Marijuana and Impairment

By Richard Bayer, MD

Does marijuana alone, inhaled eight or more hours before activities such as driving a vehicle or working with machinery, cause significant mental or motor impairment that might increase risk to self or others? This is the question that the Oregon legislature has considered during the session just ended.

Instead, the Republican-controlled House passed a bill that would allow employers to fire — without evidence of impairment — workers who register with the Oregon Medical Marijuana Program and who use marijuana as medicine. Fortunately, the house bill failed in a Democrat-controlled Senate committee after heated testimony, but this may be a temporary reprieve as this legislation will probably be introduced again in the next round.

The scientific evidence

Cannabis has been used to relieve pain for centuries throughout the world, including the US, prior to the enactment of the Cannabis Tax Act of 1937. Cannabis is a category of substances with cannabis-like properties and include the natural cannabis plant, synthetic cannabinoids, and internal (endogenous) hormones that mimic cannabis.

Case reports of the benefits of smoked cannabis to relieve pain are published. The major psychoactive cannabinoid, THC, is as effective as codeine for relieving pain. Researchers wrote, “This trial has demonstrated an analgesic [pain relief] effect of THC in patients with cancer pain.”

Experiments with monkeys and rats show unequivocal science for the analgesic effect of cannabinoids in laboratory animals.

Endogenous cannabinoids are important in pain control. GW Pharmaceuticals has performed randomized, double-blind placebo-controlled trials showing Sativex, a cannabis extract administered under the tongue, markedly improves pain and muscle spasticity in MS patients. The International Association for Cannabis as Medicine (IACM) lists dozens of clinical studies including studies on pain. Perhaps the best summary is from the National Institute of Medicine, in “Conclusion, the available evidence from animal and human studies indicates that cannabinoids can have a substantial analgesic effect.”

The Oregon Medical Marijuana Act passed in 1998 states, “The people of the state of Oregon hereby find that: (1) Patients and doctors have found marijuana to be an effective treatment for suffering caused by debilitating medical conditions, and therefore, marijuana should be treated like other medicines.” This means Oregonians voted to make medical marijuana treated like medical morphine, medical synthetic THC, or Food and Drug Administration-approved medicines.

An inhaled medicine typically works faster but the effects usually do not last as long as a medicine taken by mouth that must be absorbed by the digestive tract. The psychoactive effects of both synthetic THC (Marinol) and herbal marijuana are extremely concentrated to THC timing issues about how a drug behaves in the body are called pharmacokinetics and are mostly dependent on the method of administering the drug. For example, an inhaled medicine typically works faster but the effects usually do not last as long as a medicine taken by mouth that must be absorbed by the digestive tract. Inhaling cannabis through smoking or vaporizing cannabis bypasses the digestive tract.

In “A Primer of Drug Action,” pharmacologist Robert Jainson, MD, PhD states, “absorption of inhaled drugs is rapid and complete. The onset of behavioral effects of THC in smoked marijuana occurs almost immediately after smoking begins and corresponds with the rapid attainment of peak concentrations in plasma. Unless more is smoked, the effects seldom last longer than three to four hours.”

In “Clinical Pharmacokinetics of Cannabinoids” Franjo Grotenhermen, MD, wrote, “Pulmonary [lung] assimilation of inhaled THC causes a maximum plasma concentration within minutes, while psychotropic effects [the “high”] start within seconds to a few minutes, reach a maximum after 15 to 30 minutes, and taper off within two or three hours.”

Grotenhermen states, “The peak psychotropic effects [‘high’] after intravenous and inhaled THC application were noted after 20-30 minutes and decreased to low-levels after three hours and to baseline after four hours (Hollister et al 1981).”

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In clinical studies, baseline plasma THC levels remain low long after smoking marijuana.

Since THC acts identically whether synthetic or herbal, we look at the warnings sections of the US Food and Drug Administration (FDA)-approved synthetic (Marinol) THC marketed as Marinol: “WARNING: Patients receiving treatment with Marinol should be specifically warned not to drive, operate machinery, or engage in any hazardous activity until it is established that they are able to tolerate the drug and perform their task safely.” This is sound advice.

In the above studies, impairment from smoked cannabis or marijuana resolves within four hours.

Impairment from smoked cannabis or marijuana resolves within four hours. Since THC acts identically whether synthetic or herbal, it is important to avoid impairment when driving, operating machinery, or engaging in any hazardous activity whether in the workplace or not. Monitoring by family, friends, peers, and co-workers for anyone’s impairment can improve safety. One reason that direct observation of impairment is important is that impairment can be caused by health problems not related to prescription medicines. Things like non-prescription over-the-counter medicines, acute influenza, or a family emergency resulting in lost sleep can cause impairment. This means good communication between employers and employee can lessen risk of impairment at work.

