This peer reviewed research will appear in *Transportation Journal - Fall Issue 2023*, published by Penn State University Press. It is a journal of the Association for Supply Chain Management (ASCM). ASCM is the global leader in supply chain organizational transformation, innovation, and leadership. As the largest non-profit association for supply chain, ASCM is an unbiased partner, connecting companies around the world to the newest thought leadership on all aspects of supply chain. Distribution prior to publication is by permission of Penn State University Press.

COMPARING DRUG TESTING METHODS IN THE TRUCKING INDUSTRY: THE DRUG AND ALCOHOL CLEARINGHOUSE V. HAIR TESTING

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**This research was financially supported by The Alliance for Driver Safety and Security. The authors would like to thank Drs. Andrew Balthrop and Ronald Gordon for their contributions.

ABSTRACT

The Omnibus Transportation Employee Testing Act of 1991 mandated urine drug testing for U.S. truck drivers but some trucking companies prefer hair testing because it has a longer look back period and better detects lifestyle drug users. Previous research established that 276,500 current truck drivers may be disqualified if they submitted to hair drug tests instead of federally accepted urinalysis. This research compares hair and urine drug test results provided by eight U.S. trucking companies who are members of The Alliance for Driver Safety and Security (i.e., The Trucking Alliance) with urine test results drawn from the federal Drug and Alcohol Clearinghouse to determine differences in hair v. urine positivity rates and drugs detected. Results indicate hair testing has a 6.00% positivity rate, 4.01% higher than urine. If this difference were generalized to the drivers who submitted urine tests to the Drug and Alcohol Clearinghouse, hair testing would have likely disqualified 57,337 additional drivers in 2020. Results further indicate urine testing is better able to detect marijuana while hair testing is superior in detecting cocaine and opioids. This implies federal agencies should consider allowing hair test results to be submitted to the Drug and Alcohol Clearinghouse to support a more drug free driver workforce.

*Keywords: Trucking, Motor Carrier, Safety, Drug Testing, Hair Testing, Urine Testing

INTRODUCTION

Our shared pandemic experience highlighted the importance of several essential industries. Trucking is among the most essential (FMCSA 2020). The U.S. trucking industry is composed of 1.9 million carriers employing 3.36 million drivers who travel over 300 billion miles to deliver 72.5% of total domestic freight (American Trucking Associations 2022). Trucking is critical to the U.S. economy and the ability to procure necessary goods.

Trucking also impacts the health and wellness of those with whom truck drivers share the road. Americans operate their personal vehicles three feet from 80,000-pound trucks traveling Interstate speeds. Therefore, safety is a moral imperative for the trucking industry and maintaining a drug-free driver workforce is important to carriers' safety performance (Knipling 2009).

To improve roadway safety, the Omnibus Transportation Employee Testing Act of 1991 mandated urine drug testing for truck drivers and other safety sensitive employees (Voss and Cangelosi 2020). Unfortunately, evidence exists that urine testing may be insufficient. For example, urine tests are only able to detect drugs consumed in the previous 2-3 days (Mieczkowski 1992, 1993, 2010). Drivers who are scheduled to undergo a pre-employment drug screen need only stop using drugs for 2-3 days, pass the test, then resume their drug habit.

To compensate, several trucking companies utilize hair testing in addition to urinalysis. Hair testing assesses the presence of drug metabolites in a 1.5" strand of hair generally taken from the drivers' head and has a 2-3 month look back period. Therefore, hair testing can detect drug use that urine testing may miss.

The purpose of this research is to assess the differential efficacy of hair and urine drug testing. Apart from Voss and Cangelosi (2020) and Henriksson (1992), the supply chain literature is largely silent on drug testing in the trucking industry. Little is known about the differences between urine and hair testing among truck drivers. Given this gap in the literature, researchers worked with The Alliance for Driver Safety and Security (i.e., The Trucking Alliance; TA) to obtain pre-employment hair and urine drug test results and compared them to pre-employment urine tests drawn from a nationwide sample obtained from the federal Drug and Alcohol Clearinghouse (DAC). Results indicate hair tests yield higher positivity rates compared to urine testing. Further, hair testing detects drugs urine may miss (e.g. cocaine and opioids). These results have important implications for trucking managers seeking to improve safety performance and public policy makers debating whether to allow hair test results into DAC.

This remainder of this manuscript reviews prior safety and drug testing literature then details methods employed to address research questions. Results are subsequently presented

followed by a discussion of managerial and public policy implications. Finally, limitations are presented followed by concluding remarks.

