



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Research and Engineering
Washington, DC

Medical Factual Report

September 27, 2017

Mary Pat McKay, MD, MPH
Chief Medical Officer

A. ACCIDENT: HWY17MH005; Palm Springs, CA

Location: Westbound Interstate 10 (I-10) in the vicinity of post mile marker 32.5, near Palm Springs, Riverside County, California

Vehicle #1: 1996 MCI Motorcoach

Operator #1: USA Holiday Inc.

Vehicle #2: 2015 International Prostar Truck in combination with a 2013 Utility 3000 R Semi-trailer

Operator #2: TSC, Tri-State Collision, LLC

Date: October 23, 2016

Time: Approximately 05:16 a.m. Pacific Daylight Time (PDT)

Transported: 30 Motorcoach Passengers, 1 Truck Driver

Fatalities: 12 Motorcoach Passengers, 1 Motorcoach Driver

B. GROUP IDENTIFICATION

No group was formed for the medical evaluation in this accident.

C. RELEVANT REGULATION AND MEDICAL GUIDANCE

Title 49 *Code of Federal Regulations* (CFR) Section 391.41 covers driver physical qualifications; interstate drivers of commercial vehicles must undergo routine medical evaluation and certification using forms available from 49 CFR Section 391.43 which include questions about previous medical conditions, current conditions, medications, a physical examination including vital signs, vision testing, and urine dip testing.

Diabetes

Diabetes is a group of diseases resulting in elevated blood glucose. In type 1 diabetes, the body's production of insulin is severely impaired; this requires treatment with replacement insulin. In type 2 diabetes body does not produce enough insulin or use insulin well enough. Type 2 diabetes can be treated with diet alone, or a number of oral and injectable medications, but some patients may require insulin for glucose control. Commercial drivers may be certified to drive as long as he or she, "Has no established medical history or clinical diagnosis of diabetes mellitus currently requiring insulin for control." (49 CFR Section 391.41 (b)(3))

Normal fasting glucose levels range from about 65 to 99 mg/dl. Diabetes is defined as a fasting blood glucose greater than or equal to 126 mg/ml; individuals with glucose between 100 and 125 are considered to have prediabetes.¹ When the blood glucose is higher than about 180-200 mg/dl, the kidney responds by allowing glucose to spill into the urine. Patients with new onset or uncontrolled diabetes often develop increased urination, thirst, fatigue, weight loss, and blurred vision. In severe cases, altered consciousness or coma can develop. Hemoglobin A1C is a measure of the percentage of hemoglobin molecules that have a glucose molecule attached to them (what percentage have been glycosylated). It is used as a measure of average blood glucose over the preceding several weeks. Non-diabetic levels are below 5.4%. Between 5.5% and 6.4% is considered "pre-diabetes" and above 6.5% is diagnostic of diabetes. For diabetic individuals, levels below 7.0% are considered "good control."² Long-term, excessive blood glucose results in progressive damage to small blood vessels of multiple organs including the eyes, nerves, kidneys, and extremities eventually leading to blindness, numbness, kidney failure, and loss of limbs.³

In previously available guidance issued by the Federal Motor Carrier Safety Administration (FMCSA), the 2014 FMCSA Medical Examiner Handbook stated, "Abnormal dip stick readings may indicate a need for further testing. As a medical examiner, you should evaluate the test results and other physical findings to determine the next step. For example, glycosuria may prompt you to obtain a blood glucose test." However, this Handbook is no longer available from the FMCSA website, which now states only that it is "in the process of being updated."⁴ No other information or guidance is readily available from FMCSA regarding best practices for the further evaluation of drivers who test positive for glucose in their urine.

¹ American Diabetes Association, Diagnosis and Classification of Diabetes Mellitus, Diabetes Care 2004 Jan; 27(suppl 1): s5-s10. http://care.diabetesjournals.org/content/27/suppl_1/s5 Accessed 7/19/2016.

² American Diabetes Association, Standards of Medical Care in Diabetes—2016, Volume 39, Supplement 1, January 2016 http://care.diabetesjournals.org/highwire/filestream/5646/field_highwire_adjunct_files/0/2016-Standards-of-Care.pdf Accessed 7/16/2016.

