logistics

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A Comparison of Truck Driver Pre-Employment Hair and Urine Drug Test Efficacy

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Abstract: *Background*: To help ensure roadway safety, the federal government mandates trucking companies to conduct pre-employment urine drug tests before allowing drivers to operate a commercial motor vehicle. Unfortunately, urine testing has a short detection window and is easily thwarted, leading some carriers to employ hair testing. *Methods*: *t*-tests were utilized to compare hair and urine pre-employment drug test results provided by seven large U.S. trucking companies. *Results*: results indicate that hair's positivity rate is statistically greater than urine for each examined drug and across all drugs combined. *Conclusions*: This paper is the only supply chain work of which we are aware that assesses the statistical differences between hair and urine testing positivity rates. Results support hair testing's increased ability to prevent lifestyle drug users from operating commercial motor vehicles and should be considered by public policy makers considering whether hair testing results should be allowed into the Drug and Alcohol Clearinghouse.

Keywords: drug testing; hair testing; urine testing; trucking; drivers; regulation

Citation: Li, M.; Voss, M.D.; Cangelosi, J.D. A Comparison of Truck Driver Pre-Employment Hair and Urine Drug Test Efficacy. *Logistics* **2023**, *7*, 44. https://doi.org/10.3390/logistics7030044

Academic Editor: Robert Handfield

Received: 31 May 2023
Revised: 7 July 2023
Accepted: 24 July 2023
Published: 26 July 2023

1. Introduction

The American motor carrier industry employs over 3.5 million drivers who move seventy percent of the nation's goods in trucks that weigh 80,000 pounds, traveling at interstate speeds in close proximity to other vehicles. Given the industry's importance and their interaction with the traveling public, the Federal Motor Carrier Safety Administration (FMCSA) regulates motor carrier safety performance through the Compliance, Safety, and Accountability (CSA) program [1].

CSA gathers pertinent safety information from trucking companies during roadside inspections and following safety incidents. CSA's Behavioral Analysis and Safety Improvement Categories (BASICs) are used to measure information gathered through these processes. BASICs measure behaviors that are shown to cause safety incidents and address these behaviors before an incident occurs.

In 2020, thirty-two percent of fatal large truck crashes involved a driver-related factor such as impairment by drugs or alcohol [2]. The U.S. government has long recognized the impact of controlled substances on a driver's ability to operate a commercial vehicle. Therefore, one BASIC measures motor carriers' "controlled substances/alcohol" violations. The impact of the controlled substances/alcohol BASIC on carrier safety was reinforced by Mitra [3], who found that a poor performance in the controlled substances BASIC increased the likelihood of motor carrier crashes.

Truck drivers must pass a federally mandated pre-employment urinalysis drug screen before they start driving for a carrier. Unfortunately, existing evidence shows that urine testing may not be as effective as we all would hope [4]. For example, the Oregon highway patrol administered 821 unannounced urine drug tests on drivers at ports of entry and found that twenty-one percent of them tested positive for a controlled substance [5].

To address this issue, some trucking companies have voluntarily chosen to employ hair testing in addition to urine testing [6]. Hair testing detects drugs that were used up

to three months in the past and has been shown to have a higher positivity rate when compared to urine testing [7].

While Gordon et al. [7] demonstrated that hair testing yields more positive results than urine testing, they did not test whether the difference was statistically significant. In fact, despite its impact on carrier safety performance, the literature on supply chains is mainly silent regarding drug testing and the differences between hair and urine testing.

The purpose of this article is to determine whether hair testing yields more positive test results than urine by examining 157,210 urine and hair pre-employment drug screens administered in 2021 by seven large trucking companies. The results represent the first contribution to the literature on supply chains in terms of assessing the statistical differences in hair and urine positivity rates overall and by drug type. This article begins with a review of the literature and a hypothesis development. The methods employed are subsequently discussed, followed by the results. This article concludes with a discussion, opportunities for future research, and limitations.

2. Review of the Literature

The literature on supply chains has extensively covered the subject of motor carrier safety. Douglas and Swartz [8] posit that carrier safety climate, the prevailing regulatory climate, and external factors influence drivers' attitudes, judgments, and intentions, which, in turn, influence driver behaviors. Knipling [9] highlights the influence of carrier safety climate on motor carrier safety performance. One safety climate indicator is the extent to which carriers monitor driver behaviors that could potentially cause crashes. For instance, Miller et al. [10] utilize the deterrence theory and examine the impact of electronic hours of service monitoring on driver hours of service compliance. Their findings indicate that motor carriers with higher monitoring levels achieve higher hours of service compliance but the improvements are pre-conditioned on current electronic monitoring implementation.

