) and another for CMV drivers who have not had a sleep study. The surveys were initially distributed at the 2016 Mid-America Trucking Show (MATS), held March 31 – April 2, 2016 in Louisville, Kentucky. Following MATS, both surveys were available online on ATRI’s website ([www.atri-online.org](http://www.atri-online.org)) from April 14, 2016 until May 9, 2016. The surveys were advertised through industry trade press and through interviews on Sirius XM Radio. In total, 822 drivers completed one of the two OSA surveys.

## **3.0 RESULTS**

### ***3.1 Survey Respondents***

Both surveys sought information on age, gender, employment type, and motor carrier policies relating to OSA. Reported figures in this section are stratified by whether a driver has had a sleep study (“sleep study”) or if they have not had a sleep study (“no sleep study”).

#### *Driver Demographics*

First, respondents were asked about their age (Figure 1). Respondents who have had a sleep study are more likely to be over 50 (61%) than respondents who have not had a sleep study (49%). This reflects the increased risk of OSA in older individuals, which is a potential risk factor considered by CMEs or other medical professionals when referring drivers to sleep studies.<sup>8,9</sup>

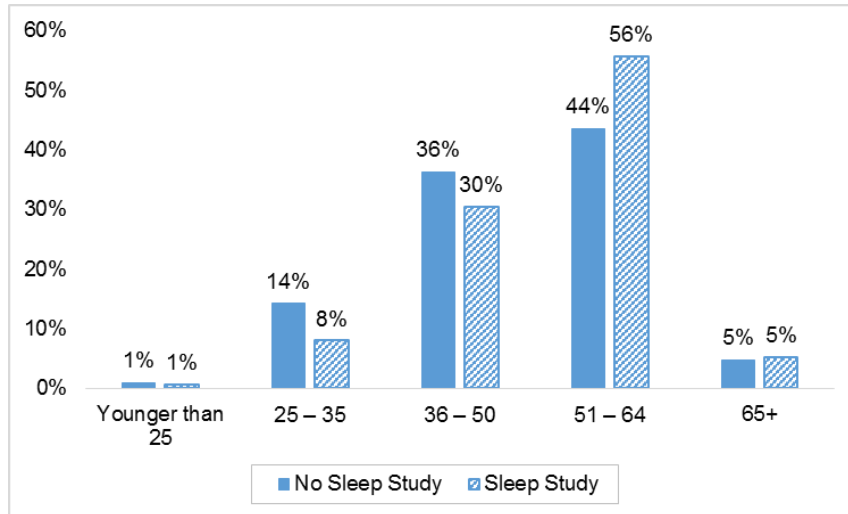
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<sup>8</sup> *Sleep Apnea Risk Factors*. (n.d.) Mayo Clinic. Available Online: <http://www.mayoclinic.org/diseases-conditions/sleep-apnea/basics/risk-factors/con-20020286>. Accessed May 19, 2016.

<sup>9</sup> The STOP-BANG questionnaire, one screening tool to determine OSA risk, considers being over 50 a risk factor for OSA. Available Online: <https://www.sleepassociation.org/sleep-apnea-screening-questionnaire-stop-bang/>. Accessed May 19, 2016.

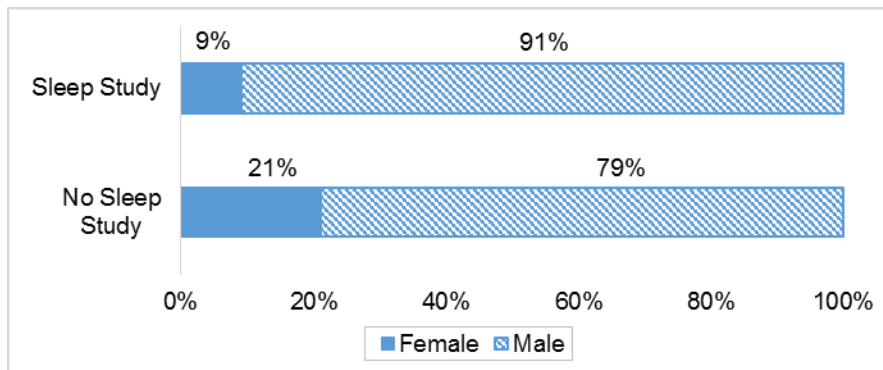


**Figure 1: Driver Age**



The gender distribution of respondents is shown in Figure 2. The respondents of both surveys included proportionally more women than the industry at large, where women comprise six percent of the driver population.<sup>10</sup>

**Figure 2: Respondent Gender**



The operating status of respondents to both surveys consisted of 72.0 percent employee drivers, 8.5 percent Owner-Operators (O-O) with their own authority, and 19.5 percent Independent Contractors (I-C) or O-O leased to a motor carrier. The operating status distribution did not vary significantly when stratified by whether respondents had completed a sleep study.

<sup>10</sup> *American Trucking Trends 2015*. (2015). Arlington, VA: American Trucking Associations

*Carrier OSA Policies*

Finally, both surveys asked employee drivers and drivers leased to a motor carrier about specific policies in place regarding OSA (Table 1). One third of drivers, irrespective of operating status, did not know if their carrier had a defined OSA policy. Employee drivers in the sample were more likely to be subject to a carrier-defined OSA policy, which may reflect that some carrier OSA policies and/or I-C issues vary depending on operating status.

**Table 1: Does your carrier have a defined OSA policy?**

	<b>Employee Driver</b>	<b>O-O / I-C Leased to a Motor Carrier</b>
<b>Yes</b>	24%	12%
<b>No</b>	46%	57%
<b>Don't Know</b>	30%	32%

Similarly, drivers leased to a motor carrier have some additional freedom in having a choice of what clinic or CME to go to for DOT physicals. Over half of drivers leased to a motor carrier could choose their CME or clinic (59%) while only a quarter of employee drivers have that choice (28%).

**Table 2: Is the CME or clinic you go to for DOT physicals chosen by your carrier?**

	<b>Employee Driver</b>	<b>O-O/I-C Leased to a Motor Carrier</b>
<b>Yes</b>	65%	39%
<b>No</b>	28%	59%
<b>Don't Know</b>	7%	2%

### **3.2 Drivers Who Have Not Had a Sleep Study Survey**

The survey for drivers who have not had a sleep study consisted of 12 multiple choice questions and an open-response question (see Appendix A). The survey gathered information from these drivers on their perceptions of the risks of untreated OSA and the costs associated with OSA diagnosis and treatment. A total of 414 surveys were completed by drivers who had not had a sleep study.

#### *Perceived Prevalence of OSA*

As part of its ANPRM, FMCSA is seeking data on the prevalence of OSA among the driver population. Absent current data on OSA prevalence among commercial drivers, it will be challenging for FMCSA to accurately project costs and benefits of a sleep apnea rule as part of a Regulatory Impact Analysis (RIA).

Earlier work on quantifying prevalence among commercial drivers was completed for FMCSA by ATRI and the University of Pennsylvania in 2002.<sup>11</sup> That research, which is now nearly 15 years old, revealed that 17.6 percent of commercial drivers had mild sleep apnea, 5.8 percent had moderate sleep apnea and 4.7 percent had severe sleep apnea. The study was based on testing a random sample of CDL holders within a 50-mile radius of the University of Pennsylvania.

FMCSA's website states that, "The disqualifying level of sleep apnea is moderate to severe, which interferes with safe driving."<sup>12</sup> Using this criteria, only 10.5 percent of the drivers in the 2002 study would require treatment.

