

Driving and Cognitive Impairment Conference



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The Driveable Cognitive Evaluation for the **M**edically **A**t **R**isk **D**river



MARD

Education and Disclosure*



- **MD degree at Medical College of Georgia 1983**
- **Neurology Residency at Emory University 1984-1987**
- **Private practice at Northwest Neurology in Marietta and Austell, Georgia from 1987 to present.**
- **Member of the Governor's Older Driver Task Force**
- **Georgia Drivers License Advisory Board***
- **Shareowner in Driveable**

Goals for Georgia



- To make our roads the safest in the country
- Benefits:
- Fewer crashes
- Save lives: **LIVES MATTER**
- Reduced health costs
- Benefit to business and tourism

Georgia Department of Driver Services



- To renew your drivers license
- Complete a driver's license/ID card application
- Take a new photo
- Applicants who are over 64 or older must pass a vision test
- **THAT IS IT!!!**

Georgia DDS



- No mandatory reporting by physicians
- No self reporting

Every week for the past 30 years I hear:



- “I am worried about Daddy driving.”
- Am I safe to drive?
- When can I return to driving?

Driving



Is a PRIVILEGE

It is not a right

Implied Contract Of Trust

“Get It Right”



- Everyone: Physicians, family members, patients, and the public want to do the right thing.
- **Goal is to enable those who are safe to drive to drive as long as possible, and**
- **to stop from driving those that are no longer competent to drive.**

MEDICALLY AT RISK DRIVER



- Being a **MARD** does not mean you cannot drive.
- It means you should be tested.
- Because when you do not “GET IT RIGHT” tragedy can occur.

They did not “GET IT RIGHT”



Norma Stokes

George Weller

Norma Stokes



- February 12th, 2016
- Norma was age 80
- She was a woman of impeccable character with an unblemished driving record
- She was on her way home from a doctors visit
- She perceived another car was too close behind her
- She panicked and hit the accelerator and became befuddled and she was unable to correct her error (she was cognitively loaded)

Norma Stokes



- She demolished a bollard, mounted the kerb, drove 120 metres (394 feet) down the pavement and crashed into 8 pupils, aged 11 to 16, at Belvedere Academy in Liverpool
- 5 were seriously injured
- She surrender her drivers license
- Given a suspended prison sentence

Norma Stokes Headlines



- “Why was she still on the road”
- Judge calls for urgent review of the law on elderly drivers after woman, 80, mows down schoolgirls

Santa Monica Farmer's Market



- July 16, 2003
- George Weller age 86
- Entire sequence of collisions lasted **10 seconds**
- Weller's car struck another car, then accelerated around a road closure sign, crashed through wooden sawhorses, and plowed through the market place, traveling 1000 feet at speeds between 40-60 mph
- **10 people killed and 63 injured**
- **Accidentally placed his foot on the accelerator pedal instead of the brake**

Driving Tsunami in the US



- In 2010 , older drivers are expected to increase over 100% from 40.2 million to an estimated 88.5 million by 2050

Driving Tsunami



- In 2025 one in every 5 drivers will be 65 and older

Driving Tsunami in the UK



- The number of drivers over 85 will double to 1,000,000 by 2025
- In 2014 some 4.7 million car drivers were aged 70 and over. This figure is estimated at 8.5 million in 2035 ODTF 2014
- We need to prepare and try to be proactive to prevent the Norma Stokes-George Weller events

GP's in the UK (and US)



- Medical practitioners in the UK are on the front line as they are responsible for assessing whether their patients are fit to drive or need further assessment
- GP's are busy people and are not trained to assess a patients driving skills. ODTF 2014
- Same as in the US: No one receives any training on how to evaluate an individuals ability to drive

Warwick Medical School Study 2010



- Three quarters of patients were not advised correctly about the DVLA rules for their medical condition ODTF 2014

“Houston We Have a Problem”



- Apollo 13 in 1970
- Actual Quote-“Ok, Houston, we've had a problem here.”