LITERATURE REVIEW

Many motor carriers are engaged in interstate commerce, which necessitates federal regulation. The government generally abdicated its role as an economic regulator following the Motor Carrier Act of 1980 but has remained heavily involved in regulating carrier safety (Tsai, Swartz, and Megahed 2018).

Several authors have investigated the impact of federal regulations on motor carrier safety and operational performance. For example, Miller et al. (2019) examine the impact of electronic logging devices and find that hours of service compliance may be impacted by technology investments. Guntuka et al. (2019) find safety incidents are positively associated with the likelihood that a carrier exits the industry. Therefore, driver safety is an important concern for trucking executives (Douglas and Swartz 2016)

Drug use has a deleterious effect on safety (Knipling 2009). Henrickson (1992) discussed front-line supervisors' role in managing employee drug abuse following the Omnibus Transportation Employee Testing Act of 1991. Mitra (2016) investigates the relationship of Compliance, Safety, and Accountability (CSA) BASIC scores to crash rate frequency and finds that increased controlled substance violations negatively impact safety performance.

To improve roadway safety by reducing the number of drivers who abuse drugs, the Substance Abuse and Mental Health Services Administration (SAMHSA) and Federal Motor Carrier Safety Administration (FMCSA) require trucking companies to conduct pre-employment

urine drug screens (SAMHSA 2020, FMCSA 2022). These tests assess the presence of marijuana, cocaine, opioids, amphetamines/methamphetamines, and PCP.

Unfortunately, evidence indicates urine testing may be insufficient in its ability to detect and deter drivers who use drugs. Girotto et al. (2014) conduct a systematic review of thirty-six studies and find truck drivers frequently abuse drugs including alcohol, marijuana, cocaine, and methamphetamines. Couper et al. (2002) report the results of an Oregon law enforcement exercise involving unannounced truck driver urine tests during roadside and port of entry inspections. Twenty one percent of 822 samples tested positive for controlled substances. Couper et al. (2002) conclude, "…in spite of comprehensive drug testing in the trucking industry, some tractor-trailer drivers are continuing to take illicit and other drugs with the potential of having a negative effect on their driving ability" (p. 562).

To compensate for urine testing's inability to sufficiently detect and deter drug users, some motor carriers have chosen to voluntarily supplement urinalysis with hair testing (Voss and Cangelosi 2020). Mieczkowski (1992, 1993, 2000, 2002, 2011) has consistently advocated for hair testing in the criminology literature. When compared to urine testing, Mieczkowski posits hair testing is unbiased (2000, 2011), has a longer look back period (1992), is more tamper resistant (1992), easier to handle and store (1993), better able to detect cocaine (1993), and a worthy supplement to self-reported drug use (2002).

Voss and Cangelosi (2020) utilized data obtained from TA members to study hair testing in trucking. TA had previously claimed that about 301,000 U.S. truck drivers would be disqualified if required to undergo hair testing by extrapolating the difference in urine v. hair test failure rates across the U.S. driver population (Gallagher 2019). Voss and Cangelosi (2020) utilized TA's stated difference in urine v. hair positivity rates and found 276,500 would be

unable to legally drive if required to submit to hair testing. Voss and Cangelosi (2020) first sought to determine whether TA was justified in generalizing their sample across the entire U.S. driver population. Sample size adequacy calculations revealed that n = 16,641 is necessary to generalize across N = 3.5 million U.S. driver population. They further compared the number of TA drivers by state of licensure and the number of truck drivers in each state as reported by the Bureau of Labor Statistics. Results indicated a .880 correlation between TA driver geographic distribution and that of the national driver population.

Voss and Cangelosi (2020) further investigated whether hair testing is racially biased as claimed by some hair testing opponents (Heise 2018). Using the federally accepted "four-fifths rule" and chi-square difference tests, the authors found hair testing failure rates were higher than urine across every examined ethnic group but did not discriminate against any individual group, which supports previous findings that hair testing is racially agnostic (Mieczkowski 2000, 2011).

Voss and Cangelosi (2020) did not examine differences in hair versus urine positivity rates without moderating ethnic influences nor did they report differences in the drugs identified via hair and urine testing. Further, publicly available DAC data now provides the opportunity to compare a large, generalizable TA sample of hair and urine test results to the nationwide DAC sample of pre-employment urine test results.