In the current survey, respondents were queried on how prevalent they believe OSA is among commercial drivers. Almost one third of respondents (29%) believed that OSA affects 25 percent or less of commercial drivers, similar to the prevalence findings in the 2002 study. Another 27 percent of respondents indicated that they did not know how prevalent OSA is among truck drivers.

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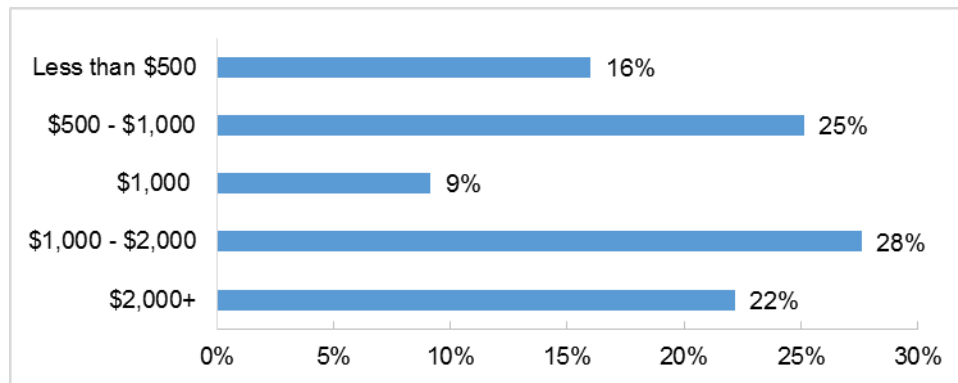
<sup>11</sup> Pack, A.I., Dinges, D.F. & Maislin, G. A Study of the Prevalence of Sleep Apnea among Commercial Truck Drivers. Federal Motor Carrier Safety Administration (Publication No. DOT-RT-02-030). Washington, DC.

<sup>12</sup> Driving When You Have Sleep Apnea. Federal Motor Carrier Safety Administration website. Available at: <https://www.fmcsa.dot.gov/driver-safety/sleep-apnea/driving-when-you-have-sleep-apnea>. Accessed on May 12, 2016.

*Driver Perceptions of OSA Diagnosis, Treatment, and Associated Costs*

Next, drivers were asked for information relating to their knowledge about being diagnosed with OSA. The majority of drivers surveyed, 70 percent, believed that in-lab sleep studies were necessary for an OSA diagnosis. Based on this research, if future OSA regulations allowed home-sleep tests, the cost of diagnosis could be reduced significantly. Home sleep studies are less expensive than in-lab studies and the flexibility of home tests would allow drivers to minimize lost wages resulting from taking time off for an in-lab sleep study.<sup>13</sup> Half of drivers estimated that in-lab sleep studies cost more than \$1,000 (Figure 3).

**Figure 3: Driver Estimates of In-Lab Sleep Study Costs**

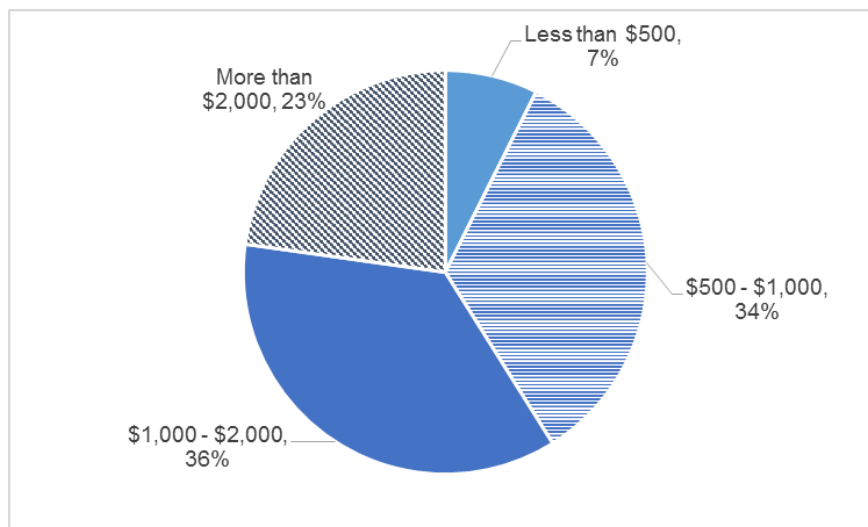


Information was also gathered on driver knowledge of OSA treatment options and associated costs. Over half of respondents (63%) knew that use of a continuous positive air pressure (CPAP) machine was not the only treatment for OSA. This treatment regimen, however, is common for safety-sensitive occupations since most other OSA treatments do not record compliance.<sup>14</sup> Figure 4 displays driver estimates of CPAP machine costs. Most drivers estimated CPAP costs to exceed \$1,000 (59%).

<sup>13</sup> Ungar, L. (February 2013). *In-home tests gain traction in sleep disorder diagnoses*. Courier-Journal. Louisville, KY. Available Online: <http://www.usatoday.com/story/news/nation/2013/02/15/home-sleep-apnea-tests-momentum/1922335/>

<sup>14</sup> Some oral appliances to treat OSA now have compliance recording features.

**Figure 4: Driver Estimates of CPAP Costs**



*Driver Perceptions of OSA Risk Factors and Potential Consequences of Untreated OSA*

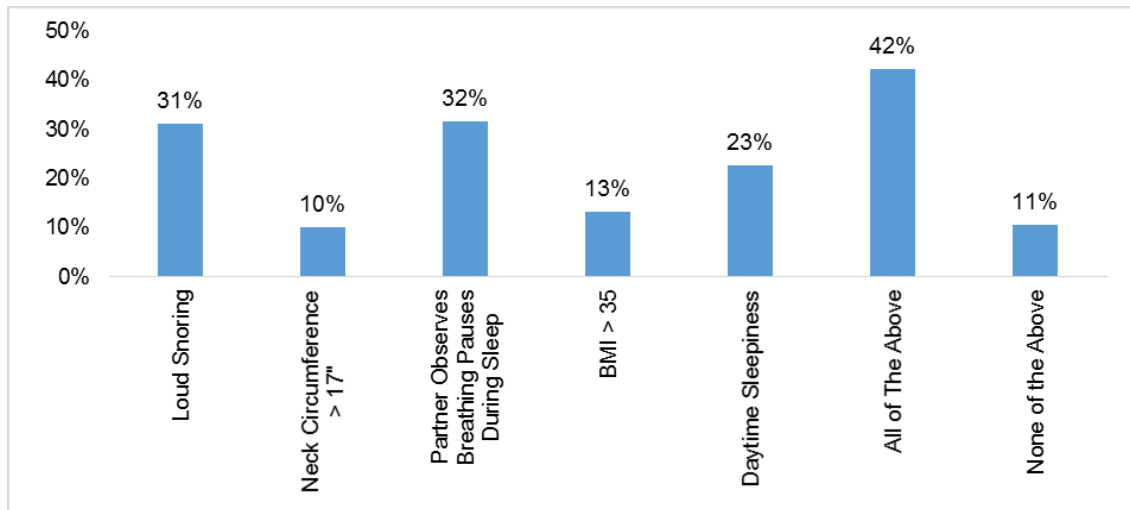
Finally, the survey asked about possible indicators of OSA and possible complications resulting from untreated OSA. The list of potential indicators was derived from an expert panel on OSA assembled by FMCSA.<sup>15</sup> Drivers were asked if loud snoring, neck circumference, a partner observing breathing pauses during sleep, body mass index (BMI), or daytime sleepiness are indicators of OSA (Figure 5). Less than half of respondents (42%) believed that all of the listed conditions could indicate OSA and a minority (11%) thought that none of the listed conditions were potentially indicative of OSA.