How 'Safe' Are Older Drivers



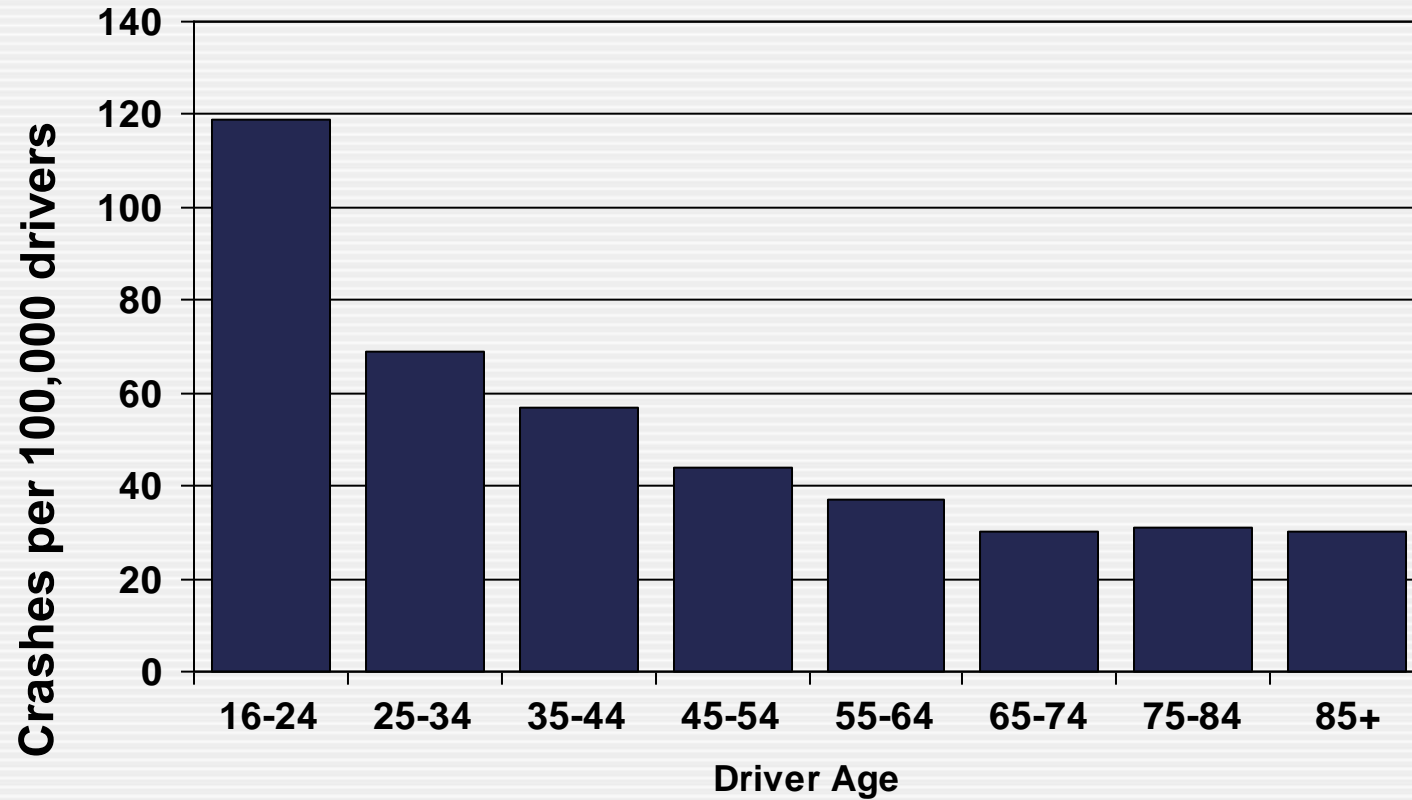
- Can look at crash rate as a measure of safety
- Can measure crash rate in terms of :
 - **Absolute number of crashes**
 - **Crashes per miles driven**