DAC is a federal repository of driver drug test results. Before hiring a driver, carriers must query DAC to determine whether the driver has previously failed a drug test. If the driver has failed a drug test, the potential employer cannot hire the driver unless he/she has successfully completed the federally mandated rehabilitation process. Without DAC, drivers could fail a pre-employment drug screen, wait three days, apply to drive for another carrier, pass a pre-employment urine drug screen, begin driving, then resume drug use.

Despite congressional mandates to allow hair testing as an alternative to urinalysis (Fixing America's Surface Transportation Act 2015; Opioid Crisis Response Act 2018), carriers are not allowed to submit positive hair test results to DAC in isolation. A federal rulemaking was issued in February 2022 that would allow carriers to submit positive hair test results to DAC if they are accompanied by a positive urine or saliva test (Federal Register 2022). Saliva testing has many advantages but only has a 24 hour look back period (Russo 2022) and, given its relative novelty, data on saliva testing is not available for analysis. Requiring an accompanying, positive urine or saliva result prevents carriers from reporting drug use that occurred beyond the time horizon afforded by hair or saliva and forces carriers who may wish to utilize hair testing in isolation to bear duplicative urine testing costs.

In summary, hair testing has demonstrable benefits to carriers who wish to look back further than urine testing allows. While Voss and Cangelosi (2020) demonstrated that hair testing has higher failure rates than urine, no available work in the supply chain literature has explicitly compared hair v. urine pass fail rates without moderating influences. Further, no work in the supply chain literature has compared the ability of hair and urine tests to detect individual drugs. Finally, before DAC, it was not possible to compare hair failure rates to a national sample of urine tests.

To address these gaps in the literature, researchers utilized 2020 TA and DAC data to address two research questions (RQs). Specifically:

RQ1: How do positivity rates differ between hair testing and urinalysis?

RQ2: How do drugs detected differ between hair testing and urinalysis?

METHOD AND DATA DESCRIPTION

Researchers obtained company-level, aggregated annual hair and urine pre-employment drug test results for the years 2017, 2018, 2019, and 2020 from eight TA member companies: US Xpress, Cargo Transporters, Dupre, JB Hunt, KLLM, Knight/Swift, Maverick USA, and Schneider National. Driver-level data was not available. Carrier demographic information is presented in Table 1.

<See Table 1 in Attached Document>

TA data encompassed 305,337 urine and 288,495 hair tests. The current research compares 2020 TA data (TA $urine_n$ = 68,025; TA $hair_n$ = 66,875) to 2020 DAC data drawn from DAC's December 2020 monthly report (DAC $urine_n$ = 1,429,842). DAC registration began on September 28, 2019, and queries began January 2020. Utilizing the December 2020 monthly DAC report allowed researchers to directly compare 2020 TA data with DAC data from the same year. DAC queries were used as a proxy for the number of pre-employment urine tests administered by carriers reporting to DAC. This is justifiable given each query represents a driver who applied to a carrier and submitted to urinalysis. Given the federal government did not allow companies to submit hair test results in 2020, the DAC sample does not include TA driver hair test results.

2020 TA and DAC test data is presented in Table 2.

<See Table 2 in Attached Document>

RQ1 examines the percentage of positive TA hair, TA urine, and DAC urine tests to determine differences in positivity rates. Positivity rate percentages were calculated by dividing the number of positive tests by the total number of tests for each group (i.e. TA hair, TA urine, and DAC urine). RQ2 examines the frequency with which individual drugs are detected. Frequencies are expressed as percentages that are calculated by dividing the number of times a given drug was detected by the total number of times drugs were detected in a given group (i.e. TA hair, TA urine, and DAC urine). Chi-square difference tests are used to support RQ2 and compare differences in the distribution of drugs detected in TA hair vs. DAC urine and TA hair vs TA urine. Chi-square difference tests determine the extent to which distributions covary by calculating observed v. expected values for each drug in each pairwise comparison. Chi-square is appropriate in this context given researchers were only provided with company-level, aggregated annual data from each carrier. An insignificant chi-square value indicates the distributions are similar whereas a significant value indicates they are different.

RESULTS

RESEARCH QUESTION 1: HOW DO POSITIVITY RATES DIFFER BETWEEN HAIR AND URINE

RQ1 compares the percentage of positive TA hair and urine tests with the percentage of positive DAC urine tests to determine the differences in positivity rates. Data are presented in Table 3.

