National Transportation Safety Board
Office of Research and Engineering
Washington, DC 20594

HWY24MH005

MEDICAL

Specialist's Factual Report

October 8, 2024

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A ACCIDENT

Location: Rushville, Schuyler County, Illinois
Date: March 11, 2024
Time: 11:29 a.m. CDT

B MEDICAL SPECIALIST

Specialist JE Tuttle MD MHA FACS
National Transportation Safety Board
Washington, DC

C DETAILS OF THE INVESTIGATION

1.0 Purpose

This investigation was performed to evaluate the school bus driver and the sand truck driver for potentially impairing medical conditions and substances.

2.0 Methods

The school bus driver's Social Security Administration (SSA) medical file, pre-event medical records, State of Illinois Prescription Monitoring Program (PMP) records, and personal pharmacy records were reviewed as well as the State of Illinois Physical Examination and Certificate forms for school bus drivers. The school bus driver's autopsy report and toxicology reports were also reviewed. The sand truck driver's United States Department of Transportation (DOT) physical qualification examination to include the Medical Examination Report (MER) Form, MCSA-5875, and Medical Examiner's Certificate (MEC), Form MCSA-5876, personal pharmacy records, autopsy report, and toxicology report were reviewed.

Selected NTSB investigator reports, and relevant regulation and medical literature were also reviewed.

D FACTUAL INFORMATION

1.0 School Bus Driver

1.1 Social Security Medical File

The 57-year-old female school bus driver's SSA medical file was reviewed. The SSA file also contained the school bus driver's personal medical records from the primary care physician group that was providing her care in 2016, as well as hospital records which were submitted to support her petition for Supplemental Security Income (SSI) due to disability. According to the SSA medical file, the school bus driver applied for SSI in April of 2016. The disabilities claimed that prevented her full-time employment were disorders of the back and neck, including discogenic and degenerative disease of the spine, chronic fatigue syndrome, arthritis, fibromyalgia, hepatitis, anemia, and post-operative consequences from a spinal fusion operation.[1] According to the personal medical records contained in the SSA file, in January of 2016, the school bus driver underwent an operative cervical fusion fusing the cervical spine from the C4 vertebrae to the C7 vertebrae.[2] According to the operative note, the indication for operation was the school bus driver's severe, acute bilateral arm weakness and pain with radiological imaging consistent with cervical spinal canal narrowing, disc disease and multiple cervical nerve impingements. Immediately post-operatively, the school bus driver had improved function of her arms (right greater than left); however, she still had weakness in her arms when compared to normal. She applied for SSI and was denied in July 2016. According to the SSA medical file, the

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[1]Chronic fatigue is a diagnosis based on self-reported fatigue lasting at least 6 months and may be either persistent or re-lapsing. It can also be a symptom of other chronic diseases.

Fukuda, K., Straus, S.E., Hickie, I.B., Sharpe, M., Dobbins, J.G., & Komaroff, A.L. (1994). The Chronic Fatigue Syndrome: A Comprehensive Approach to Its Definition and Study. *Annals of Internal Medicine*, 121, 953-959.

Fibromyalgia is a medical condition which causes chronic pain, fatigue, and cognitive disorders. Other symptoms may include headaches, abdominal pain, and depression. There are no definitive diagnostic tests and diagnoses depends on self- reports of those affected.

Wolfe, F., Clauw, D. J., Fitzcharles, M. A., Goldenberg, D. L., Häuser, W., Katz, R. L., Mease, P. J., Russell, A. S., Russell, I. J., & Walitt, B. (2016). 2016 Revisions to the 2010/2011 fibromyalgia diagnostic criteria. *Seminars in arthritis and rheumatism*, 46(3), 319–329. https://doi.org/10.1016/j.semarthrit.2016.08.012.

[2] A cervical fusion is an operative procedure that involves joining one or more of the spinal bones (vertebrae) together with screws and plates to make the neck more stable. Normally, between each vertebra, there is a disc that acts as a "shock absorber;" these are removed during a fusion procedure and replaced with either bone grafts or medical devices. The more levels involved in the fusion, the higher the risk of complications including continued pain, limited range of motion, impairment of activity and degeneration of adjacent vertebrae. In one study, only 39% of patients undergoing a 3-level fusion were able to return to some type of work.

De la Garza-Ramos R, Xu R, Ramhmdani S, et al. Long-term clinical outcomes following 3- and 4-level anterior cervical discectomy and fusion. *Journal of Neurosurgery: Spine*. 2016;24(6):885-891. doi: https://doi.org/10.3171/2015.10.spine15795

SSI medical examiner denied her application stating that his denial was based on "overinflation of her symptoms and reported limitations when compared to actual objective medical evidence in her file."