Older Drivers



- They do not speed
- They are experienced
- They wear seat belts
- Generally, they are safe drivers
- However, medical conditions can intervene and alter their driving ability

Absolute Number of Crashes by Age*



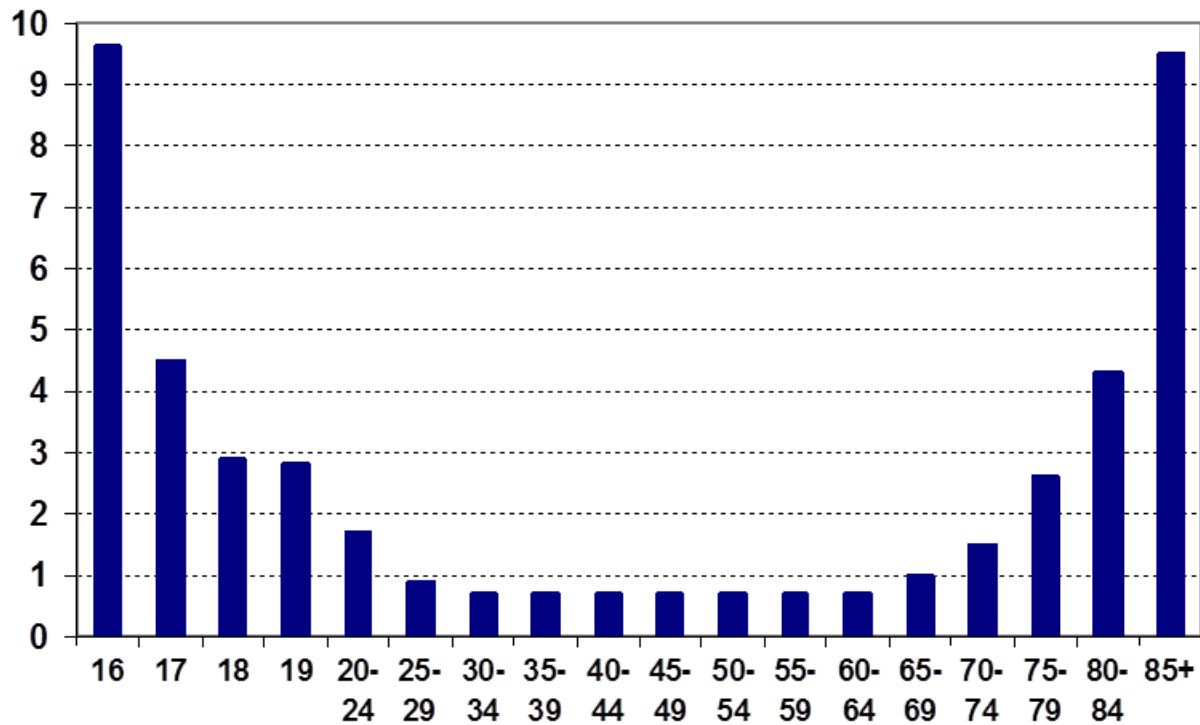
But:



- Absolute number of crashes does not tell the whole story
- Looking at crashes based on exposure (e.g., miles driven) tells a very different story

Driver Fatality Rate*

(per 100 million VMT)



MARD



- We know that:
- older drivers drive fewer miles
- they stick to surface streets (less highway driving than younger drivers)
- they don't speed
- they don't drive impaired
- they use their safety belts
- **IN SHORT, THEY DO EVERYTHING RIGHT, but they are still dying in crashes at unacceptable rates.**

FRAILTY FACTOR



- Older drivers are more likely to be **killed or injured**. More likely to be **hospitalized** due to their injuries. Hospital stays are **longer**.
- Recovery is **less complete**.
- Often stated: the cost of older driver crashes is high because of the **‘frailty’ factor**-irrespective of cause.

