Impairment Science, Inc.

Stop Drug Testing

Start Impairment Testing

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The Case for Impairment Testing, Not Drug Testing

Introducing the Druid® App and Druid® Enterprise

> The occupational safety issue is not cannabis, alcohol, or other drug use itself, but whether employees show evidence of cognitive and motor impairment on the job.

The Limitations of Drug Testing

Worldwide, hundreds of millions of workers are in safety-sensitive jobs, including mining, oil extraction and refining, chemical production, agriculture, transportation, utilities, construction, manufacturing, warehousing, public safety, private security, medicine, and many others. In these industries, degradation of an employee's balance, coordination, and mental acuity – *whatever the cause* – can expose the employee and their coworkers to a greater risk of serious injury or even death.

The impact of cannabis, alcohol, and other drug use on worker safety is a long-standing concern, but employers in these industries are even more alarmed as marijuana legalization continues to gain momentum in the United States and around the world. As a result, more and more companies have responded by requiring drug testing as a condition of employment or by conducting random drug tests.

Standard drug tests can detect Δ9-tetrahydrocannabinol (THC), the main psychoactive chemical in cannabis, but they are intrusive, time-consuming to administer, slow to report results, and expensive. *More importantly, drug testing for the presence of THC or other drugs is an inherently flawed strategy for maintaining workplace safety*.

Research shows that no blood, saliva, urine, or breathalyzer analysis can ascertain whether a person who has used cannabis is actually impaired, and that there is no level of THC in blood or saliva that can discriminate between an impaired and unimpaired person. *Why is this the case?* THC is stored in body fat and enters the bloodstream over a long period of time. This means that people whose most recent cannabis was several days or even a few weeks ago may still have THC in their body but show no evidence of cognitive or motor impairment.

The courts are taking note. In 2019, a federal district judge in Arizona ruled that Wal-Mart discriminated against a worker who had a state-issued medical marijuana card when it fired her after a positive drug test, *but without any evidence that she "used, possessed, or was impaired by marijuana" while at work* [Whitmire v. Wal-Mart Stores Inc., 2019 WL 479842 (D. Ariz. Feb. 7, 2019)]. Likewise, a state judge in Oklahoma ruled that *because a positive drug test did not prove marijuana use had caused a worker's accident*, he was eligible for workers' compensation benefits [Rose v. Berry Plastics Corp. et al., 2019 OK Civ. App. 55 (Ok. Civ. Ct. App. Oct. 16, 2019)].

> The legalization of cannabis highlights the need for a paradigm shift in how we assess cognitive and motor impairment.

There's another important fact to consider: Testing for cannabis, alcohol, or other drug use cannot detect other causes of cognitive and motor impairment, including fatigue, illness, chronic health conditions, or injury.

Clearly, to protect worker safety and their businesses, employers need a test that assesses whether workers are functionally impaired on the job and unfit for duty – *a test that is quick, portable, accurate, sensitive, objective, and inexpensive*.[1]

Introducing Druid and Druid Enterprise

Impairment Science, Inc. designed an app to assess a person's level of cognitive and motor impairment due to any cause or combination of causes. Informed by published scientific research on impairment, the app requires users to perform four game-like tasks that measure reaction time, decision-making accuracy, hand-eye coordination, time estimation, balance, and the ability to perform divided-attention tasks.

All four tasks can be completed in *under three minutes*. The app collects and integrates hundreds of measurements during that time to produce an *impairment score* that ranges from 0 to 100. In practice, the vast majority of scores fall between 30 and 70.

[1] Drug testing is appropriate if an employer (e.g., police department) must assert a zero-tolerance policy for illegal substance use. In addition, employers may require drug testing in response to accidents, objective evidence of impairment, or other work performance issues.

To use the app successfully, users must practice three to five times to become familiar with what the tasks require, after which they can establish a stable baseline score at a time when they are unimpaired. A typical baseline score is typically in the range of 35-50.[2]

Future test scores can then be compared against the baseline score, with scores materially elevated above the baseline indicating likely impairment.

The personal version of the app – called *Druid* – allows people to assess their level of impairment so they can avoid driving or engaging in any other demanding or high-risk activity if they have become impaired after using cannabis, prescription medications, illegal drugs, alcohol, or polydrug use. Before Druid there was no way for an individual to quickly and objectively assess their own level of impairment.

The workplace version of the app – *Druid Enterprise* – takes the core Druid impairment test and embeds it into a cloud-based software solution, with administrative management tools that allows managers to view their employees' scores individually or collectively by age range, gender, or workgroup (production, distribution, sales, administration, etc.). Scores can be displayed over time for a specific date or a range of dates (by week, month, days of the week, etc.). Graphical displays draw attention to higher scores that may indicate impairment and thus warrant further examination.