In July of 2016, the school bus driver underwent electromyography (EMG) nerve conduction testing.[3] The study performed on July 18, 2016, showed evidence of on-going and chronic nerve damage involving the C6 nerve of the left arm (this nerve is responsible for flexing the arm and extending the wrist). The remainder of the EMG results were within normal limits including the right arm and both legs. The school bus driver re-applied for SSI in August of 2016.

Also included in the school bus driver's SSA medical file, are personal medical records that document multiple emergency room, primary care, and specialty physician visits for various complaints including un-resolved post-operative neck and arm pain for the period of January 2016 to September 2016. According to the SSA medical file, the school bus driver was approved for SSI in October 2016. The school bus driver submitted a continuing disability review report in January 2023 to justify continued SSI. In addition, a work activity report was filed in February 2023.[4] The school bus driver did not meet the substantial and gainful employment requirements defined by SSA and remained on SSI at the time of the crash.[5]

1.2 Personal Medical Records July 2022 – March 2024

The school bus driver was first seen in a new primary care practice in July 2022 in order to transfer primary care from her former primary care physician group. On the initial intake form for new patients, the school bus driver reported her prescription medications at the time included gabapentin, a prescription medication commonly used to treat nerve pain; baclofen, a prescription medication that is commonly used for muscle spasm and as a muscle relaxant; sumatriptan, a prescription medication used to treat acute migraine headaches; tramadol, a prescription opioid pain medication used to treat moderate to severe pain; and oxycodone/acetaminophen, an opioid pain medication used to treat severe pain. In a

[3] EMG nerve conduction testing determines the speed at which nerve input stimulates muscle tissue. Slower conduction is a sign of nerve damage. M. Freedman. Electromyography (EMG) and nerve conduction studies. *Merk Manual*. https://www.merckmanuals.com/professional/neurologic-disorders/neurologic-tests-and-procedures/electromyography-emg-and-nerve-conduction-studies. Updated August 2023. Accessed April 23, 2024.

[4] A work activity report is a questionnaire the SSA will send a beneficiary if there is an indication that the beneficiary worked despite claiming a disability. Form SSA-821: Work Activity Report – Employee. https://www.ssa.gov/forms/ssa-821.html. Accessed April 25, 2024.

[5] Substantial and gainful employment is used to describe a level of work activity and earnings. SSI benefits are currently $1800 monthly. If the work pursued by the beneficiary pays less than the monthly allocation from SSI, it is not considered "substantial and gainful" employment. SSA: Social Security Handbook. Part 603:1. https://www.ssa.gov/OP_Home/handbook/handbook.06/handbook-0603.html. Updated November 16, 2010. Accessed May 22, 2024.

follow up visit, September 2022, the school bus driver's medication list additionally included promethazine, a prescription medication used for sedation, psychosis, anxiety and nausea, and amitriptyline, a prescription medication used to treat depression. At her initial visit at the new primary care practice, the school bus driver reported a history of chronic back and neck pain, right and left arm nerve pain post-surgery, muscle spasms, and chronic headaches; she also reported multiple other diagnoses. In October 2022, the new primary care group signed a pain contract with the school bus driver such that she agreed that she would not seek or accept prescription pain medications from other physicians outside of the new primary care group.

From July 2022 to February 19, 2024, the school bus driver made over 15 outpatient visits to the new primary care group for pain in her neck and shoulders, back pain, and other complaints. She also had multiple emergency department visits during the same time period. In November 2022, the primary care group referred the school bus driver to physical therapy for an intense outpatient treatment course due to her reported ongoing and worsening neck and shoulder pain. According to the physical therapist's note, the initial assessment was limited by the school bus driver's extreme pain. A magnetic resonance imaging (MRI) was obtained of the school bus driver's neck at that time, which was unchanged from previous studies and showed no new findings.[6] The school bus driver was discharged from physical therapy in December of 2022 due to her lack of participation, poor tolerance for activity and elevated levels of pain with minimal activity. Due to ongoing complaints of pain, in February 2023, the partner of her operative neurosurgeon saw the school bus driver. At that visit, the neurosurgeon reported that the school bus driver complained of numbness and weakness in both hands. At that visit, her physical examination by the neurosurgeon was documented as normal. Radiological imaging obtained at that visit was consistent with previous studies and showed no new findings.