Almost half of respondents did not consider neck circumference or BMI to be OSA risk factors (48% and 45%, respectively). These standards, while not viewed by drivers to be good indicators of OSA risk, may be preferred by the medical community as objective, physical standards. Other common questions to assess OSA risk are self-reported, subjective measures, such as experiencing daytime fatigue.

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<sup>15</sup> *Opinions of Expert Panel*. (2008). Federal Motor Carrier Administration. Available Online: <https://www.fmcsa.dot.gov/regulations/medical/opinions-expert-panel-obstructive-sleep-apnea-and-commercial-motor-vehicle>

**Figure 5: Commercial Driver Knowledge of OSA Indicators**



While respondents were aware of OSA risk factors, many were less convinced of the potential consequences of untreated OSA (Table 3). Daytime fatigue and high blood pressure were identified as potential complications of OSA by many respondents (91% and 67%, respectively).<sup>16</sup> Increased crash risk was identified as a potential consequence of untreated OSA by 79 percent of respondents. The success of any future OSA rulemaking will rely on industry understanding and acceptance of a connection between untreated OSA and driver health and safety performance.

**Table 3: Commercial Driver Knowledge of Potential Untreated OSA Complications**

Daytime Fatigue	Increased Crash Risk	High Blood Pressure	Type-2 Diabetes	All of the Above	None of the Above
54%	42%	30%	5%	37%	6%

<sup>16</sup> The figures described here have combined “all of the above” responses with the other responses individually described.

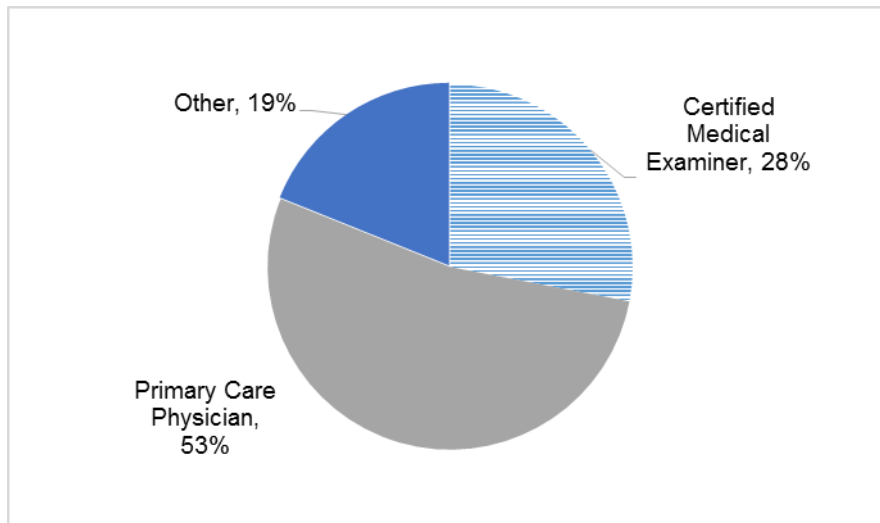
### 3.3 Drivers Who Have Had a Sleep Study Survey

The survey for drivers who have had a sleep study sought information relating to their sleep study, the costs of OSA diagnosis and treatment, and treatment efficacy (see Appendix B). A total of 408 surveys were completed by drivers who have completed a sleep study.

#### *Sleep Study Referral Experience*

A majority of drivers (53%) were referred to a sleep study by their primary care physician (Figure 6). When a driver was referred to a sleep study by an individual other than their primary care physician or a CME, drivers reported being self-referred, or referred by a family member, another physician, or based on a company-specific OSA policy.

**Figure 6: Who referred you to a sleep study?**



Following referral to a sleep study, most drivers (88%) did not get a second opinion on whether a sleep study was needed. Drivers primarily took in-lab sleep studies (85%) with a small number completing home sleep studies (15%).

#### *Out-of-Pocket Sleep Study Costs*

Next, drivers were asked about out-of-pocket sleep study costs. In the ATRI sample:

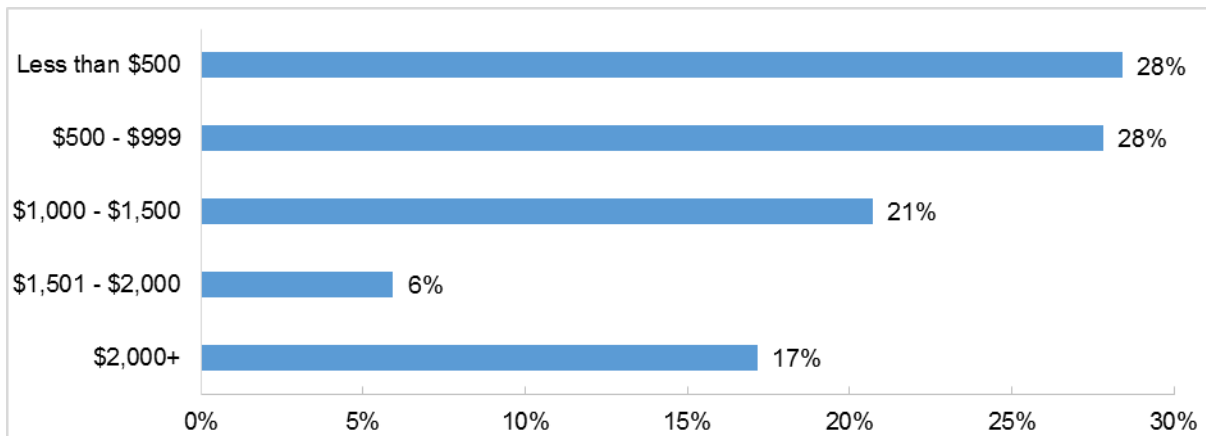
- 53 percent of drivers paid out-of-pocket costs;
- 40 percent of drivers did not pay any out-of-pocket costs; and
- 7 percent of drivers did not know if they paid any out-of-pocket costs.

Those drivers who indicated bearing some or all of the cost of the sleep study were asked to provide a specific amount paid; 169 drivers provided data on the out-of-pocket costs for their sleep study (Figure 7). On average, drivers in this data collection paid \$1,220 out-of-pocket for a sleep study. The median out-of-pocket cost was \$800 and there was a significant range in

reported out-of-pocket costs of over \$6,000. The impact of sleep study costs on commercial drivers is apparent when considered in relation to the national median truck driver wage - \$805 per week.<sup>17</sup>

The variation can be attributed to numerous factors, including, whether or not drivers have insurance, and for drivers with insurance, whether or not their insurance covered sleep study costs, whether they had already exceeded their health insurance deductible, and whether the driver completed an at-home or in-lab sleep study.<sup>18</sup> Cost savings could be achieved by having drivers complete home sleep studies rather than in-lab sleep studies when possible, which can cost twice as much as a home sleep study.

**Figure 7: Out-of-Pocket Sleep Study Costs**



One of the impacts on how much a driver will pay out-of-pocket for sleep study costs is insurance and motor carrier coverage of some or all of the costs (Table 4).