The monitoring requirements for electronic hours of service represent only one part of the federal motor carrier safety regulatory regime and, in general, federal safety regulations were proven to be beneficial. Corsi et al. [11] found that every dollar spent on federal safety inspection programs yields almost nine dollars in benefits. Given that carriers with a poor performance in the controlled substances BASIC are more likely to be involved in crashes [3], federal safety regulations that deter and detect truck drivers who consume illegal drugs may be particularly beneficial.

Government entities examine drivers and their vehicles for signs of controlled substances/alcohol violations during roadside inspections but also rely on motor carriers to drug test potential new hires. These pre-employment drug screens utilize urinalysis to assess whether a driver has consumed drugs within the previous 2–3 days [12].

The Omnibus Transportation Employee Testing Act of 1991 [13] mandated alcohol and urine drug testing requirements for safety-sensitive trucking employees and was passed following a fatal 1987 train accident involving an operator who was under the influence [14]. The Act and other appropriate regulatory bodies mandated urine testing to help maintain a drug-free driver workforce. The FMCSA requires trucking companies to administer urine testing in the following circumstances: before employees begin safety-sensitive duties (pre-employment test); when an observation indicates the possibility of substance abuse (reasonable suspicion test); after safety incidents involving death, serious injury, or a disabled vehicle (post-accident test); unscheduled testing for 50% of a fleet each year (random test); before an employee can return to work following a positive test (return to duty test); and after a driver has returned to duty following treatment (follow-up test) [12]. Commonly referred to as a five-panel drug screen, a urinalysis assesses the presence of marijuana, cocaine, opioids, amphetamines/methamphetamines, and PCP.

Unfortunately, existing evidence shows that urine testing does not sufficiently detect and deter some truck drivers from drug abuse. Urine tests are only able to detect drugs that were consumed 2–3 days beforehand [15–17]. Drivers who are scheduled to undergo a pre-employment drug screen only need to stop using drugs for 2–3 days, pass the test, and then

resume their drug use habit. In addition, Lin et al. [18] found that urine samples are often adulterated, substituted, or invalid. This is supported by a Government Accountability Office (GAO) report that uncovered the ease with which drivers can purchase drug-masking agents and contaminate urine samples at testing locations [19]. Rep. Jim Oberstar, then Chairman of the U.S. House Transportation and Infrastructure Committee, stated that the GAO report was "...frankly astonishing and shocking and dismaying. You can manipulate the tests, you can mask substance abuse and go undetected on the roadways" [19] (p. 1).

To compensate for these issues, 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 that is generally taken from a driver's head and has a 2–3 month look-back period. Therefore, hair testing can detect drug use among those who might try to thwart urine tests by discontinuing drug use for a few days before a pre-employment drug screen. An inability to wash metabolites out of hair also makes it difficult to adulterate the sample.

Because of its advantages, Congress directed federal agencies to formulate policies allowing for trucking companies to utilize hair testing in lieu of urine testing [20,21] and submit hair testing results to the federal Drug and Alcohol Clearinghouse (DAC). The DAC is a federal repository of drug test results whose purpose is to prevent drivers from obtaining employment after a positive drug screen without first undergoing the federally mandated rehabilitation protocol. Without the DAC, drivers could fail a pre-employment drug screen, wait three days, apply to drive for another carrier, pass their pre-employment drug screen, and then resume drug use. Unfortunately, carriers are not allowed to submit positive hair test results to the DAC without an accompanying positive urine test [22]. This negates hair testing's ability to remove drug abusers from the driver workforce.

While the literature on supply chains has remained largely silent on drug testing, the literature on criminology has devoted more research to this topic [15–17,23,24]. For instance, Mieczkowski [17] examined the differences in hair and urine positivity rates. His findings indicate that job applicants are more likely to test positive for drug use than current employees and support the use of pre-employment drug screens. Mieczkowski [17] also found that hair testing detects more drugs than urinalysis.