In October of 2023, the school bus driver was seen by a new Family Medicine group to establish care as a new patient. Her documented self-reported diagnoses at the initial visit with the new Family Medicine group included arthritis, neck pain, fibromyalgia, lupus, Lyme's disease, a history of cervical spine fusion surgery, multiple sclerosis, and breast disease. Her physical examination was documented as normal at the initial visit. At the request of her new Family Medicine group, the bus driver was also evaluated by a Neurologist in December 2023 for complaints of chronic headache and pain. Her records from that visit document that her neurological examination was normal, and an EMG performed at that time was also normal. The school bus driver reported her medications at that time included baclofen,

[6] MRI is a medical imaging technique that does not use radiation. Instead, MRIs use magnetic fields, magnetic field gradients, and radio waves to generate images of structures in the body. United States Food and Drug Administration. Magnetic Resonance Imaging (MRI). https://www.fda.gov/radiation-emitting-products/medical-imaging/mri-magnetic-resonance-imaging. Updated August 29, 2018. Accessed April 24, 2024.

gabapentin, sumatriptan, promethazine, tramadol and phentermine, a prescription medication used to augment weight loss. She also reported taking hydroxyzine, a prescription antihistamine used to treat allergies, anxiety, and provide sedation. The Family Medicine group renewed prescriptions for promethazine, tramadol, and gabapentin for the school bus driver and requested her medical records from the previous primary care providers as well as other specialists. During the same time period, the school bus driver was also continuing to be seen at her previous primary care group for the weight loss medication, phentermine. From the medical records reviewed, it is not documented that the new Family Medicine group was aware of the bus driver's continued relationship with her previous primary care providers.

1.3 Chiropractor Records October 2023 – March 2024

Chiropractor records from the school bus driver's most recent chiropractor were reviewed. The school bus driver visited her chiropractor's office for eight visits during the time period reviewed for complaints and treatment of low and mid back pain. Her last visit was on the day of the crash, March 11, 2024. On that day, she was reported to be in a good mood, alert and awake and her pain in her low and mid back were reported as minimal Her physical examination by the chiropractor, by his report, demonstrated normal range of motion in her neck, moderate pain in the low back that responded to therapy with significant improvement.[7] She was released from treatment by the chiropractor with follow up scheduled only as needed. From the medical records reviewed, it is not documented that the chiropractor was aware of the bus driver's extensive medical history or her medication use.

1.4 Pharmacy and Illinois Prescription Monitoring Program Record Review

Pharmacy records for the school bus driver were reviewed for the time period April 2023 to March 2024. From April 2023 to July 2023, her primary pharmacy regularly filled prescriptions for gabapentin, tramadol, baclofen, and hydroxyzine. These prescriptions were primarily supplied by the primary care group; however, the gabapentin prescription was supplied by a prior physician's group for the duration of the records. In August of 2023, the school bus driver changed pharmacies. Prescriptions for gabapentin, tramadol, baclofen, and promethazine were regularly dispensed. In October of 2023, the prescriptions for gabapentin, and tramadol were changed and supplied by the new Family Medicine providers. According to pharmacy records, the dose of tramadol was substantially reduced at that time, and the prescription was dispensed routinely early after the dose reduction. The prescription for promethazine was supplied by both the former caring primary care group and the new Family Medicine providers. The prescriptions for baclofen and

[7] Representatives from NTSB had a conversation with the treating chiropractor on October 2, 2024 regarding his care of the school bus driver, and her mood, mental status, and specifics regarding her physical exam on the day of the crash.

phentermine were supplied by the former caring primary care group for the duration of the pharmacy records.

From 2020 to 2024, the State of Illinois prescription monitoring program records, were reviewed for the school bus driver.[8] These records were consistent with the medications recorded in the bus driver's personal medical records. All of the prescribers were members of her primary care and family medicine physicians of whom she was a patient during the time periods recorded. Her last prescription dispensed for oxycodone was July 2, 2022, and was prescribed by her primary care physician at the time.

1.5 Medical Standard for School Bus Drivers, State of Illinois

According to the Office of the Illinois Secretary of State, medical standards for school bus drivers are defined by a State of Illinois Administrative Code. This code includes standards for medical disqualifiers as well as required physical abilities, including standards for hearing and vision for school bus drivers. Medical requirements for being a school bus driver in Illinois include satisfactory completion of a physical exam, as well as a negative drug and tuberculosis tests within 90 days of the physical examination.[9,10] A completed Physical Examination and Certificate form for Illinois school bus drivers is required to be completed for any applicant that does not already possess a valid FMCSA medical certificate, and may be performed by any licensed physician in the State of Illinois. The required Physical Examination and Certificate form contains detailed instructions for the medical providers completing the form. The Physical Examination and Certificate form for Illinois school bus drivers provides a health history checklist that the medical provider is instructed to complete; however, the form does not include space to document conditions not included in the medical checklist and does not require documentation of current medication use by the applicant. If the applicant has satisfactory physical findings, and the required drug and tuberculosis testing are negative, the medical provider can deem the applicant satisfactory to drive the school bus and complete the form. The medical

[8] The State of Illinois monitors prescriptions filled at all retail pharmacies in the State for schedule 2,3,4 and 5 drugs as well as other drugs of interest. It is a database that is used by prescribers and pharmacies to improve safety by preventing misuse, abuse, and diversion of controlled substances. https://www.ilpmp.org/CDC/ILPMPflyer.pdf. Updated 2024. Accessed June 11, 2024.