³ American Diabetes Association, Statistics about Diabetes. Prevalence. <http://www.diabetes.org/diabetes-basics/statistics/> Accessed 7/12/2016.

⁴ FMCSA. FMCSA Medical Examiner Handbook <https://www.fmcsa.dot.gov/regulations/medical/fmcsa-medical-examiner-handbook> Accessed 6/26/2017.

As of June 26, 2017, the only instructions regarding drivers with non-insulin treated diabetes provided electronically by FMCSA to drivers and Certified Medical Examiners is in the form of frequently asked questions on the website. The section states, “In all cases, clinical judgment is required. The Medical Examiner decides if the driver's diabetes is adequately controlled, which determines certification, length of certification or disqualification. FMCSA guidelines recommend performing annual examination for vision, neurological function and cardiovascular disease, including hypertension. In general, the diabetic driver should have annual re-certification examinations.”⁵ No other specific details or guidance are given.

Obstructive Sleep Apnea

Obstructive sleep apnea (OSA) occurs when the musculature of the airway relaxes during sleep and obstructs the flow of air into and out of the body during sleep. When carbon dioxide levels in the blood rise as a result, the person arouses from sleep, often gasping. When repeated, these arousals interfere with normal sleep architecture and lead to fatigue.⁶ Based on high quality medical evidence, male gender, age, obesity, hypertension, neck circumference, hip circumference, and episodes of nocturnal gasping are all risk factors for obstructive sleep apnea (OSA).^{7,8,9,10,11} The relationship with obesity is particularly strong; forty to 90 percent of individuals with a body mass index (BMI) above 40 kg/m² are reported have moderate to severe sleep apnea.¹² A 2002 study conducted by the University of Pennsylvania that was sponsored by FMCSA and the American Transportation Research Institute of the American Trucking Associations found that 28 percent of commercial truck drivers had some degree of sleep apnea.¹³

⁵ FMCSA. FAQ's. May a driver who has non-insulin treated diabetes mellitus (treated with oral medication) be certified for 2 years? <https://www.fmcsa.dot.gov/faq/may-driver-who-has-non-insulin-treated-diabetes-mellitus-treated-oral-medication-be-certifi> Accessed 6/26/2017.

⁶ An apneic episode is the complete absence of airflow through the mouth and nose for at least 10 seconds. A hypopnea episode is when airflow decreases by 50 percent for at least 10 seconds or decreases by 30 percent if there is an associated decrease in the oxygen saturation or an arousal from sleep. The apnea-hypopnea index (AHI) sums the frequency of both types of episodes per hour. An AHI of less than 5 is considered normal. An AHI of 5-15 is mild; 15-30 is moderate and more than 30 events per hour is considered severe sleep apnea.

⁷ Peppard PE, Young T, Barnet JH, Palta M, Hagen EW, Hla KM. Increased prevalence of sleep-disordered breathing in adults. *Am J Epidemiol.* 2013;177(9):1006-14.

⁸ Seidell JC. Waist circumference and waist/hip ratio in relation to all-cause mortality, cancer and sleep apnea. *Eur J Clin Nutr.* 2010;64(1):35-41.

⁹ Young T, Shahar E, Nieto FJ, Redline S, Newman AB, Gottlieb DJ, Walsleben JA, Finn L, Enright P, Samet JM; Sleep Heart Health Study Research Group. Predictors of sleep-disordered breathing in community-dwelling adults: the Sleep Heart Health Study. *Arch Intern Med.* 2002;162(8):893-900.

¹⁰ Olson LG, King MT, Hensley MJ, Saunders NA. A Community Study of Snoring and Sleep-disordered Breathing Prevalence. *Am J Respir Crit Care Med* 1995;152:711-6.

¹¹ Young T, Skatrud J, Peppard PE. Risk factors for obstructive sleep apnea in adults. *JAMA.* 2004;291(16):2013-6.

