Pain Physician 2012; 15:ES215-ES230 • ISSN 2150-1149

Focused Review

A Framework for "Driving Under the Influence of Drugs" Policy for the Opioid Using Driver

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Disclaimer: There was no external funding in the preparation of this manuscript.
Conflict of interest: None.

Manuscript received: 02/03/2012
Revised manuscript received: 04/17/2012
Accepted for publication: 04/20/2012

Free full manuscript: www.painphysicianjournal.com

Background: Driving under the influence of drugs (DUID) is a term used to designate the action of driving an automobile after the consumption of drugs or medications other than alcohol that interfere with the capacity to operate a vehicle safely. Unlike recreational drugs, prescription medications pose a unique challenge to those attempting to harness their benefits yet protect the driving public. As studies demonstrate a steady increase in opioid use and abuse in the United States, these same constituencies must regulate a significant percentage of drivers who are under the influence of opioids.

Objective: This article examines current DUID policy and attempts to present unified suggestions for improvement based on best scientific evidence of opioid-induced psychomotor impairment.

Study Design: Literature Review

Methods: A literature search was conducted regarding the epidemiology of opioid use and abuse, psychomotor effects of opioids, DUID, and state policy concerning DUID. A total of 23 epidemiological studies, 3 studies on acute psychomotor effects, 32 on chronic psychomotor effects, and selected pertinent law and policy were reviewed.

Results: Current state law concerning DUID is variable and often relies on prosecutorial discretion to provide protection of the driving public and prosecution of the truly impaired.

Limitations: The design of various studies included in this review imposes limitations on the epidemiological data extracted. Relationships between opioids and automobile accidents are commonly reviewed in retrospect. The data on opioid-induced psychomotor impairment and its effects on driving an automobile require further direct study to examine current inferences.

Conclusions: A sizable percentage of the driving public has detectable levels of opioids within their bodies. The best available evidence demonstrates psychomotor impairment following acute administration of opioids or an increase in opioid dosage, but impairment diminishes with chronic, stable opioid usage. Policy makers must account for this evidence when balancing the benefit of pain relief against the need for public roadway protection when drafting DUID legislation.

Key words: Driving under the influence of drugs, DUID, psychomotor impairment, opioids, regulation, automobile accident(s), driver impairment, prescription drugs, chronic opioid analgesic therapy, driving under the influence

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Driving under the influence of drugs (DUID) is a term that is used to designate the action of driving an automobile following ingestion, inhalation, absorption, or injection of drugs or medications other than alcohol that could interfere with the capacity to operate a vehicle safely (1). Although many substances, both legal and illegal, may cause impairment when taken prior to driving,

the ability of prescription drugs to impair drivers creates a special challenge for policy makers, law enforcement, and the physicians who prescribe them. In the field of pain medicine, the most prominent and frequently prescribed class of medications that can cause psychomotor impairment is opioids. As a society attempting to harness the pain relief afforded by opioids, the challenge is to properly draft and enforce laws nuanced to protect the public from impaired driving, yet allow for the safe use of opioids to palliate symptoms and increase productivity. In this review, we attempt to provide an informed framework for such policy by describing the epidemiology of opioid-linked DUID; providing a summary of best scientific evidence on opioids and impairment; reviewing the current state of public policy efforts on DUID; and discussing a framework for comprehensive DUID policy for the future.

Methods

A literature search was conducted regarding the epidemiology of opioid use and abuse, psychomotor effects of opioids, DUID, and state policy concerning DUID. The search was limited to English-language articles. Epidemiological data concerning opioid use and abuse were acquired from selected federal government databases and reports. Epidemiological data concerning opioid-related DUID were acquired from a PubMed search of the terms "opioid" and "driving" because these terms provide more comprehensive results for the study of interest than do similar medical subject heading (MeSH) terms. These terms initially produced 209 documents; we then acquired appropriate references found within selected articles to ensure that the research was thorough. Overall, 23 were selected for relevance because they measured the incidence of opioid use in the general public, DUID arrestees, or motor vehicle drivers involved in traffic accidents. Studies on psychomotor impairment caused by opioids were acquired from a PubMed search of the terms "opioid" and "psychomotor." This search provided a more comprehensive selection of articles than did searches with similar MeSH terms. It returned 711 articles in addition to appropriate references cited within those texts. We selected 3 studies as representative of psychomotor effects of commonly prescribed opioids in the acute outpatient setting. We considered these studies to have value because they were conducted on otherwise healthy individuals, and acute effects were measured through both subjective and objective psychomotor testing. Thirty-two of the 711 articles identified were selected to demonstrate the psychomotor effects of chronic opioid therapy. These studies were chosen because they measured psychomotor function in populations of patients with malignant pain, with chronic nonmalignant pain, and on opioid maintenance therapy. The policy review and discussion are based on a direct review of state statutes, case law, the American Law Review, and documents created through federal funding and at international DUID conferences, as cited.

Results

The Epidemiology of Opioid Use and Abuse

The treatment of chronic pain with opioid medications, while historically controversial, has gained greater acceptance in recent history (2). This shift in medical practice has led to a dramatic increase in the total number of prescriptions written for opioids and the total amount of opioids available for retail consumption over the past 20 years (3,4). Data from the United States Drug Enforcement Administration's Automation of Reports and Consolidated Orders System on the lawful distribution of controlled substances between 1997 and 2006 show that the total amount of prescribed opioids has steadily increased, as measured either in total grams or by grams per 100,000 people (5).

Concurrent with the increase in opioid prescriptions, studies have also documented an increase in prescription misuse and abuse (3,4). In 2009, the National Survey on Drug Use and Health estimated that approximately 5.3 million Americans had used pain relievers for nonmedical purposes within the last month, and approximately 1.9 million Americans were chemically dependent on pain relievers (6). According to the Drug Abuse Warning Network database, estimates of total emergency room visits involving opioid use have steadily increased every year from 2004 to 2007 (7). This data trend parallels that from the National Vital Statistics System Mortality File, which revealed an increase in the absolute number of yearly opioid-related poisonings from 4,041 in 1999 to 14,459 in 2007 (8,9).

In 2009, the U.S. National Highway Traffic Safety Administration (NHTSA) published the results of its 2007 National Roadside Survey of Alcohol and Drug Use by Drivers: Drug Results (NHTSA Report), which provided the first estimate of DUID among the general population in the United States (10). The NHTSA interviewed and drug tested nearly 10,000 drivers in the 48 contiguous states. It found that 11% of daytime drivers

and 14.4% of nighttime drivers tested positive for illegal, prescription, or over-the-counter medications (10). Researchers further subdivided those drivers by specific drug class and found that 1.6% of all daytime and nighttime drivers had [opioid] analgesic medications within their bodies (10).