[9] The Office of the Illinois Secretary of State. School Bus Permit: Driver Services. https://www.ilsos.gov/departments/drivers/drivers_license/schoolbus.html#:~:text=Pass%20an%20Illinois%20written%20school%20bus%20driver%20permit,for%2090%20days%29%2C%20including%20drug%20and%20tuberculosis%20testing. Updated 2024. Accessed August 13, 2024.

[10] State of Illinois Administrative Code, Title 93: Bus drivers. Section 1035:20. https://www.ilga.gov/commission/jcar/admincode/092/092010350000200R.html#:~:text=Section%201035.20%20Annual%20Medical%20Examination%20and%20Certificate%20a%29,to%20the%20date%20of%20application%20for%20the%20permit. Effective July 2016. Accessed August 14, 2024.

provider is then required to give the applicant a copy of the completed form, send a copy of the completed form to the applicant's employer, and keep a completed copy in the applicant's personal medical records. [11,12]

In March 2023, the school bus driver's Physical Examination and Certificate form for Illinois school bus drivers was completed by her previous chiropractor at the time. The chiropractor deemed her physical examination to be satisfactory in order to drive the school bus. In February of 2024, the school bus driver's Physical Examination and Certificate form for Illinois school bus drivers was completed by her new physician at the new Family Medicine group. On review of the Physical Examination and Certificate for Illinois School Bus Driver form dated February 15, 2024, the health history checklist is checked "no" for "injury where there was lost time from work", "nervous disorders", and" permanent defect due to injury". The box in the checklist to acknowledge" back injury or strain" is blank. The new Family Medicine physician deemed her qualified to drive the bus. US DOT pre-employment urine drug testing was performed March 9, 2024, and was negative for any tested-for substances.[13]

1.6 Autopsy

The Schuyler County Coroner's Office performed the autopsy of the school bus driver. The cause of death was multiple blunt force injuries sustained in a motor vehicle collision. The autopsy did not identify significant natural disease.

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[11] The Office of the Illinois Secretary of State. Physical Examination and Certificate for Illinois School Bus Drivers: Form DSD. SB 4.8. https://www.ilsos.gov/publications/pdf_publications/dsd_sb4.pdf. Updated July 2016. Accessed August 14, 2024.

[12] On the State of Illinois Physical Examination and Certification for references to drug testing standards including detection limits are referenced to "Federal Code 54 FED REG 49854 – EFF" which is the original publication in 1989 for 49 CFR 40 in the Federal Registry, outlining what were the standards for DOT testing for drug and alcohol at that time. https://archives.federalregister.gov/issue_slice/1989/12/1/49843-49884.pdf#page=12. Accessed August 14, 2024.

Current DOT standards for Tested-for substances on DOT urine drug testing are marijuana metabolites, cocaine metabolites, amphetamines, opioids, and phencyclidine (PCP), in accordance with 49 Code of Federal Regulations § 40.82, as detailed at 49 Code of Federal Regulations § 40.85.

[13] According to the Illinois Physical Examination and Certificate Form for Illinois School Bus Driver certification, a urine sample is used for Department of Transportation drug testing Tested-for substances on DOT urine drug testing are marijuana metabolites, cocaine metabolites, amphetamines, opioids, and phencyclidine (PCP), in accordance with 49 Code of Federal Regulations § 40.82, as detailed at 49 Code of Federal Regulations § 40.85.

1.7 Toxicology Results

1.7.1 Autopsy Toxicology Results

The coroner's office performed toxicology testing of postmortem heart blood of the school bus driver. Caffeine was presumptively positive.[14] Tramadol was detected at 980 ng/mL and O-desmethyltramadol at 110 ng/mL. Gabapentin was detected at 12,000 ng/mL. Promethazine was detected at 65 ng/mL and phentermine was detected at 1100 ng/ml. No other tested-for substances were detected.