<sup>17</sup>Bureau of Labor Statistics (May 2015). *Occupational Employment Statistics*. Accessed May 24, 2016. Available Online: [http://www.bls.gov/oes/current/naics4\\_484100.htm](http://www.bls.gov/oes/current/naics4_484100.htm)

<sup>18</sup> The individual effects of each of these factors was not investigated due to the relatively small number of drivers that specified how much they paid out-of-pocket.



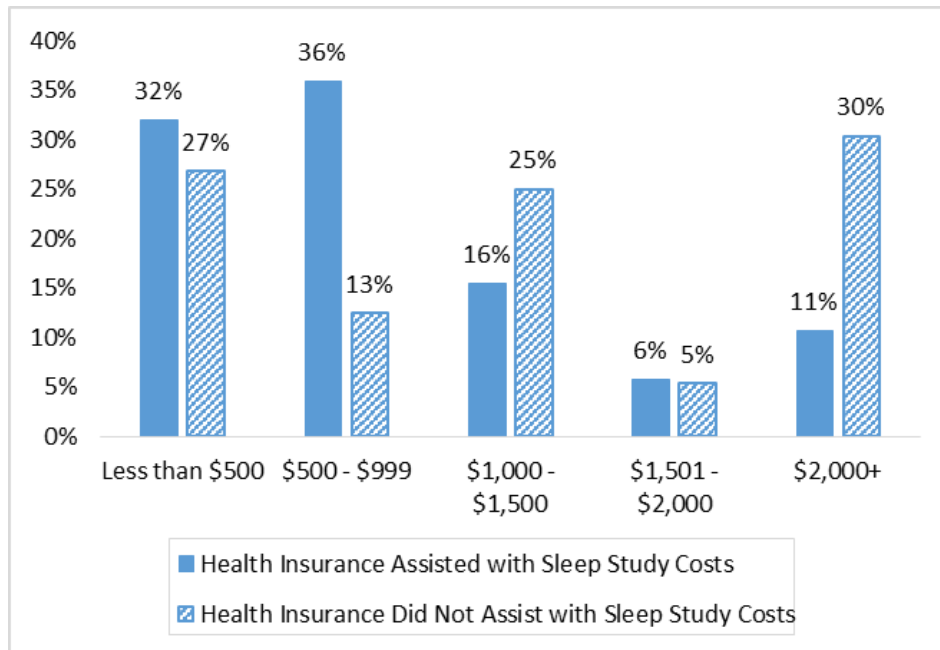
**Table 4: Health Insurance and Carrier Coverage of Sleep Study Costs**

<b>Did your health care insurance cover any sleep study costs?</b>				
	<b>Yes</b>	<b>No</b>	<b>Not Applicable</b>	<b>Don't Know</b>
<b>Employee Driver</b>	67%	19%	3%	11%
<b>O-O/I-C leased to a motor carrier</b>	50%	33%	9%	7%
<b>Did your carrier cover any sleep study costs?</b>				
	<b>Yes</b>	<b>No</b>	<b>Not Applicable</b>	<b>Don't Know</b>
<b>Employee Driver</b>	15%	71%	12%	3%
<b>O-O/I-C leased to a motor carrier</b>	10%	77%	9%	4%

Employee drivers were more likely to have health insurance coverage of their sleep study (67%) than O-O/I-C leased to a motor carrier (50%).<sup>19</sup> Health insurance assistance with sleep study costs impacted driver out-of-pocket costs significantly – 61 percent of drivers with no health care coverage of their sleep study incurred out-of-pocket costs exceeding \$1,000 compared to 32 percent of drivers whose health insurance did cover some portion of the sleep study with costs exceeding \$1,000 (Figure 8).

<sup>19</sup> O-O with their own authority are omitted due to low response levels – only 34 O-O with their own authority provided information on whether their health insurance covered their sleep study.

**Figure 8: Sleep Study Costs, by Health Insurance Coverage of a Sleep Study**



Carrier assistance with sleep study costs was not common among employee drivers and drivers leased to a motor carrier (15% and 10%, respectively). Other costs that drivers reported include:

- CPAP purchases not covered by health insurance;
- CPAP supplies that require replacement;
- Time taken off of work to complete a sleep study; and
- Instances where drivers were required to take multiple sleep studies.

Of the 196 drivers specifying the number of days they may have missed work due to OSA-related activities, 53 percent did not miss any days of work, 24 percent missed one to three days, 17 percent missed four to 30 days, and six percent missed more than 30 days. The upper extreme of more than 30 days is most likely attributable to delays created by sleep study wait lists and the amount of time required to demonstrate compliance prior to medical recertification. Some drivers noted that their insurance reimbursement for the CPAP machine was dependent on treatment compliance.

### *OSA Diagnosis and Treatment*

The sleep study diagnoses of respondents are shown in Figure 9. The apnea hypopnea index (AHI) is the number of times an individual stops breathing per hour of sleep and measures OSA severity.<sup>20</sup> AHI as high as 100 were reported by survey respondents. A majority of respondents who reported participating in a sleep study (85%) were diagnosed with OSA of varying

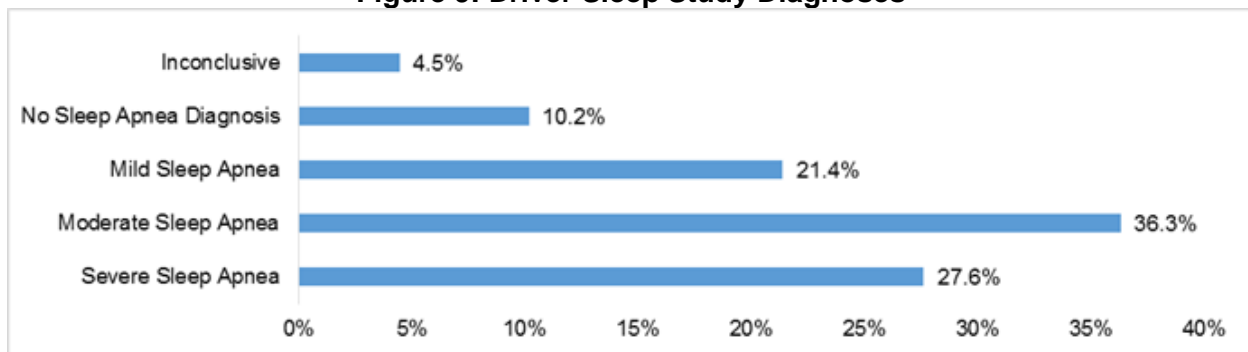
<sup>20</sup> No OSA is defined as an AHI of less than 5, mild OSA as an AHI between 5 and 15, moderate OSA as an AHI between 15 and 30 and severe OSA as an AHI of more than 30.

severities. Drivers in this sample who have had a sleep study likely exhibit multiple risk factors for OSA that led to the sleep study referral, therefore the “prevalence” figures reported here are **not** representative of the truck driver population at large.

Additionally, the drivers completing OSA surveys self-selected to participate, potentially introducing some bias. Under current FMCSA guidelines, only the drivers with moderate to severe OSA would require treatment. In this sample of 408 drivers that completed a sleep study, 64 percent of drivers would require OSA treatment for medical certification, 36 percent would not.

Of the 41 drivers who reported receiving a diagnosis of no sleep apnea, 28 percent reported that they are still referred to sleep studies regularly. The most commonly reported frequency of referral to another sleep study was every two years or every DOT physical.