¹² Alan R. Schwartz, Susheel P. Patil, Alison M. Laffan, Vsevolod Polotsky, Hartmut Schneider, Philip L. Smith Obesity and Obstructive Sleep Apnea: Pathogenic Mechanisms and Therapeutic Approaches. *Proc Am Thorac Soc.* 2008; 5(2): 185–192.

¹³ Pack AI, Dinges DF, & Maislin G. (2002). A study of prevalence of sleep apnea among commercial truck drivers (Report No. DOT-RT-02-030). Washington, DC: U.S. Department of Transportation, FMCSA.

Individuals with untreated obstructive sleep apnea are at significantly increased risk of motor vehicle crashes and other occupational injuries.^{14,15,16} A task force created by the American Academy of Sleep Medicine developed a Clinical Guideline for the Evaluation, Management, and Long Term Care of Obstructive Sleep Apnea in Adults which was published in 2009.¹⁷ The task force reached consensus that patients with obesity, congestive heart failure, atrial fibrillation, treatment refractory hypertension, type 2 diabetes, stroke, nocturnal dysrhythmias, pulmonary hypertension, those who were members of high-risk driving populations (such as commercial truck drivers), and those being evaluated for bariatric surgery were either at increased risk of having OSA, having serious complications of OSA, or having undiagnosed OSA complicate their medical care. Patients with any of these conditions or situations were identified as “high risk,” suggesting increased vigilance for the diagnosis.

The FMCSA has been working to address the need to screen, diagnose, and ensure effective treatment for commercial drivers with moderate to severe OSA. Guidance suggested in 2012 led Congress to pass PL 113–45 [HR 3095] on October 15, 2013; Commercial Motor Vehicle Operator Requirements Relating to Sleep Disorders which requires any “requirement providing for the screening, testing, or treatment of individuals operating commercial motor vehicles for sleep disorders is adopted pursuant to a rulemaking proceeding.”¹⁸ Current guidance from FMCSA is not in the form of a requirement. However, recommendations from the FMCSA’s Medical Review Board were updated in August 2016 and include a recommendation that drivers with a BMI \geq 40 kg/m² be further evaluated for sleep disorders. For drivers with a BMI \geq 33 and < 40 kg/m², a formal sleep evaluation is recommended if they meet three or more additional criteria.¹⁹

D. DETAILS OF INVESTIGATION

1. Purpose

This investigation was performed to evaluate the involved drivers for any medical conditions, the use of any medications/illicit drugs, and the presence of any toxins.

¹⁴ A.T. Mulgrew, G. Nasvadi, A. Butt et al. Risk and severity of motor vehicle crashes in patients with obstructive sleep apnoea/hypopnea. *Thorax*. 2008; 63(6):536–541.

¹⁵ E. Lindberg, N. Carter, T. Gislason et al. Role of snoring and daytime sleepiness in occupational accidents. *Am J Respir Crit Care Med*. 2001;164 (11): 2031–2035.

¹⁶ Basoglu OK, Tasbakan MS. Elevated risk of sleepiness-related motor vehicle accidents in patients with obstructive sleep apnea syndrome: a case-control study. *Traffic Inj Prev*. 2014;15(5):470-6.

¹⁷ Adult Obstructive Sleep Apnea Task Force of the American Academy of Sleep Medicine. Clinical Guideline for the Evaluation, Management, and Long Term Care of Obstructive Sleep Apnea in Adults. *J Clin Sleep Med*. 2009;5(3): 263-276.

¹⁸ <https://www.congress.gov/113/plaws/publ45/PLAW-113publ45.pdf> Accessed 6/26/2017.

¹⁹ Letter to FMCSA Administrator Darling from The MOTOR CARRIER SAFETY ADVISORY COMMITTEE and MEDICAL REVIEW BOARD <https://www.fmcsa.dot.gov/sites/fmcsa.dot.gov/files/docs/Final%20MRB%20Task%2016-01%20Letter%20Report%20from%20MCSAC%20and%20MRB.docx> Accessed 6/26/2017.

2. Methods

The CDL records and toxicology results for both drivers, autopsy report for the deceased motorcoach driver, personal medical records for the truck driver, and the investigators reports were reviewed. Attempts were made to obtain personal records for the motorcoach driver but no healthcare provider could be identified.