1.7.2 FAA Toxicology Results

At the request of the NTSB, the FAA Forensic Sciences Laboratory performed postmortem toxicological testing of specimens from the school bus driver.[15] Promethazine was detected in blood at 80 ng/mL and in liver tissue. Baclofen was detected in blood at 262 ng/mL and liver tissue at 414 ng/g. Tramadol was detected in blood at 882 ng/mL and liver tissue at 1796 ng/g. O-desmethyltramadol was detected in blood at 199 ng/mL and liver tissue at 305 ng/g. N-desmethyltramadol was detected in blood at 450 ng/mL and liver tissue at 1568 ng/g. Gabapentin was detected in blood at 16,176 ng/mL and liver tissue at 17,334 ng/g. Phentermine was detected in blood at 1101 ng/mL, in lung at 6027 ng/g, and in brain tissue at 3408 ng/g. Acetaminophen was detected in liver and muscle tissue. There was insufficient specimen for analysis of carboxyhemoglobin.

1.7.3 Descriptions of Detected Substances

Promethazine is a phenothiazine derivative that is commonly used for sedation and nausea. It is also a first-generation antihistamine and anti-psychotic. Promethazine generally carries a warning that its use may impair mental and physical abilities required to drive a vehicle or operate heavy machinery due to increased risk of somnolence, blurred vision, and dizziness. Any potential impairment from using promethazine, is increased by the simultaneous use of other sedatives, narcotic pain

[14] A presumptive positive indicates a substance is present on a screening test. In order to confirm presence or quantity of the detected substance, a confirmatory test must be performed. Quest Diagnostics. Presumptive and definitive testing. https://www.questdiagnostics.com/healthcare-professionals/diagnostic-insights/articles/2021/presumptive-definitive-testing-understand-differences. Updated November 9, 2021. Accessed August 14, 2024.

[15] The FAA Forensic Sciences laboratory has the capability to test for around a thousand substances including toxins, prescription and over-the-counter medications, and illicit drugs.

medications, antidepressants, and other central nervous system depressants.[16,17] Use of first-generation antihistamines have been shown to impact driving performance.[18]

Baclofen is a muscle relaxant used to decrease muscle spasms as a result of spinal injury. Baclofen generally carries a precaution that care should be taken when driving a vehicle, operating heavy machinery, or participating in activities that require alertness. Any potential impairment from baclofen is increased by the concomitant use of other central nervous system depressants.[19]

Tramadol is a synthetic opioid used to treat moderate to severe pain. It generally carries a warning that use may impair the mental and physical abilities required to drive a vehicle or operate heavy machinery. The use of tramadol with other central nervous system depressants particularly phenothiazines, increases the risk of respiratory depression, death, and impairment.[20] Chronic use of tramadol can lead to an opioid use disorder. After hydrocodone and oxycodone, tramadol is the third highest used and misused opioid in the United States.[21] O-desmethyltramadol is the active metabolite of tramadol with higher affinity for pain receptors leading to enhanced pain relief. N-desmethyltramadol is an inactive metabolite of tramadol.[22]

Gabapentin is a medication that is approved by the U.S Food and Drug Administration (FDA) for seizure disorders and nerve pain caused by herpes

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[16] Phenothiazines are a class of drugs used to treat psychosis, anxiety, and nausea. Ohlow MJ, Moosmann B. Phenothiazine: the seven lives of pharmacology's first lead structure. *Drug Discovery Today*. 2011;16(3-4):119-131. doi: https://doi.org/10.1016/j.drudis.2011.01.001.

[17] National Institutes of Health National Library of Medicine. Promethazine hydrochloride tablet. DailyMed. https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=24086b53-a85c-443e-ad85-c1295ddf23c7. Updated August 18, 2020. Accessed April 29, 2024.

[18] Verster JC, Volkerts ER. Antihistamines and driving ability: evidence from on-the-road driving studies during normal traffic [published correction appears in Ann Allergy Asthma Immunol. 2004 Jun;92(6):675] [published correction appears in Ann Allergy Asthma Immunol. 2005 Mar;94(3):409-10]. *Ann Allergy Asthma Immunol*. 2004;92(3):294-355.

[19] National Institutes of Health National Library of Medicine. Baclofen tablet. DailyMed. https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=b9199878-3fb4-46dc-adbb-b3d9dc3852d4. Updated June 8, 2023. Accessed April 29, 2024.

[20] National Institutes of Health National Library of Medicine. Tramadol hydrochloride tablet. DailyMed. https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=ae7c54b1-b440-4cca-97e8-e5b825413d32. Updated March 30, 2007. Accessed April 29, 2024.

[21] Mukau L, Wormley K, Tomaszewski C, Ahmad B, Vohra R, Herring AA. Buprenorphine for High-dose Tramadol Dependence: A Case Report of Successful Outpatient Treatment. *Clin Pract Cases Emerg Med*. 2022;6(1):71-74. doi:10.5811/cpcem.2021.12.54602.