Although statistics about opioids found in the general population are useful, demonstrating that opioids are found in the bloodstream of drivers involved in traffic accidents leads to the question of whether opioids are involved in driver impairment (Table 1). Walsh et al (11) studied drivers admitted to a major trauma center after a motor vehicle accident. Among 108 drivers, 50.9% tested positive for recent drug use. Eleven of the 108 drivers (10.2%) had opioids in their system before being administered postaccident medical care (11). Data for multivariate analysis correlating a quantitative amount of opioid and fatal crashes were not available for review.

In Washington State, state law requires a blood toxicology screen for all drivers who died within 4 hours of a traffic accident (12). Data collected from February 1, 2001, through January 31, 2002 included 370 specimens, of which 24 (6.4%) tested positive for opioids (12). The breakdown of specific opioids identified among opioid-positive drivers was: hydrocodone 29%, morphine 25%, methadone 16.6%, codeine 12.5%, oxycodone 12.5%, and meperidine 4.1% (12). A comparison of the 2001-2002 data with data acquired in 1992-1993 revealed significant increases in the rate of hydrocodone (from 0.31% to 1.89%) and morphine (from 1.26% to 1.62%) being implicated in fatal motor vehicle crashes (12). Data for multivariate analysis correlating a quantitative amount of opioid and DUID arrest were again unavailable for review (Table 1).

Despite the burgeoning interest in DUID, the accuracy of epidemiological statistics is fraught with limitations owing to legal and methodological obstacles, as present in the studies cited above. If a general population of drivers is screened, researchers must consider that drug use and abuse varies with the time of day or day of week (13). In addition, a certain percentage of drivers will refuse screening, which renders derived incidence rates prone to error (13). Studies of driver subpopulations arrested for DUID or involved in collisions are currently hampered because few legal systems authorize mandatory drug testing on them, much less coordinated quantitative testing across jurisdictions (13). A cross-study comparison and analysis of a link between opioids and driving impairment from such epidemiological data are therefore imperfect at best (13).

Best Evidence Concerning the Use of Opioid Medications and Impaired Driving

Opioids have well-known effects on the central nervous system, such as sedation, mood changes, dizziness, mental clouding, and loss of fine motor skills; such effects appear to diminish over time as a patient develops tolerance (38). However, this side effect profile creates concern regarding the driving capacity of patients on either short-term or long-standing opioid therapy, as driving is a complex task that requires perception, attention, learning, memory, and decision-making (39).

Evidence shows that opioids impair the psychomotor function of opioid-naïve individuals. Several studies conducted by Zacny and colleagues (40-42) examined the subjective, psychomotor, and physiological effects of commonly prescribed opioid analgesics in previously healthy, opioid-naïve patients. To measure subjective experience, Zacny et al (40-42) used questionnaires that asked test patients to rate their experience using adjectives describing commonly mentioned sensations from opioid users. The experience was quantified with a 0–100 visual analog scale.

From the Zacny studies, it is clear that opioid-naïve patients who take commonly prescribed amounts of opioid medications experience subjective feelings that most of the public would consider to be incompatible with driving (Table 2) (40-42). To complement the subjective reports, Zacny included objective testing of psychomotor and cognitive performance (Table 3). These tests included hand-eye coordination, digit-symbol substitution, auditory reaction time, and a logical reasoning test (40-42). Compared to the subjective tests, the objective motor and cognitive tests were considerably less likely to demonstrate a statistically significant difference from placebo (40-42).

Although the acute ingestion of opioids by opioid-naïve patients induces subjective and occasionally objective impairment, patients on long-term, stable doses of opioids have been found to experience fewer deleterious side effects (Table 4). Fishbain et al (43) performed an extensive literature review on opioid use and driving in an attempt to shed light on whether opioids affect the driving ability of patients on chronic stable doses. The authors grouped the studies into categories to answer 5 questions.

Table 1. *Epidemiology of Opioids in the Driving Public*

Author	Years Studied	Population	Number of Subjects	% Positive for Opioids
Incidence of Opioid Use in the General Population of Drivers				
Behrensdorff et al. 2003 (14)	Unspecified	Drivers of the general population in Denmark	896	2.6
Ingsathit et al. 2009 (15)	2005-2006	Drivers of the general population in Thailand	1635	0.1
Labat et al. 2007 (16)	2003-2004	Truck drivers screened randomly in France	1000	6.8
Movig et al. 2004 (17)	2000-2001	Drivers involved in traffic accidents and drivers of the general population in The Netherlands	Accident = 110 Gen. Pop. = 816	8 3
Wylie et al. 2005 (18)	Unspecified	Drivers of the general population in Scotland	1396	4.9
Incidence of opioid use in drivers suspected of driving under the influence				
Appenzeller et al. 2005 (19)	2001-2002	Drivers suspected of driving under the influence in Luxembourg	210	1
Augsburger et al. 2005 (20)	2002-2003	Drivers suspected of driving under the influence in France	440	16
Christophersen et al. 1999 (21)	1996	Drivers suspected of driving under the influence in Norway, Denmark, Finland, Iceland, Sweden	Norway = 140 Denmark = 255 Finland = 270 Iceland = 40 Sweden = 86	Norway = 6 Denmark = 1 Finland = 0 Iceland = 0.25 Sweden = 5
Fitzpatrick et al. 2006 (22)	Unspecified	Drivers suspected of driving under the influence in Ireland	2000	7.5
Jones et al. 2007 (23)	2004-2005	Drivers arrested for DUID in Sweden	14,811	12
Ojaniemi et al. 2009 (24)		Drivers suspected of driving under the influence in Finland	31,963	13.8
Palmentier et al. 2009 (25)	2001-2005	Drivers suspected of driving under the influence in Ontario	42	16
Senna et al. 2010 (26)	2005	Cases of DUID submitted for toxicological testing	4794	15
Smink et al. 2001 (27)	1995-1998	Drivers suspected of driving under the influence in The Netherlands	1665	17.4
Toth et al. 2009 (28)	2000-2007	Drivers suspected of driving under the influence in Hungary	1740	12
Incidence of Opioid Use in Drivers Involved in Traffic Accidents				
Bernhoft et al. 2005 (29)	2002-2004	Injured drivers at emergency rooms in Denmark	30	3.3
Carmen del Rio et al. 2002 (30)	1991-2000	Drivers involved in fatal traffic accidents in Spain	5745	3.2
Drummer et al. 2003 (31)	1990-1999	Fatally injured drivers in Victoria, New South Wales, and Western Australia, Australia	3398	4.9
Elliot et al. 2009 (32)	2000-2006	Drivers involved in fatal traffic accidents in Great Britain	588	7–9
Jones et al. 2009 (33)	2003-2007	Drivers involved in fatal traffic accidents in Sweden	1403	4.9
Movig et al. 2004 (34)	2000-2001	Drivers involved in traffic accidents and drivers of the general population in The Netherlands	Accident = 110 Gen. Pop. = 816	8 3
Mravcik et al. 2007 (35)	2003-2005	Drivers fatally injured in traffic accidents in the Czech Republic	474	0.4
Mura et al. 2003 (36)	2000-2001	Drivers non-fatally injured in traffic accidents in France	900	2.7
Papadodima et al. 2008 (37)	1998-2004	Drivers involved in traffic accidents in Greece	3167	4