Mieczkowski and Newell [16] examined the differences in hair, urine, and self-reported drug use in correctional facilities. The results highlight the benefits of hair testing in detecting the presence of cocaine. In a separate study based on the Arrestee Drug Abuse Monitoring (ADAM) program, Mieczkowski [23] found that hair testing is better able to detect cocaine, heroin, and amphetamines.

Mieczkowski [24] examined claims that hair testing is biased against certain ethnic groups. His findings indicate that the risk of a positive test result is not a function of ethnicity. Mieczkowski [15] advocates for hair testing and posits it to be "a useful tool in studying drug epidemiology" (p. 149) and calls for the development of a large epidemiological database of drug test results.

Apart from Voss and Cangelosi [25], Gordon et al. [7], and Henriksson [26], the literature on supply chains is largely silent on drug testing in the trucking industry.

Henricksson's study [26] was published immediately following the Omnibus Transportation Employee Testing Act of 1991 and discussed the importance of front-line supervisors in managing employee drug abuse.

Voss and Cangelosi [25] found that 276,500 U.S. truck drivers would be unable to legally operate a commercial motor vehicle if required to undergo hair testing. To justify generalizing their sample across the U.S. truck driver population, the authors compared the number of drivers in their sample by the state of CDL licensure and the number of truck drivers in each state as reported by the Bureau of Labor Statistics. The results indicate a 0.880 correlation between their sample and that of the national driver population. They also utilized sample size adequacy methods to determine the number of subjects necessary to generalize results across the entire U.S. driver population and found that a sample of 16,641 drivers is necessary to generalize across 3.5 million U.S. truck drivers.

Criminology research finds that hair testing is not biased against ethnic groups [24], but some hair testing critics continue to claim otherwise [27]. Voss and Cangelosi [25] investigated whether hair testing is racially biased using the federally accepted "four-fifths rule". The authors found that the hair testing failure rates were higher than those of urine testing across every examined ethnic group but did not discriminate against any individual group, which supports previous findings that hair testing is racially agnostic [24,28].

Gordon et al. [7] examined different drug testing methods and presented directional evidence that hair testing is better able to detect "harder" drugs such as cocaine and opioids. However, while their reported directional differences were substantial, Gordon et al. [7] did not assess the significant differences between hair and urine testing positivity rates and, therefore, the possibility exists that the differences could be due to a sampling error [29].

Given this gap in the literature, this manuscript assesses the statistical differences between hair and urine detection rates overall and by drug type using a federally mandated five-panel drug screen. Hypotheses 1–7 are underpinned by Mieczkowski [15,17,23,24,30] as well as Mieczkowski and Newell [16] who found that pre-employment drug tests are more likely to be positive than those from existing employees, hair testing detects more drugs than urinalysis, and hair testing detects more cocaine and amphetamines. Gordon et al. [7] found that hair testing detects more opioids than urine. Voss and Cangelosi [25] documented that hair testing has a 2–3-month look-back period compared to urine testing's 2–3-day look-back period. Hair testing's longer look-back period negates a driver's ability to abstain from drug use for a short time and still pass a urine screen. Further, drivers are unable to mask the presence of drugs in hair samples. Therefore, hypotheses 1–7 posit that hair drug screens will detect significantly more positive results than urine testing for each examined drug and across all examined drugs combined.

H1: *Hair drug screens produce significantly more positive cocaine test results than urine drug screens.*

H2: *Hair drug screens produce significantly more positive marijuana test results than urine drug screens.*

H3: *Hair drug screens produce significantly more positive opioid test results than urine drug screens.*

H4: *Hair drug screens produce significantly more positive amphetamine/methamphetamine test results than urine drug screens.*

H5: *Hair drug screens produce significantly more positive ecstasy test results than urine drug screens.*

H6: *Hair drug screens produce significantly more positive PCP test results than urine drug screens.*

H7: *Hair drug screens produce significantly more positive overall drug test results than urine drug screens.*

3. Method

Hypotheses 1–7 are tested by comparing the number of positive hair and urine tests for cocaine, marijuana, opioids, amphetamines/methamphetamines, ecstasy, PCP, and a combination of these drugs. Seven large U.S. trucking companies (J.B. Hunt Transport, Knight-Swift Transportation, Schneider National, Maverick USA, KLLM/FFE Transportation Services, US Xpress, and Cargo Transporters) engaged in the full truckload transportation of dry van, refrigerated, and/or flatbed freight [26] and independently provided researchers with 172,632 driver-level pre-employment hair and urine drug screen test results. Each carrier was a member of the Alliance for Driver Safety and Security.