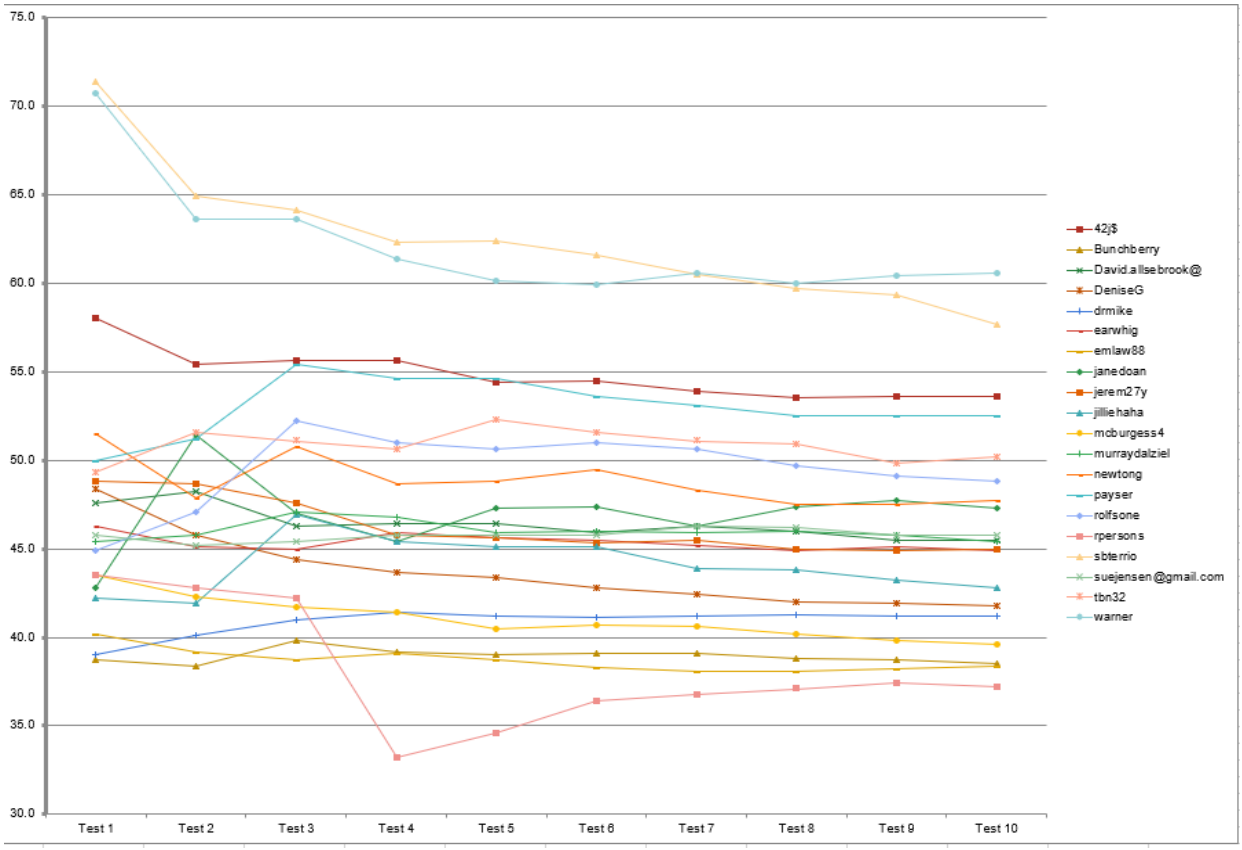
Druid and Druid Enterprise function on all iOS devices and Android devices.

Research on the Druid App's Capacity to Detect Impairment

Is Druid reliable – that is, does the app produce similar scores when used under the same testing conditions? To demonstrate Druid's reliability, we asked 20 people to use the app for at least ten days in a row when they were unimpaired, ideally at the same time each morning.

The figure on the next page shows the participants' Druid scores for the first ten days. As we had expected, many of the participants needed to use the app a few times to become familiar with how to perform its four tasks. This is reflected in the day-to-day instability of their earliest tests. By the fifth test, however, all 20 participants began to produce relatively stable scores – that is, scores that fell within a narrow range.

[2] It is important to note that, at this time, the Druid app is not intended for one-time use when an individual does not have an established baseline.



Can the Druid app detect impairment caused by alcohol intoxication? Richmond and May (2019) validated Druid in a study with 48 volunteers, ages 21 to 40. They practiced the app, established their baseline score, drank alcohol until they reached a blood alcohol concentration (BAC) equal to or greater than 0.08% - an amount that defines legal impairment in the US[3] - and then used the app a second time. At baseline, participants' mean[4] score was 44.3. After being dosed with alcohol, their mean score rose to 57.1, a statistically significant increase.