**Figure 9: Driver Sleep Study Diagnoses**



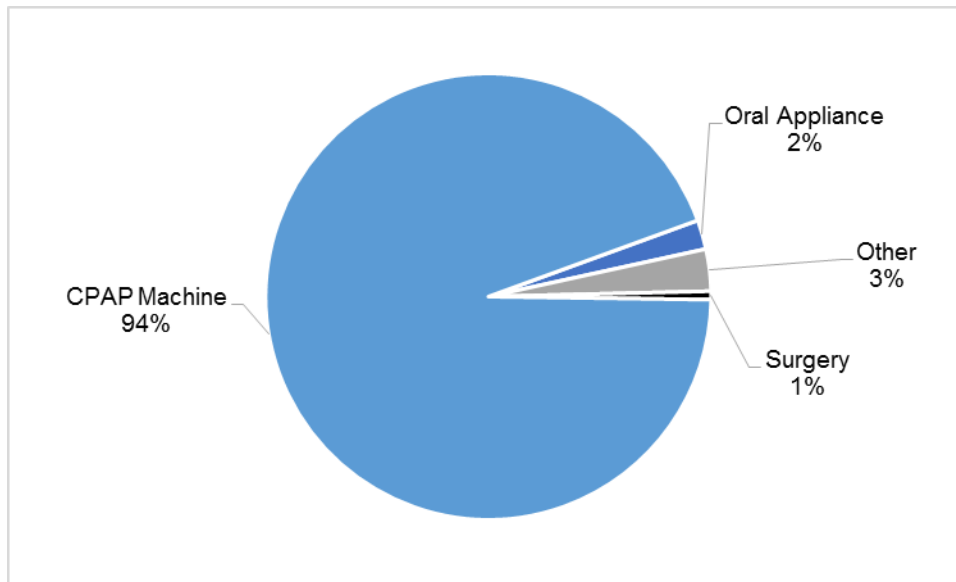
Sleep study results, stratified by age, are shown in Table 5. Sleep study results for drivers 50 years old or younger were more likely to indicate no OSA or inconclusive results (20%) relative to drivers aged 51 or older (10%). Sleep studies resulting in diagnoses of moderate-to-severe OSA occurred in 69 percent of drivers 51 years of age or older, and 58 percent of drivers 50 years of age or younger. Again, these drivers likely exhibited OSA risk factors that led to their sleep study referral, so these figures are **not** reflective of the truck driver population at large.

**Table 5: Sleep Apnea Diagnosis by Age**

Age	Inconclusive / No OSA Diagnosis	Mild OSA	Moderate OSA	Severe OSA
50 or Younger	20%	22%	29%	29%
51+	10%	21%	42%	27%

Figure 10 displays the prescribed OSA treatments for survey respondents. The overwhelming majority of respondents (94 percent) were treated using CPAP machines, which is common in the trucking industry due to the need for compliance monitoring. The “other” responses that were specified typically indicated that the respondent had received multiple, different treatment types.

**Figure 10: Prescribed Treatment Types**



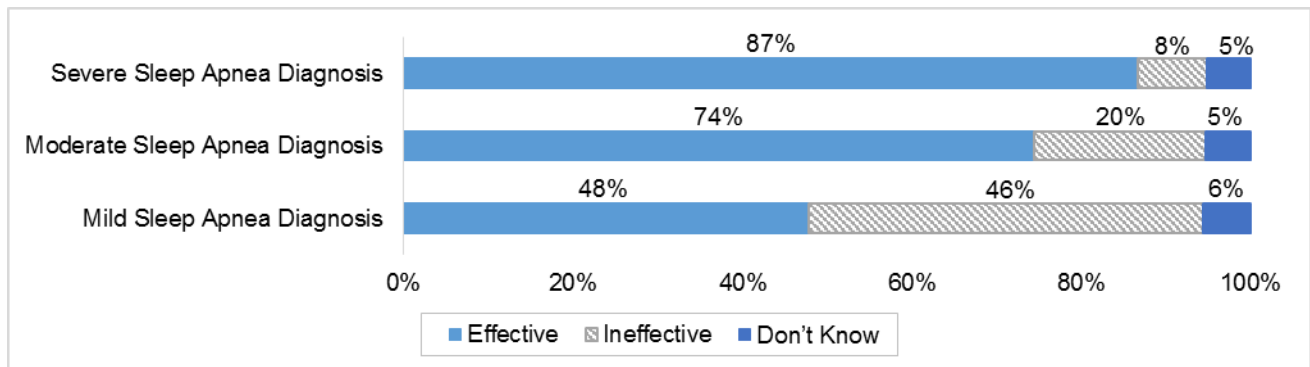
Respondents were asked whether they believe that the prescribed OSA treatment is effective. Of respondents using CPAP machines, 72 percent found treatment effective, 21 percent did not find treatment effective, and 7 percent were not sure if treatment was effective.<sup>21</sup> With almost a quarter of CPAP machine-treated drivers reporting that they believe their treatment is ineffective, treatment option flexibility will be an important component of any proposed rule.

Drivers treating their OSA with CPAP machines for more than one year were almost twice as likely to find their treatment effective (82%) than drivers who have been using CPAP treatment for less than one year (45%). The reason for this relationship is unknown; possible explanations could include drivers becoming accustomed to the CPAP treatment over time or certain drivers finding the treatment ineffective and quitting the CPAP treatment regimen.

The need for treatment flexibility is further demonstrated by the relationship between OSA severity and perceived treatment efficacy (Figure 11). Drivers with moderate and severe OSA in the ATRI sample were more likely to find their CPAP treatment effective (74% and 87% respectively) than drivers with mild OSA (48%).

<sup>21</sup> Due to the small number of individuals treating OSA with oral appliances, surgery, or another treatment, this analysis omits reporting the individual efficacy of each of treatment.

**Figure 11: Driver-Reported CPAP Treatment Efficacy by OSA Severity**



The specific effects of CPAP treatment for respondents, stratified by OSA severity, are reported in Table 6. Generally, drivers experienced more positive effects of CPAP treatment the more severe their OSA diagnosis. Drivers diagnosed with severe OSA experienced largely positive effects from CPAP treatment, reporting increased amounts of sleep (71%), feeling better when they wake up (84%), and lower blood pressure (75%). Half of drivers with severe OSA also reported losing weight after treating their OSA with a CPAP device (50%). Positive effects of CPAP treatment were evident in drivers with moderate OSA, but less pronounced than the effects CPAP treatment had on drivers with severe OSA. Roughly half of drivers with moderate OSA experienced improvements in sleep, with 54 percent sleeping more and 75 percent feeling better when they wake up.