The carriers were asked to complete a template asking for the driver-level state of CDL licensure, urine test results for the examined drugs, and hair test results for the examined drugs. The carriers generally completed the template themselves, but some provided the authors with data from a third-party drug testing partner.

The data consisted of pre-employment hair and urine tests that were administered during the calendar year 2021. The test results were generally matched (i.e., drivers took both hair and urine tests at the same time), but some drivers were only administered one

test. For instance, if a driver first failed a urine test, the carriers may have chosen to forgo the more expensive hair test.

Given that drug screen results are either positive (1) or negative (0), the researchers aggregated the data at the state level based on the driver state of CDL licensure (n = 157,210), which yielded continuous data. STATA version 15.1 was used to conduct *t*-tests to assess significant differences between the number of positive hair and urine tests. The hair and urine sample sizes were approximately equal (n_{hair} = 77,783; n_{urine} = 79,427).

Given that the data were aggregated at the state level, the *t*-tests utilized a sample of n = 46 (45 states + DC). No drivers in our sample held a CDL from Hawaii, Montana, New Hampshire, South Dakota, or Vermont. The number of positive hair and urine tests for each state + DC is presented below in Table 1. Table 2 details the correlations between the positive tests overall and by drug type to illustrate inter-drug and test relationships.

Table 1. Drug positives by state.

State	Hair Positives	Urine Positives	State	Hair Positives	Urine Positives
AK	5	0	MO	80	12
AL	108	11	MS	105	14
AR	54	2	NC	147	13
AZ	234	8	ND	1	0
CA	409	45	NE	3	0
CO	37	3	NJ	49	4
CT	21	6	NM	20	0
DC	5	0	NV	55	8
DE	20	1	NY	55	7
FL	249	26	OH	114	13
GA	348	30	OK	47	5
IA	24	0	OR	14	1
ID	7	1	PA	118	11
IL	175	24	RI	5	0
IN	58	6	SC	97	6
KS	33	5	TN	107	7
KY	24	4	TX	441	34
LA	131	10	UT	16	2
MA	24	3	VA	79	9
MD	44	8	WA	32	8
ME	4	0	WI	34	4
MI	79	8	WV	6	0
MN	16	3	WY	0	0

Table 2. Correlation of positive test results.

	$Hair_{All\ Drugs}$	$Urine_{All\ Drugs}$	$Cocaine_H$	$Cocaine_U$	$Marijuana_H$	$Marijuana_U$	$Opioid_H$	$Opioid_U$]	$Amph/Meth_H$	$Amph/Meth_U$	$Ecstasy_H$	$Ecstasy_U$	PCP_H	PCP_U
$Hair_{All\ Drugs}$	--													
$Urine_{All\ Drugs}$	0.94 [a]	--												
$Cocaine_H$	0.98 [a]	0.93 [a]	--											
$Cocaine_U$	0.66 [a]	0.70 [a]	0.73 [a]	--										
$Marijuana_H$	0.98 [a]	0.91 [a]	0.95 [a]	0.62 [a]	--									
$Marijuana_U$	0.93 [a]	0.99 [a]	0.92 [a]	0.65 [a]	0.90 [a]	--								
$Opioid_H$	0.52 [a]	0.43 [b]	0.56 [a]	0.34 [c]	0.55 [a]	0.38 [b]	--							
$Opioid_U$	0.93 [a]	0.89 [a]	0.92 [a]	0.60 [a]	0.88 [a]	0.89 [a]	0.49 [a]	--						
$Amph/Meth_H$	0.93 [a]	0.88 [a]	0.89 [a]	0.55 [a]	0.89 [a]	0.89 [a]	0.33 [c]	0.86 [a]	--					
$Amph/Meth_U$	0.50 [a]	0.63 [a]	0.46 [b]	0.25 [c]	0.47 [a]	0.58 [a]	0.10	0.43 [b]	0.55 [a]	--				
$Ecstasy_H$	0.46 [b]	0.55 [a]	0.43 [b]	0.24	0.48 [a]	0.57 [a]	0.18	0.32 [c]	0.45 [b]	0.36 [c]	--			
$Ecstasy_U$	0.04	0.10	0.00	−0.10	0.08	0.13	−0.10	0.04	−0.01	−0.08	0.09	--		
PCP_H	0.43 [b]	0.47 [b]	0.39 [b]	0.38 [c]	0.46 [b]	0.44 [b]	0.23	0.51 [a]	0.30 [c]	0.30 [c]	0.18	−0.06	--	
PCP_U	0.00	0.04	0.01	0.14	0.01	0.01	0.02	0.08	−0.08	−0.11	0.03	−0.03	0.55 [a]	--

[a] Significant at $p < 0.01$. [b] Significant at $p < 0.05$. [c] Significant at $p < 0.10$.