CARtoon by Suddick

MY CATARACTS
ARE SO BAD I
CAN BARELY SEE
MY HAND IN
FRONT OF MY
FACE!

MY ARTHRITIS
MAKES IT HARD
TO GRIP THINGS
OR TURN MY
HEAD.

THESE DRUGS
FOR HIGH
BLOOD PRESSURE
REALLY MAKE
ME DIZZY!

AWW, QUIT
COMPLAINING,
AT LEAST WE
CAN ALL STILL
DRIVE!



Redelmeier, et. al. NEJM 2012



- Identified consecutive patients who received a medical warning in Ontario, Canada, between April 1, 2006, and December 31, 2009, from a physician who judged them to be potentially unfit to drive

Redelmeier et. al. NEJM 2012



- A total of 100,075 patients received a medical warning from a total of 6098 physicians.
- During the 3-year baseline interval, there were 1430 road crashes in which the patient was a driver and presented to the emergency department, as compared with 273 road crashes during the 1-year subsequent interval, representing a reduction of approximately 45% in the annual rate of crashes per 1000 patients after the warning

Redelmeier , NEJM 2012



- A physicians' warnings to potentially unfit drivers were associated with a reduction in the subsequent risk of road crashes.
- The reduction in risk was immediate, substantial, and sustained.
- Warning patients who are medically unfit to drive may reduce the risk of road crashes.

Which Patients Are At-Risk?*



Red Flags*

- **Cardiovascular disease** (e.g., congestive heart failure, cardiac arrhythmia,)
- **Metabolic disease** (e.g., diabetes, hypothyroidism)
- **Renal disease** (chronic renal failure)
- **Respiratory disease** (e.g., chronic obstructive pulmonary disease, respiratory failure)
- **Psychiatric illness** (e.g., schizophrenia, depression)

*From B. Dobbs (2000) NHTSA report

More **RED** Flags



- **Neurological disease (e.g., Cerebrovascular disease, dementia, head injury, Parkinson's Disease, Multiple Sclerosis, tumor, narcolepsy, sleep apnea)**
- **Medications (e.g., anti-depressants, other medications having prominent central nervous system effects)**

Another **Red** Flag



Age

Red Flags For Driving



- The typical patient in my office that comes for testing has 3-5 red flags
- Average number of medications: 7 with a range from 2-3 up to 15 to 20 and many with potential CNS affects

Evaluating a MARD



- Before 2011
- I would provide my best medical judgment to decide if a MARD should or should not be driving
- No training in residency or medical school
- No one to ask for help

Driving Evaluation Programs in Georgia



- On Road Assessment
- Cost \$350 to \$899
- Who is going to pay that amount to be told they cannot drive
- All of my patients refused to pay

AMA Physicians Guide to Assessing and Counseling Older Drivers 2003



- DriveABLE Assessment Centres Inc. offers an evaluation designed specifically for individuals whose ability to drive safely may be compromised by medical conditions or medications. This evaluation has been scientifically developed and validated, and includes an in-office component of computer-based testing as well as road evaluation if needed.
- Chapter 10, Page 188

Driveable



- A University of Alberta spin-off
- Driveable On Road Evaluation (DORE)
- In Office Driveable Cognitive Assessment Tool (DCAT)

Driveable On Road Evaluation (DORE)



- Involves a closed course as well as a public course route.
- Emergency situations and cognitive loading are controlled and standardized in the closed course.
- Only the on-road evaluation measures **competence defining errors** of cognitively at risk drivers.
- Determines what errors are made in cognitively impaired people as compared to non cognitively impaired people (bad habits).