[22] Levo A, Koski A, Ojanperä I, Vuori E, Sajantila A. Post-mortem SNP analysis of CYP2D6 gene reveals correlation between genotype and opioid drug (tramadol) metabolite ratios in blood. Forensic Science International. 2003;135(1):9-15. doi: https://doi.org/10.1016/s0379-0738(03)00159-2

infections. It generally carries a warning that use may cause somnolence, dizziness, and general central nervous system depression. Precautions are advised for driving a vehicle or operating heavy machinery until the user can assess the impact of dosing on alertness and motor activities. The use of opioids along with gabapentin is not advised without first substantially lowering the dose of the opioid; use of opioids with gabapentin increases the concentration of gabapentin in blood thus increasing the risk of central nervous system depression.[23] Gabapentin is most commonly prescribed for FDA off-label uses such as insomnia, anxiety, depression, migraine, analgesia related to neuropathic pain, postoperative pain, and fibromyalgia. In 2020, NMS labs included gabapentin in its expanded panel for driving under the influence (DUI) testing. From 2020-2023, gabapentin was detected and confirmed in 8-9% of all specimens tested for DUI by NMS. The median levels detected of gabapentin in the DUI specimens ranged from 7,000 -9,000 ng/mL. [24]

Phentermine is an amphetamine derivative used as a short-term adjunct with diet modification and exercise to increase weight loss. Phentermine generally carries a warning that use may impair the ability to operate a motor vehicle or operate heavy machinery. In addition, phentermine generally carries a warning regarding the risk of abuse as it is a stimulant. Phentermine use may also contribute to insomnia due to its stimulant effects.[25]

Acetaminophen is an over-the-counter pain reliever and fever reducer.[26] Caffeine is a central nervous system stimulant that is commonly ingested, including in coffee, tea, soft drinks, and chocolate, and is also an ingredient in certain anti-drowsiness medications and headache medications.[27] Acetaminophen and caffeine are not generally considered impairing.

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[23] National Institutes of Health National Library of Medicine. Neurontin-gabapentin capsule. DailyMed. https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=ee9ad9ed-6d9f-4ee1-9d7f-cfad438df388. Updated July 12, 2022. Accessed April 24, 2024.

[24] Bierly JJ, Chan-Hosokawa A. Gabapentin in drugged driving investigations. *J Forensic Sci.* 2024; 69: 986–92. https://doi.org/10.1111/1556-4029.15500.

[25] National Institutes of Health National Library of Medicine. Phentermine hydrochloride. DailyMed. https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=02b8f684-b1ca-4ab7-9567-bcacc6a92779. Updated February 27, 2020. Accessed April 30, 2024.

[26] National Institutes of Health National Library of Medicine. Tylenol regular strength-acetaminophen tablet. DailyMed. https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=511536b2-6cbd-463e-b2db-6feec474cf6b. Updated January 16, 2024. Accessed April 30, 2024.

[27] National Institutes of Health National Library of Medicine. Caffeine. DailyMed. https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=6d9b3926-7198-5e00-e053-2a91aa0a9580. Updated September 23, 2020. Accessed May 22, 2024.

2.0 Truck Driver

2.1 FMCSA Record

The 72-year-old male truck drivers' most recent MER form was reviewed. The examination was performed January 23, 2024, by a certified advanced nurse practitioner. The driver reported high blood pressure, lung cancer, throat and neck cancer, cataract surgery, and placement of a tracheostomy in 2022. He reported no medication use at the time of the exam. His height was 72 inches and weight 202 lbs. The examiner did not identify any abnormal findings on physical examination. His medical certificate was valid for 2 years.

2.2 Pharmacy Records

Pharmacy records for the truck driver were reviewed from March 2023 – April 2024. In November 2023, hydrocodone/acetaminophen solution was prescribed and dispensed. In February 2024, dexamethasone and olanzapine were prescribed and dispensed. The sand truck driver's Medical Oncologist supplied all prescriptions.

2.3 Autopsy

The Schuyler County Coroner's Office performed the autopsy of the truck driver. The cause of death was blunt force injuries of the head, thermal burns, and smoke inhalation, sustained in a motor vehicle collision. A subcutaneous infusion port was noted in the right chest. The tracheostomy was not noted in the exam, nor the presence of malignancy. The autopsy did not identify significant natural disease.

2.4 Toxicology Results

2.4.1 Autopsy Toxicology Results

The coroner's office performed toxicology testing of postmortem heart blood of the truck driver. Caffeine was presumptively positive.[14] Olanzapine was detected at 4.2 ng/mL and carboxyhemoglobin was detected at 36%.[28]

[28] Carboxyhemoglobin is a complex of carbon monoxide and hemoglobin that forms when hemoglobin is exposed to CO. The average non-smoker usually has a carboxyhemoglobin less than 3%, whereas smokers may have a carboxyhemoglobin close to 10%.