Can the Druid app detect impairment caused by cannabis use among infrequent users? Researchers at The Johns Hopkins University School of Medicine, under a grant to Impairment Science from the National Institutes of Health (NIH), tested Druid with 20 participants, ages 18-45, who were infrequent cannabis users (Spindle et al., 2020).

[3] Only Utah defines legal impairment as a BAC equal to or greater than 0.05%.

[4] The mean score is the arithmetic average of the 21 participants' scores.

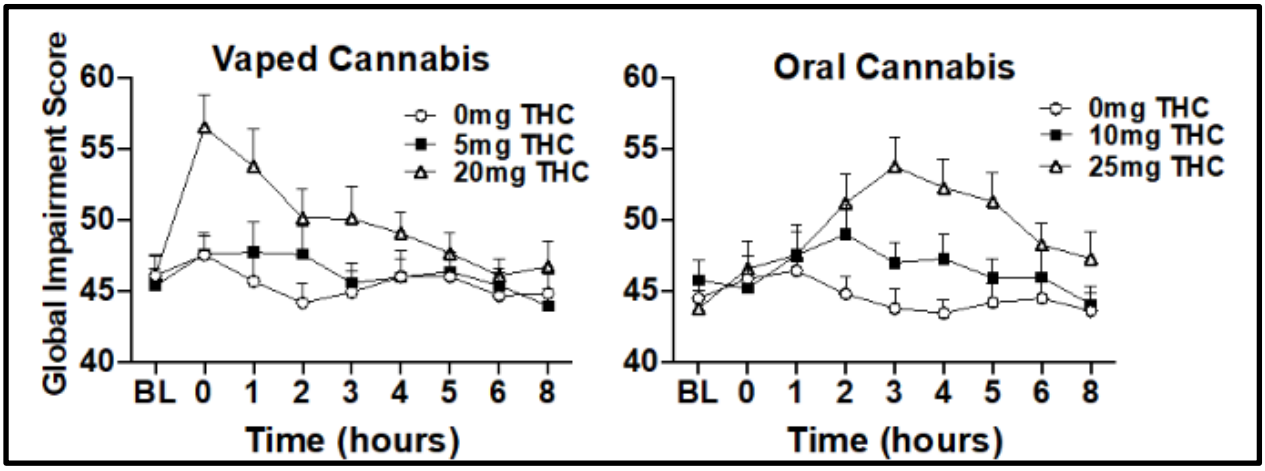
Participants completed a series of double-blind[5] testing sessions on six different days: (a) ingested cannabis brownies containing 0, 10, or 25 mg THC; and (b) inhaled vaporized cannabis containing 0, 5, or 20 mg THC.

During each session, 10 measures of impairment were taken hourly for 8 hours: (a) three computerized cognitive-psychomotor performance assessments: Digit Symbol Substitution Task (DSST), Paced Serial Addition Task (PSAT), and Divided Attention Task (DAT); (b) six field sobriety tests: horizontal gaze nystagmus, lack of eye convergence, pupillary response, walk and turn (WT), one-leg stand (OLS), and Modified Romberg Balance (MRB); and (c) the Druid app. The participants also reported any subjective effects they were experiencing.

The 10 mg oral dose and the 5 mg vaporized dose produced positive subjective effects, but Druid and the other impairment measures did not indicate significantly greater impairment in cognitive-psychomotor performance relative to the 0 mg placebo.

The 25 mg oral dose and the 20 mg vaporized dose increased both positive and negative subjective effects, while also impairing performance on Druid and the other cognitive-psychomotor tasks. Importantly, the six field sobriety tests proved to be generally insensitive to cannabis-induced impairment.

The figure shown below displays the mean Druid scores for the six testing sessions. As would be expected, in the 25 mg oral THC condition, the study participants' Druid performance was significantly impaired relative to baseline 2 to 5 hours after ingestion, but both immediately (time 0) and after 1 hour in the 20 mg vaped THC condition.



[5] A double-blind procedure means that neither the participant nor the researcher conducting the session knows the THC content of the ingested or vaped cannabis.