Conversely, many drivers with mild OSA did not experience improvements in sleep. Less than half of drivers in the sample with mild OSA reported sleeping more (32%) or feeling better when they woke up (44%). Often, the CPAP treatment had a negative effect on sleep for drivers with mild OSA – 26 percent did not feel better when they woke up and 43 percent slept less. Similarly, studies on CPAP treatment for mild OSA have found that while CPAP treatment reduces AHI, objective measures of sleepiness did not improve.<sup>22</sup>

CPAP treatment was the dominant form of treatment prescribed to drivers in the ATRI sample with mild OSA (91%), even though no regulations require the treatment of mild OSA in commercial drivers. Often, it is recommended that mild OSA be treated with conservative measures – sleeping on your side, quitting smoking and drinking alcohol, and losing weight.<sup>23 24</sup> However, conservative treatment options do not allow for compliance monitoring. The prevalence of CPAP treatment, which is more costly than the conservative treatment approach and often does not improve sleep in drivers with mild OSA suggests that treatment flexibility is

<sup>22</sup> Gay P, Weaver T, Loubé D, Iber C, et al. Evaluation of positive airway pressure treatment for sleep related breathing disorders in adults. A Review by the Positive Airway Pressure Task Force of the Standards of Practice Committee of the American Academy of Sleep Medicine. *Sleep* 2006;29:381-401. Available Online:

[http://www.aasmnet.org/resources/practiceparameters/review\\_positiveairwaypressure.pdf](http://www.aasmnet.org/resources/practiceparameters/review_positiveairwaypressure.pdf)

<sup>23</sup> Obstructive Sleep Apnea Treatments. (n.d.) Mayo Clinic. Accessed May 20, 2016.

<http://www.mayoclinic.org/diseases-conditions/obstructive-sleep-apnea/basics/treatment/con-20027941>

<sup>24</sup> Sleep Apnea. (n.d.) Cleveland Clinic. Accessed May 20, 2016.

[http://my.clevelandclinic.org/services/neurological\\_institute/sleep-disorders-center/disorders-conditions/hic-sleep-apnea](http://my.clevelandclinic.org/services/neurological_institute/sleep-disorders-center/disorders-conditions/hic-sleep-apnea)

paramount to any success that OSA regulations in commercial drivers will have on reducing fatigued driving.

**Table 6: CPAP Treatment Effects by OSA Severity**

	OSA Severity	Agree	Disagree	Don't Know	No Change
<b>My blood pressure has decreased</b>	Mild OSA	0%	0%	14%	86%
	Moderate OSA	30%	0%	0%	70%
	Severe OSA	75%	0%	0%	25%
<b>Amount of sleep has increased</b>	Mild OSA	32%	43%	0%	25%
	Moderate OSA	54%	23%	1%	22%
	Severe OSA	71%	13%	2%	13%
<b>My weight has decreased</b>	Mild OSA	29%	0%	14%	57%
	Moderate OSA	50%	10%	0%	40%
	Severe OSA	50%	25%	0%	25%
<b>I feel better when I wake up</b>	Mild OSA	44%	26%	1%	28%
	Moderate OSA	75%	13%	0%	13%
	Severe OSA	84%	3%	1%	12%

The survey also gathered information on OSA compliance review. Of drivers treating their OSA with CPAP machines, 75 percent are reviewed by their CME for treatment compliance and 27 percent are reviewed by their employer for treatment compliance. Over half of drivers (66%) using CPAP treatment reported that their carrier did not have restrictive idling policies that prevented them from powering their CPAP machines on the road. However, local idling laws may impose additional barriers to powering CPAP machines on the road.<sup>25</sup>

Recently research on the potential crash safety risk associated with not adhering to OSA treatment indicated that truck drivers who did not adhere (at all) to their prescribed treatment regimen were five times more likely to be involved in a preventable, DOT-reportable crash.<sup>26</sup> However, in this ATRI survey research, the number of moderate to severe truck driver respondents who indicated that they were not adhering to their treatment regimen was six out of 307 respondents, or 1.95 percent.

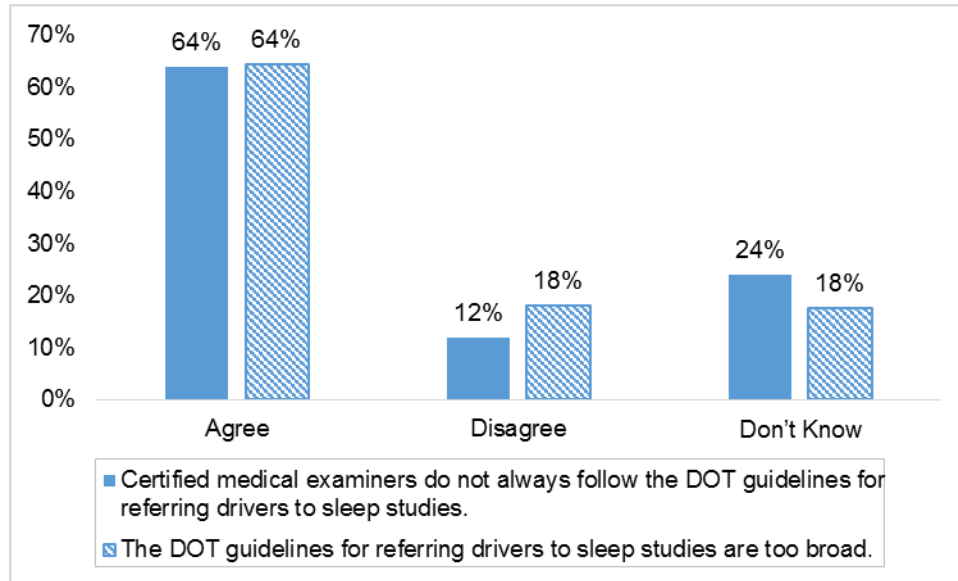
#### *Driver Opinions of Current OSA Guidelines and Guideline Implementation*

Finally, drivers were queried on their opinions on current OSA screening guidelines and whether CMEs follow these guidelines (Figure 12). Over half of drivers think OSA guidelines for sleep study referrals are too broad (64 percent) and that these guidelines are not always followed by CMEs (64 percent). The prevalence of drivers with mild OSA who reported being treated with CPAP devices, even though treatment is not required for mild OSA, corroborates these findings.

<sup>25</sup> For more information on local idling regulations, visit: <http://atri-online.org/2014/10/20/idling-regulations-compendium/>

<sup>26</sup> Burks, S.V.; Anderson, J.E.; Bombyk, M.; Haider, R.; Ganzhorn, D.; Jiao, X.; Lewis, C.; Lexvold, A.; Liu, H.; Ning, J.; Toll, A.; Hickman, J.S.; Mabry, E.; Berger, M.; Malhotra, A.; Czeisler, C.A.; Kales, S.N. (March 2016). Non-Adherence with Employer-Mandated Sleep Apnea Treatment and Increased Risk of Truck Crashes. Sleep.

**Figure 12: Driver Opinions of OSA Guidelines and Implementation of OSA Guidelines**



### 3.3 Open-Ended Responses

At the end of each of the two surveys, there was a section for drivers to include any thoughts that were not captured in the other survey questions. These responses have been grouped together based on numerous commonalities between the two surveys. Common concerns and comments included:

- Of drivers diagnosed and receiving treatment, there were many that were happy with the positive impact that treatment has had on their health. However, not all drivers reported experiencing health improvements from their treatments. Given that the predominant treatment method among survey respondents was CPAP (94%), flexibility of treatment options was desired from these drivers.
- The significant cost of OSA diagnosis and treatment.
- The use of BMI and neck circumference to refer drivers to sleep studies, often without regard to other indicators like daytime fatigue.
- The issues of medical recertification – whether a CME would accept previous sleep study results and whether medical certification was issued for adequate time to get a sleep study.
- Other conditions truck drivers face may cause fatigue more than OSA – particularly irregular sleep schedules and hours-of-service regulations.
- Company policy and anti-idling laws can interfere with CPAP compliance.
- CME abuse of an OSA regulation by referring patients to sleep studies at a clinic the CME has a vested interest in and using medical certification as collateral.
- Issues at a sleep clinic, such as being forced to sleep on their back or not being offered treatment options other than CPAP machines.