Motterlini R, Foresti R. Biological signaling by carbon monoxide and carbon monoxide-releasing molecules. *American Journal of Physiology-Cell Physiology*. 2017;312(3):C302-C313. doi: https://doi.org/10.1152/ajpcell.00360.2016

2.4.2 FAA Toxicology Results

At the request of the NTSB, the FAA Forensic Sciences Laboratory performed postmortem toxicological testing of the postmortem blood and urine of the truck driver.[15] Olanzapine, desmethylolanzapine and acetaminophen were detected in blood and urine. Carboxyhemoglobin was detected in blood at 32%. Cyanide was detected in blood at 1.01 ug/mL. No other tested-for substances were detected.

2.4.3 Descriptions of Detected Substances

Olanzapine is an atypical antipsychotic approved by the FDA for the treatment of schizophrenia, bipolar I disorder and in combination with other medications, for the treatment of resistant depression. It generally carries a warning that use has the potential to impair judgement, thinking, and motor skills and to use caution when operating heavy machinery.[29] Olanzapine at low doses, is also used FDA off-label in treating chronic nausea and vomiting in patients with advanced cancer. In cancer patients receiving olanzapine, sedation and fatigue were reported to be decreased with use.[30, 31] Desmethylolanzapine is a metabolite of olanzapine.

Acetaminophen and caffeine are described in section 1.6.3 above and are not generally considered impairing

Carboxyhemoglobin is formed when inhaled CO binds to hemoglobin, the protein containing iron in red blood cells that carries oxygen. Carbon monoxide (CO) is an odorless, colorless gas that is a byproduct of combustion, such as from an exhaust system or fire. In smoke inhalation, inhaled CO prevents the blood from carrying oxygen to tissues by displacing the oxygen molecule from the hemoglobin. Toxicity from CO is consistently observed at carboxyhemoglobin levels in excess of 15%.[28]

Cyanide is highly toxic and can be produced in high concentrations from the burning of nitrogen containing polymers found in industrial substances and household items. [32] Cyanide is a potent toxin that may be developed from

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[29] National Institutes of Health National Medical Library. Olanzapine tablet. DailyMed. https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=636665be-9d7e-443a-8134-e8cc47e6ba24. Updated November 8, 2022. Accessed May 1, 2024.

[30] Navari RM, Pywell CM, Le-Rademacher JG, et al. Olanzapine for the Treatment of Advanced Cancer–Related Chronic Nausea and/or Vomiting: A Randomized Pilot Trial. *JAMA Oncol*. 2020;6(6):895–899. doi:10.1001/jamaoncol.2020.1052.

[31] Abe M, Yamaguchi T, Fujita Y, et al. Efficacy of Olanzapine in Addition to Standard Triplet Antiemetic Therapy for Cisplatin-Based Chemotherapy: A Secondary Analysis of the J-FORCE Randomized Clinical Trial. *JAMA Netw Open*. 2023;6(5): e2310894. doi:10.1001/jamanetworkopen.2023.10894.

[32] DW Carter. Smoke inhalation. Merck Manual. November 2022. https://www.merckmanuals.com/home/injuries-

combustion of nitrogen containing items such as plastic, vinyl, wool, or silk.[33] Cyanide exposure is one of the potential causes of death from smoke inhalation.[34]

E SUMMARY OF MEDICAL FACTS

1.0 School Bus Driver

The 57-year-old female school bus driver had an extensive medical history. She applied for and received SSI in 2016 due to disability. Her qualifying medical conditions for disability included consequences secondary to a cervical fusion surgery resulting in pain both in her neck and arms. The bus driver self-reported chronic fatigue syndrome, fibromyalgia, anemia, and hepatitis. Her most recent medications prescribed prior to the crash included promethazine, baclofen, tramadol, gabapentin, hydroxyzine, and phentermine. Multiple physician groups and several pharmacies were included in prescribing and dispensing these medications to the school bus driver. During the time period the school bus driver's medical records were reviewed, she changed physician groups for primary care three times, was seen more than monthly by those groups, in addition to being seen in various emergency departments, specialists' offices and physical therapy.

Chiropractor records from the school bus driver's most recent chiropractor were reviewed. The school bus driver visited her chiropractor's office for eight visits during the time period reviewed for complaints and treatment of low and mid back pain. Her last visit was on the day of the accident. On that day, she was reported to be in a good mood, alert and awake and her pain in her low and mid back were reported as minimal. Her physical examination by the chiropractor, by his report, demonstrated normal range of motion in her neck, moderate pain in the low back that responded to therapy with significant improvement. She was released from treatment by the chiropractor with follow up scheduled only as needed. From the medical records reviewed, it is not documented that the chiropractor was aware of the school bus driver's extensive medical history or her medication use.