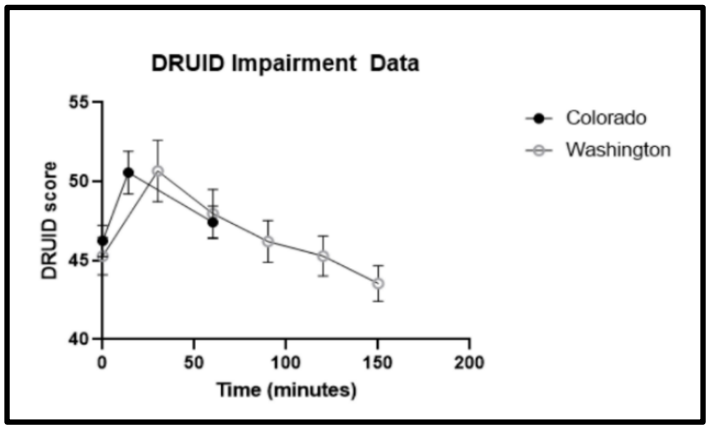
Importantly, after analyzing how well all 10 impairment measures performed, the Johns Hopkins researchers concluded that *Druid "was the most sensitive measure of impairment when compared to the other cognitive performance tasks administered…as well as several common field sobriety tests*…"

Can the Druid app detect impairment caused by cannabis use among frequent users?
Karoly et al. (2020) reported the findings of two studies with frequent cannabis users. In the Colorado study, 70 frequent cannabis users (4+ times per week) used Druid to establish a sober baseline score. Next, each participant was randomly assigned one of two cannabis flowers and one of two concentrates, and then asked to visit a local dispensary to obtain the type of cannabis they preferred to use at their second appointment.

A total of 16 participants obtained 3 grams of cannabis flower, which had either 15% or 24% THC, while 54 participants obtained 1 gram of concentrate, with had either 70% or 90% THC. During the second appointment, the participants used Druid at three timepoints: (a) pre-use; (b) immediately after acutely using cannabis; and (c) one-hour post-use.

In the Washington study, 39 daily or near-daily cannabis users used Druid prior to acute cannabis consumption and then every half hour for 2.5 hours. The participants were asked to consume the amount and type of cannabis they typically used, selecting from a variety of high-THC products made available to them, either a concentrate (2 participants) or flower cannabis pre-rolled into 0.5-gram "joints" (37 participants, with no participants using less than 1 gram).

The figure below shows the mean scores for the two studies. Both the Colorado and Washington studies demonstrated that frequent cannabis users who consumed products consistent with their typical use patterns had significantly increased impairment after ingesting high-potency cannabis.



In both studies, impairment peaked shortly after acute use and then decreased over the next hour, as would be expected. The importance of these findings is enhanced by the fact that there was variability in the amount of cannabis consumed, the type of cannabis (i.e., flower or concentrate), and the method of ingestion.

Conclusion: The Case for Druid

1) Conventional drug tests can detect Δ9-tetrahydrocannabinol (THC), the main psychoactive chemical in cannabis, but they are intrusive, time-consuming to administer, slow to report results, and expensive.
2) A recent *Cochrane Review* article[6] concluded that "the presence of a positive drug test does not necessarily confirm that the worker was impaired at the time of the work-related incident or accident."
3) Drug tests do not assess functional impairment. As reported in a U.S. Department of Transportation report to Congress,[7] "the level of THC in the blood and the degree of impairment do not appear to be closely related." Moreover, THC collects in fat and other body tissues, but then slowly reenters the bloodstream. Thus, even after a few weeks of non-use, a drug test for THC may still show evidence of cannabis use, long after any impairment has passed.[6]
4) In addition to cannabis, there are numerous other potential sources of cognitive and motor impairment that can threaten workplace safety: alcohol, prescription medications, illicit ("street") drugs, polydrug use, sleep deprivation, fatigue, injury, chronic health conditions, and cognitive or physical decline due to illness or aging.
5) To protect worker safety and their businesses, employers need a test that assesses whether workers are functionally impaired on the job and unfit for duty – *a test that is quick, portable, accurate, sensitive, objective, and inexpensive*.
6) Peer-reviewed scientific studies have demonstrated that Druid can meet this need.

Druid and Druid Enterprise stand alone in the marketplace

To explore how Druid Enterprise can help you create a "culture of safety" for your business, please email: *info@impairmentscience.com*

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[6] Els, C., Jackson, T. D., Milen, M. T., Kunyk, D., & Straube, S. (2018). Random drug and alcohol testing for preventing injury in workers. The Cochrane Database of Systematic Reviews, 2018(1). Accessed on December 29, 2020 at https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6491335/

[7] Compton, R. (2017). *Marijuana-impaired driving: A report to Congress*. (DOT HS 812 440). Washington, DC: National Highway Traffic Safety Administration. Accessed on December 29, 2020 at https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/812440-marijuana-impaired-driving-report-to-congress.pdf

References: Scientific Studies of the Druid App

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Spindle, T. R., Martin, E., Grabenauer, M., Woodward, T., Milburn, M., & Vandrey, R. (2020). Assessment of cognitive and psychomotor impairment, subjective drug effects, and blood THC concentrations following acute administration of oral and vaporized cannabis. *Manuscript submitted for publication*.