Motorcoach Driver

Commercial Driver License Medical Exams

The long forms regarding the 59 year old male motorcoach driver's most recent commercial driver license (CDL) medical examination were obtained and reviewed. The exam is dated July 6, 2016. At that time, the driver reported no medical conditions and no medications. His height was recorded as 5'7" and his weight as 242 pounds (BMI= 37.4 kg/m²).²⁰ According to the CME, a chiropractor, the remainder of the physical examination was normal or unremarkable. However, the urine dip test revealed glucose. No additional testing or information was requested but the driver was asked to return for a recheck of his urine before August 20, 2016. He returned on July 7, 2016. At that time, his urine was negative for glucose or any other abnormality and he received a medical certificate valid for 2 years.

Autopsy

According to the autopsy performed at the request of the County of Riverside Sheriff-Coroner, the cause of death was multiple blunt impact injuries.

Examination of the body for natural disease was limited by the severity of the motorcoach driver's injuries; the brain was too damaged to evaluate for underlying disease. The heart weighed 410 grams; this is average for a 243 pound man (range of 311 - 541 grams).²¹ There were focal areas of up to 30% stenosis in the three main coronary arteries but the remainder of the examination of the heart was unremarkable.

Toxicology

Toxicology testing performed at the request of the coroner by BIO-Tox Laboratories was negative for ethanol, methamphetamine, amphetamine, benzodiazepines, cannabinoids, cocaine, morphine/codeine, phencyclidine (PCP) and barbiturates.

²⁰ National Institutes of Health. National Heart, Lung, and Blood Institute. BMI Calculator. https://www.nhlbi.nih.gov/health/educational/lose_wt/BMI/bmicalc.htm Accessed 6/26/2017.

²¹ Kitzman DW, Scholz DG, Hagen PT, Ilstrup DM, Edwards WD. Age-related changes in normal human hearts during the first 10 decades of life. Part II (Maturity): A quantitative anatomic study of 765 specimens from subjects 20 to 99 years old. Mayo Clinic Proc., 1988. 63(2): p. 137-46.

Toxicology testing performed at the request of the NTSB by the FAA's Bioaeronautical Sciences Research Laboratory did not identify any tested-for drugs.²² However, clinical testing identified a hemoglobin A1C of 11.4% in blood and 281 mg/dl of glucose in the urine, indicating poorly controlled diabetes. (See Human Performance Report Attachment 3: FAA Toxicology Report.)

Personal Medical Information

According to interviews with the motorcoach driver's son, he had no regular physician and was not known to have any medical problems or use any medications. (See Human Performance Report Attachment 4: MCI driver's son interview transcript.)

Post-Crash Actions

The NTSB reported the CME's decision to simply retest the motorcoach driver's urine without performing additional tests or requiring a physician to evaluate him for diabetes to the FMCSA. Their investigation into this decision is ongoing.

Truck Driver

Commercial Driver License Medical Exams

The long forms regarding a CDL examination performed on the 50 year old male truck driver by "TeamCME" on January 13, 2015 were obtained and reviewed. The driver reported only the loss of the distal half of his left long finger in 1996. He answered "no" to the historical question which asks, "sleep disorders, pauses in breathing while asleep, daytime sleepiness, loud snoring." His height was recorded as 6'2" and his weight as 350 pounds. The examiner noted the missing finger and circled "marked overweight" for the driver but the remainder of the examination was normal or unremarkable. No neck or hip circumference was documented and his BMI was not calculated. His medical certificate was marked valid for 2 years.

Toxicology

Toxicology testing performed as required by DOT regulation found no alcohol in the truck driver's breath at 9:39 am on the day of the accident and found no tested-for drugs in the driver's urine collected at 11:21 am on the day of the accident.²³ (See Human Performance Report Attachment: 2015 International Driver Post-crash Toxicology.)

²² The labs tests for more than 1300 substances including common prescription and over the counter medications as well as illicit drugs. See: <http://jag.cami.jccbi.gov/toxicology/default.asp?offset=0> for a complete listing.