## **4.0 CONCLUSIONS**

**Rationale for OSA Rulemaking:** As FMCSA moves forward with a potential OSA rulemaking, several key factors will need to be addressed. First, there are conflicting studies linking OSA to crash risk, with FMCSA's own research failing to find any association between OSA and crash risk.<sup>27, 28</sup> And, among ATRI survey respondents, 21 percent do not believe that untreated OSA significantly affects safety outcomes. FMCSA will need to clearly link the regulating of OSA screening and treatment with safety outcomes as part of its Regulatory Impact Analysis (RIA). Additionally, as part of that RIA, FMCSA will need to quantify the affected population of drivers. The most recent study available on sleep apnea prevalence among commercial drivers is now nearly 15 years old and it identified a small percentage of drivers (10.5%) who would require treatment according to FMCSA's guidelines.

**Driver Acceptance of Sleep Study Referral Criteria:** Of drivers who have not completed a sleep study, almost half believe that neck circumference and BMI are not potential indicators of OSA (48% and 45%, respectively). The free responses of drivers echoed this lack of support for the use of BMI and neck circumference to refer drivers to sleep studies. These indicators are frequently used as a metric in OSA screening tools as objective, physical measures. Transparency regarding how and why neck circumference and BMI are used to determine if a driver meets the criteria for sleep study referral may abate some reservations about their use in OSA risk assessments.

**Driver Sleep Study Costs Are Significant:** The cost of a sleep study needed to diagnose a driver with OSA is significant, with drivers in this sample reporting, on average, over \$1,000 in out-of-pocket costs. The financial impact of sleep study costs on commercial drivers is illustrated by considering truck driver wages in relation to sleep study costs – average (\$1,220) sleep study costs as reported by drivers in the ATRI sample exceed the weekly median truck driver wages in 2015, \$805.<sup>29</sup> These costs are also extremely varied, depending on who pays the sleep study costs, what type of sleep study a driver takes, whether a driver is insured, whether a driver's insurance covers sleep studies, and how high a driver's deductible is. These costs may be mitigated by allowing drivers to take home sleep studies, which cost less than in-lab studies. Additionally, use of home sleep studies may reduce other costs that drivers incur to complete a sleep study, such as reducing the time a driver takes off work to complete a sleep study and potential travel to reach a sleep clinic.

**OSA Screening Procedures Must Be Clarified:** Per FMCSA guidelines on OSA, the drivers with moderate-to-severe OSA must manage their condition to meet medical qualifications. In ATRI's sample 36 percent of drivers who completed sleep studies did not meet the criteria of requiring OSA treatment. These drivers were diagnosed with mild sleep apnea, no sleep apnea, or received inconclusive results from their sleep study but also paid for a costly sleep study and in some cases treatment costs. Standard, effective screening procedures for OSA

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<sup>27</sup> Burks, S.V.; Anderson, J.E.; Bombyk, M.; Haider, R.; Ganzhorn, D.; Jiao, X.; Lewis, C.; Lexvold, A.; Liu, H.; Ning, J.; Toll, A.; Hickman, J.S.; Mabry, E.; Berger, M.; Malhotra, A.; Czeisler, C.A.; Kales, S.N. (March 2016). Non-Adherence with Employer-Mandated Sleep Apnea Treatment and Increased Risk of Truck Crashes. *Sleep*.

<sup>28</sup> Barr, L.C.; Boyle, L.; Maislin, G. (2004). *Sleep Apnea Crash Risk Study*. Volpe National Transportation Systems Center. Federal Motor Carrier Safety Administration.

<sup>29</sup> Bureau of Labor Statistics (May 2015). *Occupational Employment Statistics*. Accessed May 24, 2016. Available Online: [http://www.bls.gov/oes/current/naics4\\_484100.htm](http://www.bls.gov/oes/current/naics4_484100.htm)



must be developed to reduce the number of drivers completing unnecessary sleep studies and paying the costs associated with sleep studies.

**CPAP Machines Are Not Effective For Treating All Drivers:** Almost a quarter of drivers treating their OSA with CPAP machines (21%) did not find their treatment effective. Additionally, drivers reported varying levels of CPAP treatment efficacy related to OSA severity, with CPAP treatment generally being more effective for more severe OSA. Most drivers with mild OSA in this sample treated their OSA with CPAP machines (91%). Less than half of drivers with mild OSA experienced improved sleep as a result of CPAP treatment, with only 32 percent reporting increased amounts of sleep and 44 percent reported feeling better when they woke up. Often, drivers with mild OSA found CPAP treatment detrimental or had no effect on their sleep quality. The use of a costly and often ineffective treatment for drivers with mild OSA may not improve roadway safety. Flexibility in OSA treatment options may reduce the number of OSA-affected drivers who find their treatment ineffective. Prescribed treatments should consider the severity of OSA.

**Non-Adherence to Treatment Regimen.** While outside research may indicate higher crash risk associated with non-adherence to prescribed OSA treatment (partial adherence had no increased safety risk), the number of non-adherent drivers (1.95%) is relatively small according to the ATRI survey data.<sup>30</sup>

**Medical Recertification:** Addressing medical recertification concerns in the rulemaking is important to allow drivers adequate time to get a sleep study if necessary and to prevent drivers who receive a diagnosis of no OSA from being forced to complete multiple costly sleep studies. OSA-related medical recertification issues have the potential to disrupt driver financial stability significantly – with consequences such as unemployment until a sleep study is completed and CPAP compliance is demonstrated or a driver being forced to regularly undergo sleep studies to repeatedly prove that they do not have OSA.

**Preventing Conflicts of Interest:** Conflicts of interest with CMEs, clinics, or sleep specialists profiting from driver sleep study referrals and CPAP sales must be addressed to prevent abuse of potential OSA regulations. This was one of the primary concerns expressed in the free response portion of both surveys.

As a next step in OSA-focused research, ATRI will survey motor carriers to collect data on the impact a potential OSA rulemaking would have on motor carriers. This survey will focus primarily on OSA-related costs, insurance implications, health and wellness programs, and carrier-specific OSA policies.

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<sup>30</sup> Burks, S.V.; Anderson, J.E.; Bombyk, M.; Haider, R.; Ganzhorn, D.; Jiao, X.; Lewis, C.; Lexvold, A.; Liu, H.; Ning, J.; Toll, A.; Hickman, J.S.; Mabry, E.; Berger, M.; Malhotra, A.; Czeisler, C.A.; Kales, S.N. (March 2016). Non-Adherence with Employer-Mandated Sleep Apnea Treatment and Increased Risk of Truck Crashes. *Sleep*.