DUID indicates driving under the influence of drugs

Table 2. *Acute effects of opioids on non-drug-abusing volunteers as measured by subjective reports on a Visual Analog Scale*

Drug	Dose	Coasting	High	Difficulty Concentrating	Sleepy	Dizzy
Placebo (40)	Lactose Tabs	13.6	7.3	12.4	27.4	3.6
Morphine (40,42)	30 mg	22.2	19.5	23.4	36.5	17.6
	40 mg	32.8	31.8	33.7	58.1	23.2
	60 mg	42.1	22.0	41.8	78.0	39.4
Hydrocodone/ Acetaminophen (40)	5 mg/500 mg	12.3	4.4	17.8	33.4	7.3
	10 mg/500 mg	16.2	14.9	26.0	37.6	11.6
	20 mg/1000 mg	33.4	24.6	39.8	59.9	24.8
Oxycodone (42)	10 mg	24.8	25.1	28.3	59.6	18.9
	20 mg	31.3	41.0	39.3	68.3	32.3
	30 mg	39.1	51.9	50.2	70.8	38.3
Acetaminophen (40)	1000 mg	11.3	2.3	15.5	36.0	1.7

Table 3. Acute effects of opioids on non-drug-abusing volunteers as measured by psychomotor testing

Drug	Dose	Hand-Eye Coordination[A]	Digit-Symbol Substitution (Drawn Correctly)[B]	Auditory Reaction Time[C]	Logical Reasoning Test (Answered Correctly)[D]
Placebo (40)	Lactose	7.8	48.6	.324	16.7
Morphine (40,42)	30 mg	10.9	44.7	.360	14.8
	40 mg	8.9	41.2	.331	11.9
	60 mg	14.1	41.4	.358	15.2
Hydrocodone/ Acetaminophen (40)	5 mg/500 mg	8.0	44.0	.297	14.6
	10 mg/ 500 mg	8.7	43.8	.320	14.8
	20 mg/1000 mg	9.3	40.3	.301	12.6
Oxycodone (41)	10 mg	10.5	46.6	.329	15.5
	20 mg	11.7	41.8	.345	14.7
	30 mg	14.2	40.9	.351	14.3
Acetaminophen (40)	1000 mg	8.8	44.8	.295	14.4

[A]A one-minute eye–hand coordination test required the subject to track a randomly moving target (a circle) on the computer screen using a computer mouse. The dependent measure was the number of seconds that a small plus sign, which was controlled by the mouse, deviated by more than 1 cm from the center of the target circle.

[B]The digit-symbol substitution test was a 1-min paper-and-pencil test that required the participant to replace digits with corresponding symbols according to a digit-symbol code listed on the top of the paper.

[C]A one-minute auditory reaction test measured the time it took for subjects to react to ten 50-dBA computer-generated tones that were delivered at random time intervals. The mean reaction time (in seconds) to depress a computer keyboard spacebar was the dependent measure.

[D]A one-minute computerized logical reasoning test measured higher mental processes such as reasoning, logic, and verbal ability. The test was similar to the logical reasoning test developed by Baddeley (1968) and consisted of true–false statements about the juxtaposition of the two letters A and B, which were displayed on the computer monitor (e.g., A is preceded by B—true or false).