DORE



- Pass
- Borderline Pass
- Fail

Driveable Cognitive Assessment Tool (DCAT)



- Developed explicitly for drivers with confirmed or suspected cognitive impairment
- Performance is age normed (patients who fail, fail because of impairments and not age)
- Assessment validated against in car performance (DORE)
- Cut off points: Trichotomization-Pass, Require additional information (e.g. road test), Fail

DriveABLE Cognitive Assessment (DCAT)

Assesses mental abilities necessary for safe driving

- 6 tasks
- Computer presented
- Patient responds by touching the screen or pressing a button
- Certified Assessor guides patient through practice and the tasks
- Automated scoring and report generation
- Validated to be predictive of performance on the DriveABLE Road Test (DORE)



DCAT



As easy as touching an X on a piece of paper

DCAT*



- Standardized
- Eliminates subjectivity
- Immediate results
- **Tasks are easy to understand yet successful performance requires complex processing emphasizing attention, executive function, judgment, and decision making**

DCAT's Six Tasks: Composite Battery



- Motor Speed Control
- Span of Attentional Field
- Spatial Judgment and Decision Making
- Attention Shifting
- Executive Function
- Identification of Driving Situation

DCAT



- Typically takes 35-50 minutes.
- The score represents the likelihood of failing the on road evaluation (DORE).
- Therefore the lower the score the better.

Original DCAT Scoring



- 1%-99%
- Within the range of normal: 1-30%
- Indeterminate: 31-70
- Fail: 71 and above
- Dual Cut off points
- Trichotomization
- Similar example: ETOH of .08 is used as a cut off point

DCAT and DORE



- Dobbs AR, Accuracy of the Driveable cognitive assessment to determine cognitive fitness to drive, Can Fam Physician, March 2013 59: 156-161
- 3662 Patients (2639 men, mean age 74.1 years, range 18-99 years of age; 1023 women, mean age 73.5, range 18-94 years of age) with suspected or confirmed cognitive impairment
- Nineteen locations in North America from 2007-2010
- **For the total sample, the error rate for predicting actual performance on the road test was 1.7% for the pass predictions and 5.6% for the fail predictions**
- **(Using the cut off scores of 1-30, 31-70, 71+)**

Dobbs CFP 2013



- 504 passed the DCAT and 62 failed the DORE=88% accuracy
- 1474 failed the DCAT and 204 passed the DORE and 171 were indeterminate=74%
- 1684 were indeterminate and 604 (35%) passed the DORE, 673 (40%) failed the DORE, and 402 were borderline Pass, and 402 (24%) were indeterminate

DCAT Scoring



- A review of the On- Road evaluations for 5252 drivers referred to DriveABLE for evaluation by physicians showed that for those scoring $.73$, over 50% were committing dangerous driving errors

Current DCAT Scoring



- **1-25%:** Cognitive competence for driving should be considered within the range of healthy normal drivers
- **26-49%:** Cognitive abilities maybe affected. Indicates a greater probability of passing a DORE than failing a DORE
- **49-72%:** Cognitive abilities of driving are affected. Indicates a greater probability of failing a DORE than passing a DORE
- **73% and above:** Indicates cognitive competence for driving should be considered outside the range of normal based on having a greater probability of failing the DORE due to performing hazardous or extremely dangerous maneuvers

DCAT Scoring



- When assessing driver competence, some cognitively impaired drivers are a danger to themselves, the evaluator, and/or other road users when tested on public roadways. Thus, evaluation safety needs to be considered as a part of the criteria for setting category-defining cut-points.

Dangerous Drives



- These are driving errors such as those requiring the evaluator to take control of the vehicle to avoid a crash or when drivers of other vehicles (or pedestrians) have to take actions to avoid a collision.
- Driving errors for one in every two test drives exceeded what DriveABLE personnel, in consultation with persons from the medical and licensing communities, judged to be acceptable risk.

Physician Judgement



- Physicians often use the cut-points as a starting point and with factors such as red flags for driving, driving reports from family members, and recent tickets, accidents or near misses.
- The DCAT is a RISK ASSESSMENT
- The DCAT is part of the puzzle (like the findings on a brain MRI) used to make a driving recommendation (or a diagnosis)

Dual Cut Points: Trichotomization



Two rather than one cut-point is used to ensure that predictive validity for road test performance is high.