²³ Tested substances provide evidence of use of the following 11 substances: amphetamine, methamphetamine, MDMA, MDA, MDEA, tetrahydrocannabinol (THC, the active compound in marijuana), cocaine, codeine, morphine, heroin, and phencyclidine (PCP).

Personal Medical Records

Records were obtained from the 50 year old male truck driver's personal physician for three visits: October 13, 2014, December 11, 2014, and April 25, 2015. At each of these visits the truck driver was documented to be 6'2" tall and weigh 385 or 390 pounds. His body mass index (BMI) was calculated on each visit in the record as 49.23 kg/m² or 50.07 kg/m² (placing him in the morbidly obese category).²⁴

Each of these visits were for minor skin infections that were treated with antibiotics. In addition, the truck driver received a diagnosis of morbid obesity. Each time, he was asked to follow up with the physician in two weeks but did not do so.

Post Accident Testing

Following the accident, the truck driver was informed by the FMCSA that his medical certificate was invalid (the certified medical examiner, a physician, had been decertified and charged with providing certificates without performing examinations) and he underwent a CDL medical examination with a different CME. According to the long form from that examination, dated January 4, 2017, the truck driver reported only the previous partial finger amputation. His weight was recorded as 355 pounds and the remainder of the physical examination was normal or unremarkable. The CME who performed the exam, a chiropractor, noted he was "moderately obese, recommended usual physical by PCP (primary care provider)." No neck circumference or hip circumference was measured and the BMI was not calculated.

Post-Crash Actions

The NTSB reported the CME's failure to fully evaluate the truck driver for OSA during his January 2017 certification exam to the FMCSA. Their investigation of the CME's decision is ongoing. In addition, the NTSB approached the truck driver to obtain an evaluation by a sleep specialist sleep study after the accident. As of June 27, 2017, the driver had not responded to this request.

E. SUMMARY OF MEDICAL FINDINGS

The 59 year old male motorcoach driver had reported no medical conditions and no medications on his most recent commercial driver license (CDL) medical examination, dated July 6, 2016. At that time, his height was recorded as 5'7" and his weight as 242 pounds (BMI= 37.4 kg/m²). His urine dip test revealed glucose on July 6 but a repeat test was negative on the following day. He received a medical certificate valid for 2 years. Post accident toxicology testing was negative for any tested-for substances but clinical testing identified glucose in urine and a hemoglobin A1C of 11.4%, indicating the

²⁴ Morbid obesity is defined as weighing more than twice the ideal weight for a given height. See: Morbid obesity. Dictionary.com. The American Heritage Science Dictionary. Houghton Mifflin Company. <http://www.dictionary.com/browse/morbid-obesity> (accessed: February 22, 2017).

motorcoach driver had poorly controlled diabetes at the time of the accident. A family member reported he believed the motorcoach driver was in good health and took no medications. No primary care provider was identified.

The 50 year old male truck driver had reported a previous partial finger amputation but no other medical conditions and no medications on the last CDL medical examination prior to the crash, dated January 13, 2015. He answered “no” to the historical question on the form which asks, “sleep disorders, pauses in breathing while asleep, daytime sleepiness, loud snoring.” No neck or hip circumference was documented and his BMI was not calculated. His medical certificate was marked valid for 2 years. Based on his personal medical records, the truck driver was documented to be 6’2” tall and weigh 385 or 390 pounds. His body mass index (BMI) was calculated on two visits in 2014 and 2015 and recorded as 49.23 kg/m² and 50.07 kg/m². Following the crash, the truck driver’s medical certificate was invalidated due to issues with the procedures followed by the certified medical examiner (who was decertified by the FMCSA) and he underwent another CDL medical examination. According to the long form from that examination, dated January 4, 2017, the truck driver reported only the previous partial finger amputation. His weight was recorded as 355 pounds and the remainder of the physical examination was normal or unremarkable. The CME who performed the exam, a chiropractor, noted he was “moderately obese, recommended usual physical by PCP (primary care provider).” No neck circumference or hip circumference was measured and the BMI was not documented. Finally, although the NTSB has requested the truck driver undergo an evaluation by a sleep physician and formal sleep study, as of June 27, 2017, the driver has not responded to the request.