4. Results

Table 3 presents the total number of positives by drug type and test type. Hair vs. urine positivity rate comparisons by drug are presented in Tables 3–10.

Table 3. Drug-positive descriptions.

	Cocaine	Marijuana	Opioids	Amph/Meth	Ecstasy	PCP	Total
Hair	1250	1556	342	563	17	6	3734
Urine	35	276	20	28	1	2	362

Table 4. Cocaine.

	n	Mean	Std. Error	Std. Dev.	t
Hair	46	27.17	5.10	34.59	5.30 [a]
Urine	46	0.76	0.17	1.12	

[a] Significant at $p < 0.000$.

Table 5. Marijuana.

	n	Mean	Std. Error	Std. Dev.	t
Hair	46	33.83	6.27	42.51	5.31 [a]
Urine	46	6.00	1.17	7.93	

[a] Significant at $p < 0.000$.

Table 6. Opioids.

	n	Mean	Std. Error	Std. Dev.	t
Hair	46	7.44	1.47	9.94	4.94 [a]
Urine	46	0.44	0.10	0.69	

[a] Significant at $p < 0.000$.

Table 7. Amphetamines/methamphetamines.

	n	Mean	Std. Error	Std. Dev.	t
Hair	46	12.24	2.82	19.14	4.26 [a]
Urine	46	0.61	0.17	1.18	

[a] Significant at $p < 0.001$.

Table 8. Ecstasy.

	n	Mean	Std. Error	Std. Dev.	t
Hair	46	0.37	0.15	1.02	2.32 [a]
Urine	46	0.02	0.02	0.15	

[a] Significant at $p < 0.05$.

Table 9. PCP.

	n	Mean	Std. Error	Std. Dev.	t
Hair	46	0.13	0.05	0.34	2.07 [a]
Urine	46	0.04	0.03	0.21	

[a] Significant at $p < 0.05$.

Table 10. All drugs.

	n	Mean	Std. Error	Std. Dev.	t
Hair	46	81.17	15.27	103.56	5.26 [a]
Urine	46	7.87	1.43	9.72	

[a] Significant at $p < 0.000$.

H1 posits that hair drug screens produce significantly more positive cocaine test results than urine drug screens. The cocaine results are presented in Table 4.

The results indicate that hair testing detected an average of 27.17 cocaine positives. Urine testing detected an average of 0.76 cocaine positives. Hair testing detected significantly more cocaine positives than urine testing ($p < 0.000$; t = 5.30). Thus, H1 is supported.

H2 posits that hair drug screens produce significantly more positive marijuana test results than urine drug screens. The marijuana results are presented in Table 5.

The results indicate that hair testing detected an average of 33.83 marijuana positives. Urine testing detected an average of 6.00 marijuana positives. Hair testing detected significantly more marijuana positives than urine testing ($p < 0.000$; t = 5.31). Thus, H2 is supported.

H3 posits that hair drug screens produce significantly more positive opioid test results than urine drug screens. The opioid results are presented in Table 6.

The results indicate that hair testing detected an average of 7.44 opioid positives. Urine testing detected an average of 0.44 opioid positives. Hair testing detected significantly more opioid positives than urine testing ($p < 0.000$; t = 4.94). Thus, H3 is supported.

H4 posits that hair drug screens produce significantly more positive amphetamine/methamphetamine test results than urine drug screens. The amphetamine/methamphetamine results are presented in Table 7.

The results indicate that hair testing detected an average of 12.24 amphetamine/methamphetamine positives. Urine testing detected an average of 0.61 amphetamine/methamphetamine positives. Hair testing detected significantly more amphetamine/methamphetamine positives than urine testing ($p < 0.001$; t = 4.26). Thus, H4 is supported.