Table 4. *Chronic psychomotor effects of opioids*

Author	Population (Groups)	Study Question	Study Design	Study Conclusion
Non-malignant Pain Patents				
Byas-Smith et al. 2005 (44)	32 pts with CNCP on COAT vs. 50 healthy controls.	Does COAT impair the ability to drive in CNCP pts as measured by driving tests and standardized neuropsychiatric tests?	Prospective study used driving tests and neuropsychiatric tests to compare 21 pts with CNCP on COAT, 11 pts with CNCP w/o opioids, and 50 healthy controls.	Pts with CNCP on COAT performed as well as controls on driving tests and standardized neuropsychiatric tests for driving aptitude.
Dagtekin et al. 2007 (45)	30 pts with CNCP on COAT vs. 90 healthy matched controls.	Does transdermal buprenorphine cause variations in psychomotor performance?	Prospective study compared 30 pts with CNCP on COAT consisting of transdermal buprenorphine and 90 healthy matched pairs administered neuropsychiatric tests for driving aptitude.	Pts on COAT consisting of transdermal buprenorphine performed as well as controls on neuropsychiatric tests for driving aptitude.
Gaertner et al. 2006 (46)	30 pts with CNCP on COAT vs. 90 healthy matched controls.	Does COAT consisting of sustained-release oxycodone cause variations in psychomotor performance?	Prospective study compared 30 pts with CNCP on oxycodone and 90 healthy matched controls administered neuropsychiatric tests.	Pts on COAT consisting of sustained release oxycodone could not be proven to be statistically noninferior, but COAT pts performed above the 16% of test participants at the same rate as controls.
Galski et al. 2000 (47)	16 pts with CNCP on COAT vs. 327 cerebrally compromised pts.	Does COAT cause variations in psychomotor performance?	Prospective study compared the performance of 16 pts on neuropsychiatric tests and a driving simulator vs. records of brain injury pts who had passed or failed on-road driving tests.	Pts on COAT generally performed similar to brain injury pts who passed on-road driving tests. Deficits in COAT pt performance were not specific for a certain cognitive dimension.
Haythornthwaite et al. 1998 (48)	19 pts with CNCP on COAT vs. 10 pts with CNCP on "usual care."	Does COAT cause variations in psychomotor performance?	Prospective comparison of 19 pts with CNCP on COAT vs. 10 patients with CNCP w/o COAT based on questionnaires and neuropsychiatric tests.	Pts on COAT had reduced pain, anxiety, and hostility and improvements in sleep w/o significant cognitive side effects.
Jamison et al. 2003 (49)	144 pts with CNCP on COAT consisting of either oral oxycodone/acetaminophen or transdermal fentanyl.	Does COAT cause variations in psychomotor performance?	Prospective study of 144 pts subjected to two standardized neuropsychiatric test batteries at 0, 3, and 6 mos.	There was mild improvement in performance in standardized neuropsychiatric tests, including the digit-symbol substitution test and the trail-making test between mos. 0-3 and 0-6 mos.
Lorenz et al. 1997 (50)	6 pts with CNCP on COAT.	Does sustained-release morphine improve pain relief and mood while preventing decrements in psychomotor performance?	Prospective study of 6 pts with CNCP on COAT measured subjective VAS scores and objective pain and auditory reactions.	COAT improved subjective pain ratings and objective neuro signals related to vigilance and decrements in objective neuro pain signals.
Menefee et al. 2004 (51)	23 pts with CNCP on COAT consisting of transdermal fentanyl.	Does transdermal fentanyl cause variations in psychomotor performance?	Prospective study tested 23 pts with CNCP on COAT with a driving simulator and neuropsychiatric tests for driving aptitude.	Pts did not demonstrate inferiority to controls in either driving simulator or neuropsychiatric testing.
Sabatowski et al. 2003 (52)	21 pts with CNCP on COAT consisting of transdermal fentanyl vs. 90 random healthy control pts.	Does transdermal fentanyl cause variations in psychomotor performance?	Prospective study used standardized neuropsychiatric test batteries to compare 21 pts on transdermal fentanyl and 90 healthy controls.	Pts on COAT consisting of transdermal fentanyl performed as well as controls on standardized neuropsychiatric test batteries designed to measure driving aptitude.
Sjogren et al. 2000 (53)	40 pts with CNCP on COAT vs. 40 matched healthy controls.	Do pts on COAT have variations in psychomotor performance?	Prospective study used neuropsychiatric tests to compare 40 pts on COAT and 40 healthy controls on neuropsychiatric tests. 14 pts retested at 3 mos.	Pts on COAT for CNCP performed statistically worse on testing for continuous reaction time, vigilance/attention, and working memory.
Sjogren et al. 2005 (54)	91 pts with CNCP vs. 64 matched healthy controls.	Do pts with CNCP have variations in psychomotor performance from use of COAT, anticonvulsants/antidepressants, or both?	Prospective study used standardized neuropsychiatric test batteries to compare 91 pts with CNCP (21 w/o pain treatment, 19 on COAT, 18 on antidepressant/anticonvulsant therapy, and 33 on COAT and antidepressant/anticonvulsant therapy) and 64 matched controls .	Pts on COAT with or w/o antidepressant/anticonvulsant therapy for CNCP performed statistically worse on tests of sustained memory and psychomotor speed, but were noninferior on tests of working memory and information processing. Pts on combined therapy had specific deficit on tests of sustained memory.
Tassain et al. 2003 (55)	18 pts with CNCP on COAT and 10 controls with CNCP w/o opioids.	Does COAT impair psychomotor performance on a standardized battery of neuropsychiatric tests?	Prospective design subjecting 18 pts to neuropsychiatric tests at 0, 3, 6, and 12 mos.	Pts on COAT had improved pain and mood scores w/o changes in neuropsychiatric test performance.
Cancer Patients				
Banning et al. 1992 (56)	32 pts with cancer pain on COAT.	Do pts taking COAT for cancer pain have a slowed continuous reaction time (CRT)?	Prospective study used neuropsychiatric tests to compare 16 cancer pts on peripherally acting analgesic and 16 cancer pts on peripherally acting analgesic and COAT.	Pts receiving COAT had increased sedation and slowed CRT.
Bruera et al. 1989 (57)	40 pts with cancer pain on COAT.	Do acute increases in opioid dosages affect psychomotor performance for pts on COAT?	Prospective study used neuropsychiatric tests to compare 20 cancer pts on stable COAT with 20 cancer pts on COAT after acute dosage increases.	Acute dosage increases to COAT resulted in psychomotor impairment.

Table 4 (cont.). ***Chronic Psychomotor Effects of Opioids***

Author	Population (Groups)	Study Question	Study Design	Study Conclusion
Christrup et al. 1999 (58)	18 pts with cancer pain on COAT	Do immediate release (IR) morphine and continuous release (CR) morphine cause differences in sedation, pain intensity, and reaction time in cancer pts?	Prospective cross-over trial of 18 cancer pts on either IR or CR morphine for reaction time and VAS for sedation and pain intensity.	Pts with cancer exhibited no significant difference in sedation, pain intensity, or reaction time when given equivalent doses of IR or CR morphine.
Clemons et al. 1996 (59)	7 pts with cancer pain on COAT, 6 pts with cancer not on COAT, and 16 healthy controls.	Does COAT impair cancer pts performance on standardized neur 18 pts with cancer pain on COAT. opsychiatric tests?	Prospective study compared performance on comparison of 7 cancer pts on COAT, 6 cancer pts w/o COAT, 16 healthy controls on neuropsychiatric tests.	Pts with cancer had poorer performance than healthy controls on IQ, memory, and vigilance. Cancer pts on COAT had more sedation as measured by VAS than cancer pts not on COAT.
Sjogren et al. 1989 (60)	14 pts with cancer pain vs. 20 healthy controls.	Does oral or epidural COAT cause variations in psychomotor performance?	Prospective study used neuropsychiatric tests to compare 14 pts on oral and then epidural COAT and 20 healthy controls.	Pts on COAT had slower reaction times than did controls. No statistically significant difference between oral and epidural opioids was observed.
Sjogren et al. 2000 (61)	130 pts with cancer and varying Karnofsky Performance Status (KPS), presence of pain, and use of COAT.	What effects do performance status, presence of pain, and presence of COAT have on standardized neuropsychiatric tests?	Prospective comparison of 130 cancer pts (40 with KPS A, no pain, no opioids; 19 with KPS B, no pain, no opioids; 19 with KPS B, pain, no opioids; 21 with KPS B, pain, chronic opioids; 31 with KPS B, no pain, chronic opioids) on standardized neuropsychiatric tests.	Cancer pts with KPS A performed better than cancer pts with KPS B on tests of sustained memory and psychomotor speed whether or not they took COAT, but only better on tests of working memory and information processing if those patient with KPS B had unrelieved pain. Pts with KPS B and controlled pain performed better on tests of working memory and information processing than did those with unrelieved pain.
Vainio et al. 1995 (38)	24 pts with cancer pain maintained on COAT consisting of oral morphine vs. 25 cancer pts w/o malignant pain.	Does COAT consisting of oral morphine cause variations in psychomotor performance?	Prospective study used neuropsychiatric tests to compare 24 pts with cancer pain on COAT and 25 cancer pts w/o COAT.	Pts on oral morphine performed worse on tests of psychomotor function, but not to a statistically significant degree.
Wood et al. 1998 (62)	9 pts with cancer on oral morphine vs. 9 pts with cancer on subcutaneous morphine.	Does COAT consisting of oral or subcutaneous morphine cause variation in psychomotor performance?	Prospective study used neuropsychiatric tests to compare 9 cancer pts on oral COAT and 9 cancer pts on subcutaneous COAT.	Pts on either oral or subcutaneous morphine exhibited deficits in delayed recall, conceptual tracking, and attention. Conceptual tracking was significantly better for pts on oral morphine.
Patients on Opioid-Maintenance Therapy				
Baewert et al. 2007 (63)	40 pts with history of opioid abuse on buprenorphine or methadone maintenance.	Do peak and trough levels of opioids cause variations in psychomotor performance?	Prospective study compared 40 pts in neuropsychiatric tests for driving aptitude.	Trough levels were associated with more errors than were peaks. Buprenorphine pts had fewer errors than did methadone pts.
Darke et al. 2000 (64)	30 pts on methadone maintenance vs. 30 healthy matched control pts.	Do pts on methadone maintenance experience variations in psychomotor performance? What are risk factors for deficits in cognitive performance?	Prospective study used neuropsychiatric tests to compare 30 pts on opioid maintenance and 30 healthy controls.	Pts. on opioid maintenance had cognitive deficits and psychiatric morbidity at greater rates than did controls.
Lenne et al. 2003 (65)	10 methadone maintenance pts, 13 levo-alpha-acetylmethodol (LAAM) maintenance pts, 11 buprenorphine maintenance pts, 21 matched healthy controls.	Do pts on opioid maintenance consisting of methadone, LAAM, or buprenorphine experience variations in performance in a driving simulator?	Prospective study used a driving simulator to compare 34 pts on 3-mo opioid maintenance and 21 healthy matched controls.	Pts on opioid maintenance did not differ significantly from controls in driving simulator performance when stabilized on a treatment regimen for 3 mos.
Loebner et al. 2008 (66)	30 methadone maintenance pts vs. 26 buprenorphine maintenance pts.	Do pts on methadone maintenance have greater psychomotor impairment on standardized tests than do buprenorphine maintenance pts?	Prospective study used neuropsychiatric tests to compare 30 methadone maintenance pts and 26 buprenorphine maintenance pts.	Pts on methadone and buprenorphine were similar in terms of psychomotor impairment; pts on high-dose methadone demonstrated increased difficulty with vigilance.
Mintzer et al. 2002 (67)	18 methadone maintenance pts vs. 21 healthy matched control pts.	Do pts on methadone maintenance experience variations in psychomotor performance?	Prospective study used a battery of neuropsychiatric tests to compare 18 methadone maintenance pts and 21 healthy controls.	Pts on opioid maintenance demonstrated impairment in psychomotor speed, working memory, decision making, and metamemory. Pts did not have impairment in time estimation, conceptual flexibility, or long-term memory.