The upper cut-point (high probability of failing the road test) is set such that drivers scoring in this range would fail the road test with a very high probability.

The lower cut point is set (high probability of passing the road test) is set such that drivers scoring in that range would pass the road with a very high probability.

Dual Cut off Points



- Those who fall into the indeterminate range require the DriveABLE road test (DORE) to resolve driving competence.
- This reduces the number of on costly on road tests needed and the number of dangerous drives taken.
- Physician clinically may decide that an individual may need to do an on road even with scores above 73+

The Screen=DCAT



- The DriveABLE Competence Screen as a predictor of on-road driving in a clinical sample
- Nicol Korner-Bitensky and Susan Sofer
- Australian Occupational Therapy Journal (2009) 56, 200–205
- School of Physical and Occupational Therapy, McGill University, Montreal, Quebec, Canada

The Screen



- Participants were consecutive clients referred to a driving evaluation service in Montreal, Canada, who underwent DCAT and DORE testing.
- The prevalence of poor Screen outcome was expected to be fairly high, as referrals for driving evaluation are usually made only once there is considerable concern regarding driving safety.

The Screen



- The objective of this study was to determine whether the DriveABLE Competence Screen, predicts on-road driving outcome in clients referred for a driving assessment.
- This retrospective study evaluated the predictive validity of pre-road testing using the DriveABLE Screen.

The Screen



- Sixty-nine charts of consecutively assessed individuals were reviewed for eligibility.
- Seven individuals did not hold a valid driver's permit and failed the Screen, so the decision was made not to undergo the Road Test.
- Two people decided to discontinue driving based on feedback regarding poor Screen results.
- One individual underwent driver retraining between the Screen and Road Test.

The Screen



- Six individuals were deemed to be highly unsafe to proceed to the Road Test based on their Screen results; an additional subject performed so poorly on the Screen that it could not be completed.
- The remaining 52 people had complete data on both the Screen and the Road Test.

The Screen



- The DORE was undertaken 7 to 10 days after the Screen=DCAT.

The Screen



- The average age of the group was 71.6 (\pm 13.6) years, with a range of 29–93 years: 14 (27%) were female and 38 (73%) were male.
- The most frequent diagnoses were: potential or identified cognitive decline (n = 20; 38.5%); neurological conditions including stroke, traumatic head injury and Parkinson's disease (n = 10; 19.2%); psychological conditions including schizophrenia, bipolar conditions, depression (n = 4; 7.7%) and other including orthopedic conditions, rheumatoid arthritis, etc. (n = 18; 34.6%)

The Screen



- Of the 69 patients 17 did not do the road test and 16/17 failed the DCAT
- Of the 52 that performed the DCAT and DORE there were 33 that failed the DCAT and 32 that failed the DORE.
- There was a mismatch of 1/33. If you add the 16 that did not take the DORE, I suspect the number would have been 48 out of 49.

The Screen



- There were 15 that were indeterminate and 9 failed the DORE, 2 were Borderline, and 4 Passed
- There were 4 that passed the DCAT and 1 failed the DORE and 2 were borderline and 1 passed

The Screen



- **Conclusion: The DriveABLE Screen is highly predictive of clients who will fail an on-road driving evaluation**

Driving Assessment After Stroke



- Usefulness of the DriveABLE cognitive assessment in predicting the driving risk factor of stroke patients
- Seong Youl Choi, MS, Doo han Yoo, PhD, OT, Jae Shin lee, PhD, OT
- J. Phys. Ther. Sci. 27: 3133–3135, 2015

Driving Assessment After Stroke



- The main purpose of this study was to compare the cognitive and driving functions of two groups discriminated by DCAT.