<See Table 3 in Attached Document>

The TA urine failure rate was 0.71%. The DAC urine failure rate was 1.99%. The TA urine failure rate is 1.28% less than the DAC urine failure rate. DAC drivers were 2.80x more likely to fail urine tests than TA drivers (1.99%/0.71% = 2.80).

The TA hair failure rate was 6.00%, which is 4.01% higher than the DAC urine failure rate. TA drivers were 3.02x more likely to fail hair tests than DAC drivers who took urine tests (6.00%/1.99% = 3.02).

Comparing TA hair with TA urine yields similar results. TA hair tests detected drugs in 5.29% more tests than TA urine tests. In 2020, TA drivers were 8.45x more likely to fail a hair test than a urine test (6.00%/0.71% = 8.45).

RESEARCH QUESTION 2: HOW DO DRUGS DETECTED DIFFER BETWEEN HAIR AND URINE TESTS

RQ1 results demonstrate that drivers fail hair tests more frequently than urine. RQ2 extends the analysis by comparing differences in the types of drugs detected by hair and urine tests. Data are presented in Table 4.

<See Table 4 in Attached Document>

Table 4 presents the positive tests for each drug as a percentage of the total number of times drugs were detected in each group (i.e. TA hair, TA urine, and DAC urine). The rank order of drugs most frequently detected in each group are given in parentheses below the percentages.

Marijuana is the most identified drug in both hair and urine tests (DAC 55.18%, TA hair 33.40%, TA urine 69.98%). Amphetamines/methamphetamines was second for DAC (18.96%),

third for TA urine (9.03%), and fourth for TA hair (15.89%). Cocaine is ranked second for TA (TA hair = 29.24%, TA urine = 11.96%) and third for DAC (14.85%). Opioids are fourth in DAC (10.64%) and TA urine (8.58%) but third in TA hair (20.77%). MDMA (ecstasy) and PCP are detected in a relatively small percentage of positive tests for both samples.

Table 4 also details differences in drugs detected by subtracting the percentage of times each drug was found in DAC/TA urine from the percentage of times each drug was found in TA hair. A positive number indicates hair uncovered a given drug more frequently than urine whereas a negative number indicates urine uncovered a given drug more frequently than hair.

Data presented in Table 4 indicates hair detected more cocaine, opioids, and ecstasy whereas urine detected more marijuana, amphetamine/methamphetamine, and PCP. The differences in marijuana, cocaine, and opioids are particularly pronounced. Urine tests are more likely to detect the presence of marijuana (TA hair – DAC urine = -21.78%, TA hair – TA urine = -36.58%). Hair tests are more likely to detect the presence of "harder" drugs such as cocaine (TA hair – DAC urine = 14.39%, TA hair – TA urine = 17.28%) and opioids (TA hair – DAC urine = 10.13%, TA hair – TA urine = 12.19%).

Table 5 presents the number of times each drug was detected in positive tests for each group. Chi-square results indicate significant differences in the distribution of drugs detected via hair testing vs. those detected via urine testing. Specifically, results indicate the distribution of drugs detected in TA hair and DAC urine ($p<0.000$) as well as TA hair and TA urine ($p<0.000$) are significantly different. This supports the assertion that hair tests detect different drugs than urine tests as previously demonstrated through directional differences in Table 4.

<See Table 5 in Attached Document>

DISCUSSION

This research compared the differential efficacy of hair and urine testing in truck driver pre-employment drug screens. We are unaware of any other study that examines differences among truck drivers in drugs detected via hair and urine pre-employment tests. Further, no study has compared hair test results to a national sample of driver urine tests as provided by DAC. The most salient findings are discussed below.

First, TA drivers pass *urine* tests 2.80x more frequently than DAC drivers. While this may result from TA companies superior recruiting practices, it is likely that drug users simply avoid TA carriers because they administer hair tests. An Internet search for "trucking companies that hair test" reveals several websites and discussion boards where drivers share those carriers that employ hair testing. Drivers who contact carriers to inquire about a driving position will sometimes ask whether the carrier uses hair testing and discontinue the interview if so (Commercial Carrier Journal 2020).

Second, results comparing TA hair and urine tests indicate hair testing has a 5.29% greater positivity rate than urine and detects drugs 8.45x more frequently, which underscores hair testing's ability to detect drug abuse among drivers that urine testing would otherwise miss. Generalizing the 6.00% TA hair test failure rate to the DAC sample indicates an additional 57,337 DAC drivers would have likely been disqualified in 2020 if they submitted to hair testing[1]. Instead of being disqualified and undergoing a rehabilitation process, or leaving the industry altogether, these drivers were likely hired by carriers who only employ urine testing.