Urine drug testing to monitor therapy is not routinely used in clinical medicine. It is helpful in toxicology or poisoning cases when a doctor is uncertain what drugs are in the body. Urine tests are also used in medical-legal settings. The standard urine test for “marijuana” does not test for “parent” drug, THC, but tests for an inactive non-psychoactive metabolite or breakdown product of THC.
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Inactive breakdown products in a standard “urine marijuana test” can remain positive for weeks to months after consuming cannabis, even when there is no impairment. The U.S. Department of Transportation commented about urine drug testing that, “while a positive urine test is solid proof drug use within the last few days, it cannot be used by itself to prove behavioral impairment during a focal event.” In other words, urine drug testing does not prove impairment, it only proves recent use. Flight-simulator studies Between 1976 and 1991, there were at least four flight-simulator studies published according to a Library of Medicine search. One showed impairment for at least two hours that resolved by four to six hours.17 Three others by a different research team showed conflicting results. Two of those three show some impairment at 24 hours,21 while one of the three studies showed abnormal flight simulator results only at four hours but none at eight or 24 hours.20 Another unpublished study by the same group failed to find impairment, bringing the total studies to five. These mixed results create confusion. Since blood levels of THC are near baseline four hours after smoking can- nabis and impairment beyond four hours cannot be consistently demonstrated, the researchers actually call the flight simulator result a “hangover effect” rather than intoxication. According to Dr. Leirer, the purported hangover effect is “very marginal” and is only detected in tests of “very complex human/machine performance.” Comparable subtle effects are reported at very low blood-alcohol levels of 0.025%, which is well below the 0.04% level allowed in commercial motor vehicle drivers.22

It is currently unknown whether the grey area about what is “recent” and what is “pasts” use of cannabis is even if one cons- in terms of concentration of THC in their blood had a lower probability of causing a traf- fic-accident than drug free drivers, higher, THC concentrations were associated with a considerably higher culpability ratio.3

It remains unclear how to define the gray area about what is “recent” and what is “pasts” use of cannabis is even if one cons- ports using parent-drug blood THC lev- els as a marker for impairment. This is because the THC level below which there is no impairment, varies dramatically among individuals. Plus, the actual num- bers of persons who have only THC in their blood is low and studies still lack adequate sta- tistical significance to draw scientifically firm conclusions. These concerns about legislation suggest that since no culpability appears to exist below levels of 10 nano- grams per milliliter (ng/mL), that any pro- posed cutoffs be above 10 ng/mL of THC.4 A study using coordination test- ing showed inevitable failure in field so- briety testing if blood THC levels were 25-30 ng/mL but many failed testing at 90 and 150 minutes after smoking even though plasma concentrations were low.4

The researchers had the foresight to conclude that establishing a clear rela- tion between THC plasma concentrations and clinical impairment will be much more difficult than it is for alcohol.2 This is primarily because alcohol and THC are chemically different and metabolized differently inside the body. With passage of medical marijuana laws, we need ad- ditional research to show if there is a cor- relation between clinical impairment and blood THC levels. Daily cannabis users (like patients) can have levels as high as 6 to 10 ng/mL without clinical impairment even after 24 or more hours of absti- nence.23

While the sci- ence evolves, most experts think it remains premature to make firm conclusions about the proper cutoff lev- els involving blood THC for “Driving Under the Influ- ence” suspicion.24 Proper clinical discussion of medi- cal marijuana therapy and necessary clinical observa- tions to determine impairment remain the primary methods of monitoring for possible adverse reactions at this time. In summary, there is no consistent scientific evi- dence showing any impairment beyond four hours from smoking marijuana and no scien- tific evidence of any risk of motor vehicle accidents beyond four hours after smoking marijuana. As a medical cannabis expert, I do not con- done any medical marijuana use of can- nabis at work. But, private employer- employees agreements to abstain within four to eight hours prior to work appear a reasonable type of compromise. This still preserves safety, and would be consist- ent with medical treatment plans using other medicines that may impair.

Registration in the Oregon Medical Marijuana Program should never be the sole cause for termination of employment. Medical use of marijuana within Oregon law should be treated like medical Marinol, morphine, and other medicines that both in and out of the work- place. It is discriminatory to fire an un- impaired worker whose only cause for firing is registration with the Oregon Department of Human Services Oregon Medical Marijuana Program.

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