Driving Assessment After Stroke



- Stroke patients with cognitive impairments are often not allowed to drive.
- Many stroke patients who previously drove wish to drive a car again.

Driving Assessment After Stroke



- An on-road test is the gold standard but has problems regarding time, cost, accident risks of a direct assessment; hence, it's difficult to use widely.

Driving Assessment After Stroke



- A total of forty-four stroke patients with a driver's license participated in this study.
- Two participants with communication problems were excluded.

Driving Assessment After Stroke



- DCAT was used to evaluate the risk potential to the driver, and the subjects were classified into two groups according to the probability of driving risk estimated by the DCAT evaluation.
- The safe driver group (SDG) and unsafe driver group (USDG) underwent a driving simulator and cognitive function assessments.

Driving Assessment After Stroke



- Table 1. General characteristics of the participants (n=42)

- Characteristics:

| | SDG (n=11) | USDG (n=31) |
|--|------------|-------------|
| • Gender (male/female) | 8/3 | 28/3 |
| • Age (years) | 50.1±10.2 | 57.3±11.3 |
| • After stroke (months) | 61.2±58.0 | 55.9±55.2 |
| • Affected side (Right/Left) | 6/5 | 12/19 |
| • Type (Infarction/Hemorrhage) | 6/5 | 18/13 |
| • Probability of driving risk | 7.2±9.2 | 65.1±16.4 |
| • SDG: the safe driver group; USDG: the unsafe driver group | | |

Driving Assessments After Stroke



- The results of the SDG and USDG were compared.
- The SDG showed higher cognitive function than the USDG.
- In addition, the SDG showed higher ability than the USDG in most of the tests associated with the driving function (pedal reaction time, average reaction time, centerline crossing, road edge excursion, off-road accidents, collisions).
- Conclusion: DCAT is a useful tool for predicting the risk of driving. In addition, it can predict the driving ability of stroke patients related to their cognitive function.

CARS REGISTRY



- **Cognitive Assessments for Road Safety**
- The aim of this study is to evaluate patients with confirmed stroke, using the DriveABLE Cognitive Assessment Tool (DCAT) to predict their driving risk.
- A total of five hundred and fifteen patients were tested from July 1st, 2015- June 30th, 2016, out of five hundred and fifteen patients, one hundred and eight confirmed stroke patients participated in this study.
- Abstract accepted for the Controversies in Neurology Conference in Athens, Greece March 2017

CARS Registry



- 7 (6.48%) were within range of normal (1-25%)
- 17 (15.74%) patients' cognitive abilities maybe affected (26-49%)
- 22 (20.37%) cognitive abilities of driving are affected (50-72%)
- 62 (57.4%) were outside the normal range and are not suitable to drive. (73+)
- The DCAT is a helpful tool in assessing the driving risk of stroke patients

DCAT



- I follow people over time.
- Typically 6-12 month intervals or following any significant medical event such a CVA, surgery, head trauma etc.
- I may make medication adjustments if I feel medications are contributing to the cognitive impairment.
- We perform approximately 500/year and I know I have prevented many accidents-but I cannot prove it because they did not happen.

Medico-Legal Responsibility*



- Physician is protected on both ends
- Person fails the test and you tell them not to drive and it is documented
- Person passes the test and has an accident then there is no reason from a cognitive stand point that should have prevented them from driving
- Passing the DCAT does not mean you cannot have an accident it means your risk is reduced

Is Passing the DCAT a Guarantee of Accident Prevention?



- NO
- The DCAT will not determine “bone headedness”. If you are healthy and cognitively intact but distracted or inexperienced and cause an accident you do not have a cognitive disorder and you should not be forced to retire from driving
- But it will give the likelihood the person will pass or fail an on-road examination: it is a **RISK ASSESSMENT**
- Does taking an AED guarantee no seizures?
- Does taking an antiplatelet agent guarantee no strokes?

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Questions

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