Table 4 (cont.). *Chronic Psychomotor Effects of Opioids*

Author	Population (Groups)	Study Question	Study Design	Study Conclusion
Mintzer et al. 2005 (68)	20 abstinent opioid abusers, 18 methadone maintenance pts , 21 healthy matched controls.	Do abstinent opioid abusers experience variations in psychomotor performance compared with methadone maintenance pts or healthy controls?	Retrospective comparison using neuropsychiatric tests and former test results.	Abstinent opioid abusers exhibited cognitive performance between that of methadone maintenance pts and healthy controls, suggesting that methadone maintenance causes deficits beyond that of prior abuse.
Prosser et al. 2006 (69)	29 methadone maintenance pts, 27 abstinent opioid abusers, 29 healthy controls.	Do patients on opioid maintenance experience variations in psychomotor performance? Do these variations persist after complete detoxification.	Prospective study used neuropsychiatric tests to compare 29 methadone maintenance pts,27 abstinent opioid abusers, and 29 healthy controls.	Pts on opioid maintenance and those with prolonged abstinence from opioids demonstrated psychomotor impairment when compared with healthy controls.
Rapeli et al. 2007 (70)	16 methadone maintenance pts, 17 buprenorphine maintenance pts, 17 healthy controls.	Do patients on opioid maintenance consisting of methadone or buprenorphine experience variations in psychomotor performance when compared to each other or healthy controls?	Prospective study used neuropsychiatric tests to compare16 methadone maintenance pts and 17 buprenorphine maintenance pts.	Pts on methadone and buprenorphine had cognitive deficits when compared to controls. Methadone-maintained pts had significantly slower reaction times when compared with buprenorphine-related controls.
Schindler et al. 2004 (71)	30 buprenorphine or methadone maintenance pts vs. 30 healthy matched controls.	Do pts on buprenorphine or methadone maintenance have variations in psychomotor performance?	Prospective study used tests of driving aptitude to compare 30 pts on opioid maintenance and 30 healthy controls.	Pts on maintenance therapy performed worse on 2/7 tests of attention under monotonous circumstances and decision/reaction time in dynamic environments, but similar in other dimensions.
Shmygalev et al. 2011 (72)	30 buprenorphine maintenance pts vs. 90 healthy controls.	Do pts on buprenorphine maintenance have variations in psychomotor performance?	Prospective study used tests of driving aptitude to compare 30 buprenorphine pts and 90 healthy controls.	Pts on buprenorphine maintenance did not exhibit psychomotor or cognitive deficits when compared to controls.
Soyka et al. 2005 (73)	22 buprenorphine maintenance pts vs. 24 methadone maintenance pts.	Do pts on buprenorphine maintenance have variations in psychomotor performance when compared to pts on methadone maintenance?	Prospective study used neuropsychiatric tests of driving aptitude to compare 22 buprenorphine maintenance pts and 24 methadone maintenance pts.	No statistically significant differences were identified; however buprenorphine-maintained pts performed better on neuropsychiatric testing as a whole.
Verdejo et al. 2005 (74)	18 methadone maintenance pts vs. 23 abstinent opioid abusers.	Do pts on methadone maintenance have variation in psychomotor performance when compared to abstinent heroin abusers?	Prospective comparison using neuropsychiatric tests.	Methadone-maintained pts exhibited decreased processing speed, attention, cognition, and working memory when compared to abstinent abusers.

CNCP indicates chronic noncancer pain; COAT, chronic opioid analgesic therapy; CR, continuous release; CRT, continuous reaction time; IR, immediate release; KPS, Karnofsky Performance Status; LAAM, levo-alpha-acetylmetodol; pts, patients; VAS, visual analog scale.

1. Do opioid-stabilized patients have impaired psychomotor activities?
2. Do opioid-stabilized patients have impaired cognitive function?
3. Does the acute administration of opioids affect the psychomotor activities in opioid-maintained patients?
4,. Do opioid-stabilized patients have an increased likelihood of acquiring motor vehicle violations or motor vehicle accidents?
5. Do opioid-stabilized patients demonstrate driving impairments either in driving simulators or during on-road testing (43)?