## Appendix A: Survey for Drivers Who Have Not Completed a Sleep Study

1. What is your gender?
  - Male
  - Female
  
2. What is your age?
  - Younger than 25
  - 25 – 35
  - 36 – 50
  - 51 – 64
  - 65+
  
3. Which of the following best describes your employment? (*check one*)
  - Employee Driver
  - Owner-Operator (O-O) with own authority
  - Independent Contractor (I-C) leased to a motor carrier
    - a. If Employee Driver or Independent Contractor leased to a motor carrier, does your carrier have a defined sleep apnea policy?
      - Yes
      - No
      - Don't Know
  
    - b. If Employee Driver or Independent Contractor leased to a motor carrier, is the certified medical examiner or clinic you go to chosen by your carrier?
      - Yes
      - No
      - Don't Know

**Please answer the following questions based on what you think about sleep apnea among commercial drivers.**

- |   |   |
|---|---|
| <ol style="list-style-type: none"><li>4. The percentage of commercial drivers with sleep apnea is:<ul style="list-style-type: none"><li><input type="checkbox"/> 0 – 25%</li><li><input type="checkbox"/> 26 – 50%</li><li><input type="checkbox"/> 51 – 75%</li><li><input type="checkbox"/> 75 – 100%</li><li><input type="checkbox"/> Don't Know</li></ul></li></ol> | <ol style="list-style-type: none"><li>5. The following indicate the presence of sleep apnea (check all that apply):<ul style="list-style-type: none"><li><input type="checkbox"/> Loud Snoring</li><li><input type="checkbox"/> Neck Circumference greater than 17 Inches</li><li><input type="checkbox"/> Partner Observing Pauses in Breathing During Sleep</li><li><input type="checkbox"/> Body Mass Index (BMI) greater than 35</li><li><input type="checkbox"/> Daytime Sleepiness</li><li><input type="checkbox"/> All of the Above</li><li><input type="checkbox"/> None of the Above</li></ul></li></ol> |
|---|---|

6. To be diagnosed with sleep apnea requires an overnight stay in a sleep lab:
- True
  - False
7. Please estimate the cost of a test in a sleep lab:
- Less than \$500
  - \$500 - \$1,000
  - \$1,000
  - \$1,000 - \$2,000
  - \$2,000+
8. A Continuous Positive Airway Pressure (CPAP) machine is the only way to be treated for sleep apnea:
- True
  - False
9. Please estimate the cost of a CPAP machine:
- Less than \$500
  - \$500 - \$1,000
  - \$1,000 - \$2,000
  - \$2,000+
10. The following are potential complications associated with untreated sleep apnea (check all that apply):
- Daytime Fatigue
  - Increased Crash Risk
  - High Blood Pressure
  - Liver Complications
  - Type-2 Diabetes
  - All of the Above
  - None of the Above
  - Other (please specify): \_\_\_\_\_

**Thank you! We greatly appreciate your participation. If you have any additional thoughts about commercial driver sleep apnea, please write them below:**

## Appendix B: Survey for Drivers Who Have Completed a Sleep Study

1. What is your gender?
    - Male
    - Female
  
  2. What is your age?
    - Younger than 25
    - 25 – 35
    - 36 – 50
    - 51 – 64
    - 65+
  
  3. Which of the following best describes your employment? (*check one*)
    - Employee Driver
    - Owner-Operator (O-O) with own authority
    - Independent Contractor (I-C) leased to a motor carrier
- Please answer the following questions based on what you think about the current practices for referring drivers to sleep studies.**
4. The DOT guidelines for referring drivers to sleep studies are too broad.
    - Agree
    - Disagree
    - Don't Know
  
  5. Certified medical examiners do not always follow the DOT guidelines for referring drivers to sleep studies.
    - Agree
    - Disagree
    - Don't Know
- Please answer the following questions regarding your personal experience with sleep apnea testing, diagnosis, treatment, and the associated costs.**
6. Who referred you for your sleep study?
    - Primary Care Physician
    - Certified Medical Examiner
    - Other (please specify): \_\_\_\_\_
  
  7. When referred for a sleep study, I got a second opinion on the need for the study:
    - Yes
    - No

8. If Employee Driver or Independent Contractor leased to a motor carrier, does your carrier have a defined sleep apnea policy?
  - Yes
  - No
  - Don't Know
  - Not Applicable
  
9. If Employee Driver or Independent Contractor leased to a motor carrier, is the certified medical examiner or clinic you go to chosen by your carrier?
  - Yes
  - No
  - Not Applicable
  
10. What type of sleep study did you complete?
  - In-Lab Test (spent the night in a sleep clinic, hospital or other testing facility)
  - Home Sleep Test
  
11. Did you pay any out-of-pocket costs for the sleep study?
  - Yes, amount paid out of pocket: \$ \_\_\_\_\_
  - No
  - Don't Know
  
12. Did your insurance cover any of the sleep study costs?
  - Yes
  - No
  - Don't Know
  - Not Applicable
  
13. Did your carrier cover any of the sleep study costs?
  - Yes
  - No
  - Don't Know
  - Not Applicable
  
14. What were the results of your sleep study?
  - No Sleep Apnea Diagnosis
  - Mild Sleep Apnea Diagnosis
  - Moderate Sleep Apnea Diagnosis  
If you know your AHI number, enter here: \_\_\_\_\_
  - Severe Sleep Apnea Diagnosis
  - Inconclusive

**IF NO SLEEP APNEA DIAGNOSIS**, do certified medical examiners continue to refer you to sleep studies?

- Yes  
 How often have you been referred to sleep studies? \_\_\_\_\_  
 No

**IF YOU WERE DIAGNOSED WITH MILD, MODERATE OR SEVERE SLEEP APNEA, PLEASE COMPLETE QUESTIONS 15-24.**

15. What treatment was prescribed?

- Treatment with a machine (e.g Continuous Positive Airway Pressure or CPAP machine)  
 Oral Appliance  
 Surgery  
 Other (please specify): \_\_\_\_\_

16. How long have you been treating your sleep apnea since diagnosis?

- Less than 6 months  
 6 months – 1 year  
 1+ years – 5 years  
 More than 5 years  
 I am currently not treating my sleep apnea

17. Do you believe this treatment was effective?

- Yes  
 No  
 Don't Know

18. Since starting treatment, I have experienced the following:

<b>I feel better when I wake up</b>	Agree <input type="checkbox"/>	Disagree <input type="checkbox"/>	No Change <input type="checkbox"/>	Don't Know <input type="checkbox"/>
<b>Amount of sleep has increased</b>	Agree <input type="checkbox"/>	Disagree <input type="checkbox"/>	No Change <input type="checkbox"/>	Don't Know <input type="checkbox"/>
<b>My weight has decreased</b>	Agree <input type="checkbox"/>	Decrease <input type="checkbox"/>	No Change <input type="checkbox"/>	Don't Know <input type="checkbox"/>
<b>My blood pressure has decreased</b>	Agree <input type="checkbox"/>	Decrease <input type="checkbox"/>	No Change <input type="checkbox"/>	Don't Know <input type="checkbox"/>

19. Does your carrier cover any treatment costs?

- Yes  
 No  
 Don't Know  
 Not Applicable

22. At recertification exams, does the certified medical examiner review your compliance data?

- Yes  
 No  
 Don't Know

20. Does your insurance cover any treatment costs?

- Yes  
 No  
 Don't Know  
 Not Applicable

23. Does your carrier review your compliance data?

- Yes  
 No  
 Don't Know

21. How much time off work or other non-treatment costs have you incurred since your diagnosis?

- Time Off Work \_\_\_\_\_ Days  
 Other Costs \$ \_\_\_\_\_  
 Don't Know

24. Are there carrier policies or regulations in place that make it more difficult for you to adhere to your treatment (e.g. anti-idling policies/regulations that prevent you from running your CPAP)?

- Yes  
 No  
 Don't Know

**Thank you! We greatly appreciate your participation. If you have any additional thoughts about commercial driver sleep apnea, please write them here or on the back of this sheet of paper:**