H5 posits that hair drug screens produce significantly more positive ecstasy test results than urine drug screens. The ecstasy results are presented in Table 8.

The results indicate that hair testing detected an average of 0.37 ecstasy positives. Urine testing detected an average of 0.02 ecstasy positives. Hair testing detected significantly more ecstasy positives than urine testing ($p < 0.05$; t = 2.32). Thus, H5 is supported.

H6 posits that hair drug screens produce significantly more positive PCP test results than urine drug screens. The PCP results are presented in Table 9.

The results indicate that hair testing detected an average of 0.13 PCP positives. Urine testing detected an average of 0.04 PCP positives. Hair testing detected significantly more PCP positives than urine testing ($p < 0.05$; t = 2.07). Thus, H6 is supported.

H7 posits that hair drug screens produce significantly more positive overall drug test results than urine drug screens. The overall results are presented in Table 10.

The results indicate that hair testing detected an average of 81.17 positives across all drugs examined. Urine testing detected an average of 7.87 positives. Hair testing detected significantly more positives than urine testing ($p < 0.000$; t = 5.26). Thus, H7 is supported. Table 11 summarizes the results.

Table 11. Summary of results.

Hypothesis	**Result**
H1: Hair drug screens produce significantly more positive *cocaine* test results than urine drug screens.	*Supported*
H2: Hair drug screens produce significantly more positive *marijuana* test results than urine drug screens.	*Supported*
H3: Hair drug screens produce significantly more positive *opioid* test results than urine drug screens.	*Supported*
H4: Hair drug screens produce significantly more positive *amphetamine/methamphetamine* test results than urine drug screens.	*Supported*
H5: Hair drug screens produce significantly more positive *ecstasy* test results than urine drug screens.	*Supported*
H6: Hair drug screens produce significantly more positive *PCP* test results than urine drug screens.	*Supported*
H7: Hair drug screens produce significantly more positive *overall* drug test results than urine drug screens.	*Supported*

5. Discussion

Federal agencies have long mandated the use of urinalysis for drug testing truck drivers. However, urine testing has several deficiencies that have led safety-conscious motor carriers to also employ hair testing. Hair testing has a longer look-back period and is more difficult to adulterate. These factors should yield higher hair drug test positivity rates. Previous supply chain research [7] has demonstrated meaningful directional differences, but no other supply chain work has assessed the significant differences between hair and urine positivity rates. The results presented herein fill this gap in the literature on supply chains.

The results demonstrate that hair testing produces significantly more positive drug tests across all drugs combined as well as for cocaine, marijuana, opioids, amphetamines/methamphetamines, ecstasy, and PCP individually. This supports Gordon et al.'s [7] finding that urine testing under-reports the number of drivers who consume hard drugs, such as cocaine and opioids.

Logical reasons, if misguided, underpin drivers' rationale for consuming illicit substances. Cocaine and amphetamines/methamphetamines are stimulants. Despite their detrimental impact on overall well-being and safety performance, drivers may consume these substances to stay awake while driving. Given that over-the-road drivers are generally paid by the mile, there is clearly an incentive to consume drugs that increase the time spent on the task [31]. Opioid use may begin for legitimate medical reasons, but then transition to abuse if consumption continues beyond a prescribed horizon [32].

Regardless of the logical or illogical reasons for consumption, a motor carrier cannot bear the liability of employing a driver who uses drugs. Reputable trucking companies are very conscious of safety. However, not all reputable trucking companies employ hair testing. This can be due to several factors.

First, the trucking industry is engaged in an ongoing struggle to recruit and retain qualified drivers [33]. Some trucking companies likely choose not to employ hair testing for fear of further shrinking an already insufficient driver pool [34]. Second, hair testing costs about twice as much as urine testing, and some trucking companies may believe that the upfront cost burden outweighs the long-term risk of employing drivers who use drugs [35]. Third, hair test results cannot be submitted to the DAC, which means trucking companies must bear duplicative drug testing costs if they choose to employ hair testing. Finally, carriers may be unconvinced that hair testing results are different from urine. The results presented in this article should help to alleviate this final concern. These results portend important research, managerial, and public policy implications.