Sixteen of 23 studies (69.6%) supported the conclusion that no psychomotor impairment exists in patients on stable opioid dosages (43). Five of 11 studies (45.4%) that examined whether cognitive function was impaired in patients on stable opioid doses found no impairment (43). Fourteen of 15 studies showed no psychomotor impairment in patients stabilized on opioid medications after the acute administration of opioids (43). Eight studies were reviewed to answer the question of whether patients on stable doses of opioids were at greater risk of motor vehicle violations or accidents (43). These studies reviewed data for patients on chronic methadone treatment and teens who admitted to opioid usage (43). Seven of these studies found no increase in the number of motor vehicle violations or motor vehicle accidents for this population compared with age-matched controls (43). Finally, 3 studies examined whether stable doses of opioids resulted in driving impairments during simulator or on-road driving tests (43). Two of the 3 studies demonstrated that patients on chronic opioid therapy performed as well as their control-group counterparts (43).

Although patients on stable doses of opioids appear to acquire a tolerance that prevents them from demonstrating the impairment experienced by opioid-naïve individuals, acute increases in opioid dosages appear to cause the psychomotor impairment to return (57). Bruera et al (57) conducted a study of 40 cancer patients on chronic opioid therapy. Twenty patients had been on stable opioids for more than 7 days and 20 had acute increases less than 3 days prior (57). Psychomotor testing was conducted 45 minutes after the morning opioid administration (57). This testing demonstrated significant changes in psychomotor function, including increased drowsiness and nausea and decreased finger tapping speed, arithmetic problem solving speed, and visual memory in those who had had acute increases in opioid dosage (57).

In addition to the timing of acquired tolerance, several other variables of pain-related and psychomotor symptoms experienced by patients with chronic pain confound attempts to quantify the level of opioid-induced impairment. First and foremost, patients who suffer from chronic pain may experience cognitive, psychomotor, or physiologic impairment from the pain symptoms themselves (75). These symptoms alone have been shown to cause impaired driving ability (75). In these cases, pain relief may actually improve psychomotor performance (49). Second, the disease processes that cause chronic pain are not uniform. For some conditions such as cancer, either the disease itself or a concomitant treatment(s) (e.g., anxiolytics, chemotherapy) used to alleviate nonpain symptoms, can impair psychomotor skills (61). Consequently, studies to evaluate the effects of opioid use in chronic pain patients require control groups with a similar disease burden to measure the impairing effect attributable to opioids (61). Patients with a history of substance abuse or who are in opioid maintenance programs may also skew data on impairment. Such patients have been found to have higher rates of misuse, abuse, or concomitant illicit drug use that can compromise study results (71).

The Current State of Public Policy Concerning DUID

Appropriate DUID arrests and convictions begin with properly executed arrest procedures. Officers initiate an arrest when they identify erratic driving, signal the car to the roadside, and perform a Standardized Field Sobriety Test and measure breath alcohol content (BrAC) (76). If the driver appears more impaired than indicated by his BrAC, the arresting officer may call in the assistance of a drug recognition expert (DRE). The DRE is a class of officer trained to accurately assess when a driver is under the influence of drugs other than alcohol and order appropriate toxicological testing (76). The DRE opinion has been cited as strong evidence in acquiring DUID convictions (76).

Difficulty in acquiring objective evidence is created when a driver refuses to take a toxicological test. To overcome this obstacle, many states have implemented laws asserting that by driving on state roads, motorists have given "implied consent" to body fluid or tissue collection for analytic testing (Table 5) (1). These states force the driver to choose between a toxicological test or an adverse legal consequence for refusing to provide a sample (1). Two states, Alabama and Alaska, make testing compulsory if an accident involves morbidity or mortality (1). Twenty-six other states authorize officers to acquire a sample notwithstanding a driver's refusal; however, such samples are commonly limited to instances of accidents involving personal injury or death (1). Two states impose enhanced penalties on drivers who refuse testing but are eventually convicted of DUID (1). Other states consider forced samples to constitute a "search" under the Constitution, and therefore require either a search warrant or circumstances that supersede the need for such a warrant (1).

When a sample is not acquired, other options exist for prosecutors to pursue DUID or related convictions. For example, in 9 states, the refusal to submit to toxicological testing is a crime (1). Most states do not consider refusal a crime, but do allow prosecutors to admit evidence of a refusal to submit to toxicological testing at trial against the defendant driver (1). Such evidence can be incriminating toward defendants, as it can instill a suspicion of guilt within the minds of jurors. However, the use of refusal as evidence does have limitations that are not uniform among the states (1). Wisconsin requires that implied-consent rules were correctly adhered to prior to introducing evidence (1). Maryland requires that such evidence be "material and relevant" to issues related to the DUID offense (1). Michigan does not allow such information to be introduced at trial except to show that such testing was requested (1). Virginia allows such information to be admitted only as a rebuttal, meaning that the defendant would have to raise the issue of testing before the prosecution could introduce the refusal as evidence (1).

One of the most important issues at trial is whether the driver met the level of impairment that the state designates as a crime (Table 5). The vast majority of

Table 5. *State Law Concerning DUID*

Law	Applicable States
Implied Consent to Toxicology Testing for All Motorists	
No implied consent	MA, NJ, WV
Implied consent in accident with serious injury or death	AL, AK
Implied consent for toxicological testing in all circumstances	AS, AZ, AR, CA, CO, CT, DE, DC, FL, GA, HI, ID, IL, IN, IA, KS, KY, LA, ME, MD, MI, MN, MS, MO, MT, NE, NV, NH, NM, NY, NC, ND, OH, OK, OR, PA, RI, SC, SD, TN, TX, UT, VT, VA, WA, WI, WY
Criminal penalties for refusal of a toxicology test	AK, AR, IN, LA, MD, MN, NE, NM, OH, RI
Enhanced penalties for refusal of a toxicology test	KY, ME
Automatic arrest for DUID for refusal of a toxicology test	NV
Standard of Impairment Used for DUID Conviction	
"Incapacity"	AL, AR, IL, KS, NV, MD, NM, ND, OK, PA, SD, VT, WI, WY
"Impaired"	AZ, FL, HI, IN, KY, MT, SC, VA, NY•
"Per Se" any amount of prohibited drug or any amount of prohibited drug metabolite	AZ, DE, GA, IN, MN, PA, UT
"Per Se" any amount of prohibited drug	IL, IA, MI, RI, WI
"Per Se" a specified amount of prohibited drug	NV, OH, VA
"Per Se" any amount of prohibited drug in driver under 21 years old	NC, SD
"Not having normal use of mental or physical faculties"	TX
Use of a Valid Prescription for Opioids as a Defense to DUID Conviction	
Legal entitlement to a prescription drug is no defense	AL, AZ, AR, DE, GA, ID, IL, KS, KY, MT, NC, OK, PA, RI, SD, TN, TX, VT, WA, WV, PR
Use of a drug according to a valid prescription/ directions is a defense without caveats	AZ, IN, IA, MN, NC
Use of a drug according to a valid prescription/ directions is a defense with caveats	WA, NC, GA, UT, ND, MD, CA, WI*

*Wisconsin allows a defense to a charge of DUID if the driver proves by a preponderance of the evidence that at the time of the incident or occurrence he or she had a valid prescription for methamphetamine or one of its metabolic precursors, gamma-hydroxybutyric acid, or delta-9-tetrahydrocannabinol

•New York has the standard of "impaired driving" but does not use the term "under the influence" in their statute.