[1]Generalizing TA's 6.00% hair failure rate to the DAC sample is statistically justifiable given (a) the DAC and TA samples are independent because the DAC sample does not include TA drivers who failed a hair test for illegal drug use; (b) both test groups were sufficiently large to assume normality in their distributions ($n_{DACurine}$ = 1,429,842; $n_{TAurine}$ = 68,025; n_{TAhair} = 66,875); and (c) the process of drivers submitting to pre-employment drug testing is a

Third, hair and urine testing detect different drugs. Whereas TA and DAC urine test results indicate marijuana is the most detected drug, TA hair tests were more effective at catching drivers who consume cocaine and opioids. Chi-square difference test results provide statistical evidence that drugs found via urine testing are different than those found via hair testing. This indicates a multi-method drug testing program utilizing tests with differential look back periods may be more effective than a single-method program.

Finally, considering TA drivers passed urine tests at a higher rate than DAC drivers, and cocaine/opioids were detected at a much higher rate among TA driver hair tests, results indicate the use of harder drugs may be under-detected by current federal urine drug testing requirements. The severity of this issue is compounded by the finding that an additional 57,337 DAC drivers would likely have been disqualified in 2020 if they submitted to hair testing.

Managers and public policy makers may find important implications in these results. Trucking company managers should consider supplementing urine tests with hair. This may appear a daunting task given hair testing will shrink an already inadequate driver pool. However, managers should ask themselves whether it is worthwhile to employ drivers who may be lifestyle cocaine and opioid drug users.

Managers should also consider the cost of hair testing, which is roughly double that of urine. While hair testing does impose an additional cost burden, it has potential to improve safety performance by more thoroughly identifying drivers who use drugs. Drug use has been shown to negatively affect safety performance (Knipling 2009) and safety impacts health (Corsi

random process given large sample sizes. Therefore, an additional 57,337 DAC drivers would have likely failed drug tests in 2020 if they submitted to hair testing ($n_{DAC\ urine}$ = 1,429,842; (1,429,842 x 6.00%) – (1,429,842 x 1.99%) = 57,337). Further, Voss and Cangelosi (2020) determined n = 16,641is necessary to generalize to the 3.5 million truck driver population. The TA urine and hair samples greatly exceed this required sample size.

et al. 2014), supply chain operations (Hendricks and Singhal 2003), and U.S. transportation system efficiency (Cantor et al. 2006). Further, Guntuka et al. (2019) find safety incidents are positively associated with the likelihood that a carrier exits the industry. This may be partially caused by increased insurance rates resulting from safety incidents. Increased insurance rates contributed to a three-fold increase in trucking bankruptcies in the first half of 2019 when compared to the first half of 2018 (Smith 2019).

Public policy makers should allow carriers to submit hair testing results to DAC. Results indicate that a multi-method drug testing regimen would augment urine testings' superior performance in detecting marijuana with hair testings' ability to detect cocaine and opioids.

LIMITATIONS AND FUTURE RESEARCH

This study is not without limitations. TA and DAC data were only available in aggregated form. Aggregated data contains no variability and, with the exception of chi-square analyses, prevents the assessment of significant differences. While differences appear substantive, future research should seek to obtain driver-level hair and urine test data to determine statistical differences in overall hair v. urine positivity rates and types of drugs detected.

Our sample only included data from eight carriers, which is a small sample of firms relative to the total number of U.S. trucking companies. Working with a few large respondent firms yielded data that would have otherwise been difficult or impossible to obtain. However, future investigations should seek data from other carriers who use hair testing to expand this research.

Further, the 2020 DAC report does not provide carrier demographic information. This limits the ability to demographically compare DAC carriers with TA. Given DAC is a national database, and the average U.S. trucking company is smaller than those represented by TA, it is likely that the average DAC firm is smaller than the TA firms. Future research should compare hair and urine test differences by firm size.

CONCLUSIONS

Truck drivers are held to a higher standard. The overwhelming majority meet or exceed that standard. However, this research established that hair testing may have disqualified an additional 57,337 drivers in 2020. Drug testing is important for public safety, our supply chains, and to protect the overwhelming majority of drivers who want to do their jobs well, then get home safely. It is a topic worthy of further inquiry. The consequences of failure may be hair raising.

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