Voss and Cangelosi [25] found that 276,500 current drivers would be unable to legally operate a commercial motor vehicle if hair testing was required. Mitra [3] found that poor performance in the controlled substances BASIC increases the likelihood of motor carrier crashes. Our results reinforce the gap between hair and urine detection rates and support their findings. While the importance of disqualifying drivers who abuse drugs has long-standing support from the government, science, and the industry, no available research has quantified the safety benefits of removing further drivers from the road through hair testing. This article demonstrates that hair testing produces significantly more positive drug tests, but future research should quantify the extent to which hair testing improves safety performance. This research should examine the differential likelihood of safety incidents between carriers that employ hair testing versus those that rely solely on urine testing and determine whether hair testing carriers experience fewer safety incidents.

Public policy makers should consider allowing carriers to submit hair test results to the DAC. Congress mandated that the FMCSA allow for hair test results to be submitted to the DAC as part of the FAST Act of 2015 [20] but, so far, regulators have not afforded carriers the ability to submit hair test results in isolation. This places safety-conscious carriers at a cost disadvantage to those who rely on urine testing. It also increases the risk of safety incidents given that drivers can abuse drugs and take advantage of urine testing's short look-back period and susceptibility to manipulation.

Finally, trucking safety managers should consider implementing hair testing if such a policy does not already exist. An effective safety culture eschews drug users in favor of professional drivers who simply wish to deliver their load and return home safely. This research demonstrates that urine testing alone misses a significant number of drivers who abuse drugs. The economic, legal, and human cost of one catastrophic safety incident involving a driver with a positive post-accident drug screen far outweighs the increased upfront cost of pre-employment hair testing.

6. Limitations

As with any research, this paper is subject to certain limitations. The data were provided by a relatively small number of carriers. While Voss and Cangelosi [25] established that our sample size is sufficient to make generalizations to the broader driver population, this work did not assess the differences between carriers of different sizes or segments of the trucking industry. It is possible, for instance, that smaller carriers would experience different results. However, anecdotal evidence drawn from an Internet search for "which trucking companies hair test" indicates that drivers sometimes investigate whether a carrier employs hair testing before applying and then avoid applying to carriers who do employ hair testing. Therefore, given that smaller companies are less likely to be able to pay for the higher cost of hair testing, it may be true that smaller carriers would experience even more positive hair tests than the larger carriers in our sample.

Next, the authors aggregated hair and urine test positives across all states and did not assess the differences in the positivity rates between geographic regions. It is possible that drivers from some geographic areas are more likely to test positive than drivers from other geographic areas. For instance, marijuana has been legalized in many states. The results presented in this study indicate that marijuana is the most detected drug in both hair and urine tests. Drivers from legalized states may be more likely to test positive for marijuana than drivers from other states. Determining the granular geographical differences in the test outcomes was beyond the scope of this work.

7. Conclusions

Society, businesses, and the government are all impacted by technological advances, and drug testing science has evolved since federal regulations were first promulgated in 1991. The overwhelming majority of America's approximately 3.5 million truck drivers perform their jobs safely and professionally. However, previous research has demonstrated that 276,500 of them would be disqualified if required to undergo hair testing [25]. This research demonstrates that hair testing produces significantly more positive results compared to urine testing, both overall and across each individual drug.

Transportation regulatory bodies and industry desire to create safer roadways. Great efforts are required to achieve zero deaths. Achieving this lofty goal can only happen with incremental progress. One step can be accomplished by allowing carriers to submit hair tests to the DAC. This would reduce the number of drug abusers who operate commercial motor vehicles and allow for these drivers to seek help through the federal drug rehabilitation program. Hair testing has the potential to make our roadways safer and improve the quality of our driver workforce, and may even yield benefits that are beyond incremental.

Author Contributions: Conceptualization, M.D.V. and J.D.C.; methodology, M.L.; software, M.L.; validation, M.L., M.D.V. and J.D.C.; formal analysis, M.L.; investigation, M.D.V.; resources, M.D.V.; data curation, M.D.V.; writing—original draft preparation, M.D.V.; writing—review and editing, M.L., M.D.V. and J.D.C.; visualization, M.L., M.D.V. and J.D.C.; supervision, M.D.V.; project administration, M.D.V.; funding acquisition, M.D.V. All authors have read and agreed to the published version of the manuscript.

Funding: Alliance for Driver Safety and Security.

Data Availability Statement: State level, anonymous data used in this manuscript is available upon request.

Conflicts of Interest: The authors declare no conflict of interest.

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