DUID indicates driving under the influence of drugs.

the states (48) use the phrase "under the influence" to describe the level of impairment considered criminal; however, this phrase is interpreted differently among various states (1). Fourteen states define "under the influence" in the statutory language to mean "incapable of driving safely"(1). This language ensures that the prosecutor faces a heavy burden of proof in establishing that the opioid ingested incapacitated the defendant driver. Another 8 states have a lower threshold for impairment, using the word "impaired" to define "under the influence." This statutory definition implies a more modest deterioration in driving ability as grounds for conviction (1). A total of 17 states support some form of "zero tolerance" law whereby body fluid levels of any amount of drug capable of impairing driving performance may be grounds for sanction (1).

The use of legally acquired prescription medications while driving as a defense to the charge of DUID presents a question upon which states are divided (Table 5). Twenty states do not allow the legal use of a prescription medication to be pleaded as a defense to DUID (1). Five states allow such a defense (1). The state

of Maryland allows the use of a prescription medication as a defense when the defendant was unaware that the drug would render him/her incapable of driving safely and the defendant was legally entitled to use a controlled substance (1). North Dakota will allow legal entitlement to be used as a defense if the drug was used only as prescribed by a physician or other practitioner who legally prescribed or dispensed the drug to the defendant (1). The state of Washington allows the use of a drug pursuant to a prescription as a defense to its charge of negligent driving (1). North Carolina allows the use of "therapeutically appropriate amounts" of a legally prescribed drug as a defense for its per se negligence law for drivers under 21 years of age (1). Georgia allows a legal prescription to be used as a defense to its per se law unless that drug renders the driver incapable of driving safely (1). In California, the law provides a defense for lawful use by patients enrolled in opioid treatment programs (1).

The range of penalties and sanctions placed on a driver convicted of DUID is vast. A detailed discussion of such sanctions is beyond the scope of this article, but a brief summary is useful to illuminate the pertinent details that allow for an informed commentary on the direction such policies should take in the future. Most states sanction suspension of one's driver's license following conviction and provide subsequent provisions for license revocation for repeat offenders (1). A majority of states assign fines for first-time offenses that are considered misdemeanors. Escalating penalties such as increased fines or incarceration for repeat offenders generally exist, but various substitutions are often employed to ease the burden on the state penitentiary system; substitutions can include community service, house arrest, and electronic monitoring (1).

Rehabilitation of offenders is an important part of comprehensive DUID law. Thirty-one states currently have sentencing laws that include use of drug rehabilitation/education programs (1). Nine states allow judges to "sentence" offenders to attend inpatient or outpatient rehabilitation programs in lieu of prison (1). Some states screen offenders to discern whether further rehabilitation would be beneficial before assigning program attendance (1). Other states make attendance at a rehabilitation program a precondition for probation or re-acquisition of one's driver's license (1).

Physicians may face liability for the driving actions of their patients on opioid therapy under the traditional physician-patient duty of care (77). This liability extends not only to the person and property of the patient, but also to third parties (78). Cases against physicians have succeeded when the physician fails to prescribe a specific and limited dosage in accordance with current guidelines (79); regularly examine the patient (80); disclose risks, including impaired driving (81); recognize and modify treatment for drug abusers (82); and monitor the patient properly (82). Despite such cases, instituting these general principles into practice is fraught with inherent difficulty, as little consensus exists among medical professionals regarding dosage limits for opioids, what constitutes proper monitoring and surveillance, and how best to distinguish aberrant behaviors from pseudoaddiction or undertreatment.

Discussion

In 2010 the White House Office of National Drug Control Policy's (ONDCP) National Drug Control Strategy established the reduction of drugged driving as a national priority (83). The report set a goal of reducing drugged driving by 10% by the year 2015 (83). To do so, several initiatives were set. They included:

- Evaluation of current DUID laws
- Evaluation and improvement of drugged driving data collection
- Improvement of drugged driver education
- Identification and evaluation of promising models for drugged driver identification
- Standardizing drugged driver testing
- Conducting drug impairment research
- Conducting drugged driver behavioral research
- Conducting related treatment research (83).

In light of this national strategy, providers who wish to ensure that opioids are not over-regulated must be active in pursuing the research that leads to policy based upon best evidence and not based upon emotional legislative reaction to a gruesome tragedy.

Current research has established 2 groups of opioid users: those who have recently begun opioid therapy or who have recently increased their opioid dosage and are likely to demonstrate psychomotor impairment (40,41,42,57); and chronic users who do not appear to demonstrate significant psychomotor impairment (43). In addition, several of the conditions for which opioids are used can cause psychomotor impairment and interfere with the ability to drive (75). Future study on impairment must therefore be aimed at clarifying the conditions (e.g., dosage, length of treatment, combination with alcohol/drugs, comorbid conditions) under

which opioids clearly induce psychomotor impairment (84). Such studies must test psychomotor impairment through simulated or actual driving or by use of sensitive, validated instruments (84). Specific parameters of psychomotor function have been suggested by international experts in regard to DUID through the recommendations of the International Council on Alcohol, Drugs, and Traffic Safety (84).

Statutory law must authorize and fund the collection of epidemiological data on the general public and on those who have had DUID-related offenses and accidents (85). The collection of data should focus on drug- and medication-usage patterns. Information gathered should include: drugs and medications the person takes; duration of use for each drug or medication; concomitant use of other medicines; past medical history of the person; and quantitative blood levels of selected drugs and medications. The data gathered would allow researchers to run a multivariate analysis to identify the conditions associated with DUID arrest or traffic accidents. This database would not only provide cross-sectional data, but ideally would allow for recognition of trends, such as recidivism rates, and the comparison of interventions, such as criminal punishments and rehabilitation. Internationally coordinated efforts to establish congruently constructed databases could enable cross-cultural comparison and allow countries to learn from one another based on policy experiments (85).