In February of 2024, the school bus driver's Illinois School Bus driver certificate was completed by her new physician at the new Family Medicine group. The Physical Examination and Certificate form for Illinois school bus drivers does not require

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and-poisoning/burns/smoke-inhalation. Accessed May 22, 2024.

[33] Lawson-Smith P, Jansen EC, Hyldegaard O. Cyanide intoxication as part of smoke inhalation--a review on diagnosis and treatment from the emergency perspective. Scand J Trauma Resusc Emerg Med. 2011; 19:14. Published 2011 Mar 3. doi:10.1186/1757-7241-19-14.

[34] Eckstein M, Maniscalco PM. Focus on Smoke Inhalation—The Most Common Cause of Acute Cyanide Poisoning. *Prehospital and Disaster Medicine*. 2006;21(S2): s49-s55. doi:10.1017/S1049023X00015909.

documentation of current medication use by the applicant and does not provide space to report past medical or surgical history not included in a provided health history checklist. The examining medical provider is instructed to complete the health history checklist; however, the form does not provide space for the medical provider to document conditions not included in the medical checklist. On review of the Physical Examination and Certificate for Illinois School Bus Driver form dated February 15, 2024, the health history checklist is checked “no” for “injury where lost time from work”, “nervous disorders”, and” permanent defect due to injury”. The box in the checklist to acknowledge” back injury or strain” is blank. The new Family Medicine physician deemed her physical exam satisfactory to drive the bus. US DOT pre-employment urine drug testing was performed March 9, 2024, and was negative for any tested-for substances

The Schuyler County Coroner’s Office performed the autopsy of the school bus driver. The cause of death was multiple blunt force injuries sustained in a motor vehicle collision. The autopsy did not identify any significant natural disease.

The coroner’s office performed toxicology testing of postmortem heart blood of the school bus driver. Caffeine was presumptively positive. Tramadol was detected at 980 ng/mL and O-desmethyltramadol at 110 ng/mL. Gabapentin was detected at 12,000 ng/mL. Promethazine was detected at 65 ng/mL and phentermine was detected at 1100 ng/ml.

At the request of the NTSB, the FAA Forensic Sciences Laboratory performed postmortem toxicological testing of blood, liver, muscle, lung, and brain tissues of the bus driver. Promethazine was detected in blood at 80 ng/mL but not in liver tissue. Baclofen was detected in blood at 262 ng/mL and liver tissue at 414 ng/g. Tramadol was detected in blood at 882 ng/mL and liver tissue at 1796 ng/g. O-desmethyltramadol was detected in blood at 199 ng/mL and liver tissue at 305 ng/hg. N-desmethyltramadol was detected in blood at 450 ng/mL and liver tissue at 1568 ng/g. Gabapentin was detected in blood at 16,176 ng/mL and liver tissue at 17,334 ng/g. Phentermine was detected in blood at 1101 ng/mL, in lung at 6027 ng/g, and brain tissue at 3408 ng/g. Acetaminophen was detected in liver and muscle tissue. There was insufficient specimen for analysis of carboxyhemoglobin.

2.0 Truck driver

The 72-year-old male truck drivers’ most recent MER form was reviewed. The examination was performed January 23, 2024, by a certified advanced nurse practitioner. The driver reported high blood pressure, lung cancer, throat and neck cancer, cataract surgery, and placement of a tracheostomy in 2022. He reported no medication use at the time of the exam. His height was 72 inches and weight 202 lbs. The examiner did not identify any abnormal findings on physical examination. His medical certificate was valid for 2 years.

The truck driver's pharmacy records were reviewed. He was being cared for by a Medical Oncologist. During the review period, all of the truck driver's prescriptions were written by his Medical Oncologist and the truck driver used one pharmacy.

The Schuyler County Coroner's Office performed the autopsy of the truck driver. The cause of death was blunt force injuries of the head, thermal burns, and smoke inhalation, sustained in a motor vehicle collision. A subcutaneous infusion port was noted in the right chest. The tracheostomy was not noted in the exam, nor presence of malignancy. The autopsy did not identify significant natural disease.

The coroner's office performed toxicology testing of postmortem heart blood of the truck driver. Caffeine was presumptively positive. Olanzapine was detected at 4.2 ng/mL and carboxyhemoglobin was detected at 36%.

At the request of the NTSB, the FAA Forensic Sciences Laboratory performed postmortem toxicological testing of the postmortem blood and urine of the truck driver. Olanzapine, desmethylolanzapine and acetaminophen were detected in blood and urine. Carboxyhemoglobin was detected in blood at 32%. Cyanide was detected in blood at 1.01 ug/mL. No other tested-for substances were detected.

Submitted by:

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