Table 6. *Recommendations for Behaviors to Measure During DUID Research**

There are 3 core levels of behavior that should be measured to predict crash risks/accidents:
Automotive behavior: well-learned skills Tracking, steering (road tracking, critical tracking, compensatory tasks). Vigilance or sustained attention (Mackworth Clock Test).
Control behavior: maintaining distance, passing, etc. Motor performance, maneuvers (reaction time, car following tasks). Divided attention (dual attention tasks). Perception (time to collision-type tasks).
Executive planning behavior: interactive functions with ongoing traffic. Risk taking, impulsivity (stop signal, Iowa gambling tasks). Information processing, attention (choice reaction-time, selective or focused attention tasks). Cognition, judgment (Tower of London task).

* From: Walsh JM, Verstraete AG, Huestis MA, Morland J. Guidelines for research on drugged driving. *Addiction* 2008; 103:1258.

Strong database creation and enforcement strategy benefit from policies that support implied consent to roadside testing. Despite the various arguments against implied consent (e.g., violation of civil liberties), it creates an enforcement system that improves prosecution of offenders. Voting in favor of such policy, the Supreme Court of the United States has found implied consent to withstand constitutional challenge, (86) and the vast majority of states have adopted some form of implied consent. An implied consent strategy allows for driver refusal of testing, but smart policies provide a sanction for the failure to submit to drug testing that is equivalent to the sanction for a positive drug test. (87)

Roadside drug testing must continue to be refined to be as simple, noninvasive, and accurate as possible. Quantitative testing would provide the best objective evidence to the court and may improve prosecution of DUID in the way that breath alcohol testing simplified alcohol-related DUI prosecution (84). As blood and urine cannot be as safely and discretely acquired during a roadside exam, current research efforts are focused on tests that use saliva samples or finger-stick blood samples (84). No clear candidate has yet emerged as being both accurate and reliable (84). Until an effective roadside drug test emerges, policy must support standardized quantitative blood or urine tests.

The high standards of impairment and poor quality of evidence acquired during DUID arrests are obstacles to consistent, balanced prosecution. Currently, prosecutors may face the daunting task of proving that the driver was impaired and that the drug in question was directly responsible for impairment (88). The burden is higher in states where "under the influence" is defined as "incapable of safely operating a motor vehicle" (1). In several instances that an allegedly opioid-impaired driver was pulled over, prosecutors had to rely on circumstantial evidence, such as signs of intravenous injection (89), admissions of drug use (90), finding prescription bottles (91), failure of sobriety testing (91), erratic driving behaviors (92), and expert testimony to prove opioid-related impairment (93). Prosecution was therefore almost exclusively successful in instances where the defendant drivers had mixed drugs, exceeded the proper dose, or had taken controlled medications without a prescription. To improve consistency, the legal and medical communities could work to establish protocols that standardize the evidence collected and provide guidance to prosecutors on the conditions under which opioids are most likely to be involved in psychomotor impairment.

"Per se" laws, in which any specific amount of a drug or its metabolite detected in the body creates an automatic finding that the subject is "under the influence," offer an appealing alternative to the legal struggle with the "impairment" standard (94). In cases involving alcohol, such laws have led to improved prosecution efficacy and fewer highway fatalities as a result of general deterrence (95). For these reasons, per se laws have been advocated in prosecuting the illicit use of opioids (94). The ONDCP states that it will encourage states to adopt "per se" laws as part of the tactics to achieve the goal of a 10% reduction in DUID by 2015 (83). The dilemma with "per se" laws applied to properly taken and legal prescription opioids is that a per se blood level of opioid that causes impairment in all individuals has not been determined, and probably does not exist as too many variables factor into this equation. Most opioid-exposed users can tolerate blood levels of opioids without psychomotor impairment that would lead to severe side effects in opioid-naïve individuals (96). Because of this variability in tolerance, application of a "per se" law may well be improper to a patient who is attempting to use his opioid prescription properly and may not have psychomotor impairment.

The extent to which a prescription for an opioid can be used as a legal defense must be limited. The use of a prescription as a pretext, or justification, for DUID relinquishes individual responsibility and imperils the public. Such policy would not permit prosecution of a prescription-holding individual who drives while impaired. A more responsible balancing of personal rights and public safety would be to allow a legal prescription to be used as a partial defense that lessens sanctions when quantitative blood levels demonstrate the patient was using his prescription appropriately. All sanctions for DUID that involve prescription opioids should promote the goal of reducing DUID (1). Screening evaluations should be completed by the court before sentencing so that less onerous punishments, such as counseling and rehabilitation services, can be offered to offenders who might benefit from these treatments (94). A sanction tract that provides for rehabilitation and treatment is complemented by monitored adherence to rehabilitation plans (94). By providing a transparent sanction strategy, the public is aware of the consequences and a general deterrence effect is observed (95).

Within this or any framework, key constituents must recognize their interests and any conflicts of interest with their societal duties. Physicians have a duty to relieve the pain of the patient, but they also are vulnerable to personal liability when prescribing medications. To satisfy both, the physician must make prudent patient selection decisions and implement monitoring to avoid prescriptions to patients at high risk for opioid abuse while driving. Law enforcement not only has the societal duty to protect the public, but also the vulnerability that arises from being perceived by the public as enforcing draconian laws. To balance this, officers are best served by continually refining arrest protocols to ensure best practices. Use of mobile communication with DREs may facilitate greater consistency in the application of DUID protocols. Patients bear the burden of pain and disability, yet still must balance their desire to drive with the need to protect others. Self-assessment of driving capabilities must be performed daily, and should be assisted by instructions from physicians, support networks, and law enforcement personnel.

Conclusions

DUID is a topic of concern to both the medical and legal fields and one for which science has not yet provided sufficient guidance to the policy-making community. The US medical system is in the midst of a changing paradigm on pain management that could include a greater use of opioids. The success of this paradigm shift is tied to the successful reintegration of chronic pain patients into society. A failure to create appropriate policies to deal with the consequences of opioid use, such as DUID, is incompatible with the successful use of opioids. Our current understanding of impairment caused by opioids, as well as the epidemiology of DUID, can be improved by directed clinical study supported by public policies to support research and data collection. Once data are collected, effective prosecution will benefit from educated evidence gathering and understanding of opioid-induced psychomotor impairment.

Acknowledgements

1. James Zacny, PhD, Professor, University of Chicago Department of Anesthesiology and Critical Care, 5841 S. Maryland Ave., Chicago, IL 60637. Dr. Zacny provided additional data on the acute psychomotor impairment caused by opioids. 2. J. Michael Walsh, PhD, CEO, The Walsh Group, 6701 Democracy Blvd, Suite 300, Bethesda, MD 20817. Dr. Walsh provided assistance by suggesting references to benefit this publication.

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