

# Traffic Safety Facts

## Traffic Tech – Technology Transfer Series

# Testing Multiple Medication Usage and Driving Functioning

The number of older licensed drivers in the United States is growing at a rate faster than the overall population. As people age, they are more likely to take one or more potentially driver-impairing (PDI) medications. TransAnalytics, LLC, recently completed a pilot study to gain a better understanding of the safety impact on older drivers of taking multiple PDI medications. A final report titled *A Pilot Study to Test Multiple Medication Usage and Driver Functioning* provides an update on the prevalence of prescription medications in the older population, and the effects on driving of specific drugs and drug classes. Research activities included a literature review, data mining exercise, identifying other databases for future data mining, and a field study of occupational therapist on-road evaluations of older drivers who take multiple PDI medications.

## Literature Review

This project examined recently published research to update a prior NHTSA report (*Literature Review on Polypharmacy and Older Drivers*, DOT HS 810 558) on the effects of different types of PDI drugs on driving. New information about specific drugs and drug classes on driving is provided for an anti-seizure medication (topiramate) used for migraine prevention and other therapies; acute and stable dosing of opioids; sedating and non-sedating antihistamines; antidepressants; short- and long-half-life sedative-hypnotics; an immediate-release versus extended-release anti-anxiety medication (benzodiazepine); a skeletal muscle relaxant (carisoprodol); and anti-diabetic medications.

Studies that assessed the behavioral consequences of medication usage among older people, i.e., gauging the risk associated with prescription and over-the-counter drugs versus the medical conditions treated by the medications, were reviewed. Vehicle crash involvement among older drivers has been significantly associated with a history of falling down in the previous two years. The same medications that mediate the risk of falling may also mediate motor vehicle crash risk. Although certain drugs increase the risk of falls in older persons, chronic medical conditions were often more important than medications in causing falls. Since cardiovascular events often contribute to falls, this report reviewed studies that examined adverse drug-induced cardiovascular events that are reversible after the withdrawal of specific drugs.

## Identifying Preferred Patient-Level Administrative Databases for Data Mining

This project defined an ideal database to study the crash involvement of older drivers taking PDI medications—which would contain linked medical, hospital, and pharmaceutical data for each eligible person and would be the *only* provider of services—then evaluated a number of candidates for such work. The “ideal” database, which would capture the complete record of drug utilization for a patient (driver), unfortunately does not presently exist. However, several promising candidates for future NHTSA investigations were identified, and information on each is contained in the final report.

## Proportion of Crash-Involved Drivers Taking Two or More PDI Medications, by Age Cohort



## Data Mining Exercise

This project examined a patient-level administrative claims database containing prescription information and E-codes identifying the incidence of motor vehicle injuries to identify drivers who were taking PDI medications and were involved in crashes. The number of PDI drugs taken by crash-involved individuals within the age cohorts from 16 through 49 and then in 5-year cohorts up through age 75+, ranged from zero to 16. The use of multiple PDI medications by crash-involved drivers 50 and older climbs steadily with age, until leveling off at the 65- to 69-year-old cohort. At the same time, one-third to one-half of crash-involved drivers in each of these cohorts were taking *no* PDI medications. From this exercise,

a set of two PDI drug combinations—hypotensives in combination with one or more other classes of PDI medications such as lipotropics, beta blockers, calcium channel blockers, NSAIDs, SSRIs, and gastric acid secretion reducers—emerged as inclusion criteria in the subsequent field study.

## Field Study

Forty-four healthy older drivers between the ages of 57 and 89, who lived in residential communities in Delaware and Maryland and drove an average of 50 miles and/or three days each week, participated in a pilot study to examine their use of PDI medications and driving abilities. A pharmacist collected data on each participant's medication usage via a one-on-one "brown bag" medication review. Each driver's functional status was measured using a computer-based test battery. Then, an occupational therapist (OT) or certified driver rehabilitation specialist measured drivers' on-road performance. This included onboard measures of brake response time under alerted and unalerted conditions.

Due to the small sample size relative to the number of drugs and drug classes, logistic regression was unable to significantly associate medication usage with observed differences in functional (cognitive) status, driving evaluation outcomes, or brake response time. However, the drivers who "failed" the OT evaluation were also among the oldest.

PDI medications may be more impairing to driving performance with increasing age, due to a wide range of age-related physiological changes and changes in how these drugs are metabolized. ACE inhibitors, generally, and ACE inhibitor/thiazide diuretic combinations, in particular, may be deserving of special attention in future research; but this must be regarded as a tentative conclusion given the research limitations noted above.

## Instrumented Vehicle Analyses

The private cars of a sub-sample of five individuals were equipped with instruments to collect video, GPS, and speed recordings to examine the variability in selected behaviors—surrogates of driver attention/distraction, plus speed choice—during independent driving. These same instruments were present during their drives with the OT, which took place in the same area, under comparable conditions.

Comparing behavior during independent driving versus a formal driving evaluation showed that, on road segments common to both sets of drives, an 82-year-old woman was more likely to drive slower on her own than during the OT evaluation when other traffic was present, but *faster* on her own than when observed by the OT under "empty road" conditions where other traffic could not affect speed choice.

In the aggregate, the sub-sample of 5 drivers with instrumented vehicles spent more time looking down and inside the vehicle and less looking toward the inside rearview mirror when driving independently than when the OT was present, including during intersection negotiation when active scanning of the road environment is most critical. This highlights a difference between independent driving and older drivers' behavior during a driving evaluation that may have significant safety implications.

## Conclusion

Small-sample empirical investigations are not a practical route to understanding of multiple medications and driving impairment. The prevalence of PDI drugs in any population-based sample work against successfully modeling the predictor-criterion relationships of greatest interest, but sample recruitment is daunting.

This report recommends two promising methods for future research. First, databases highlighted in this report can be used to mine patient-level information that can pinpoint drugs and combinations of drugs to target in future information and education interventions. Second, unobtrusive, miniature, in-car instrumentation packages can monitor drivers' behaviors to measure behavioral variability as a function of driving context and to determine normative exposure levels.

## How to Order

To order *A Pilot Study to Test Multiple Medication Usage and Driving Functioning* (92 pages plus appendices), prepared by TransAnalytics, LLC, write to the Office of Behavioral Safety Research, NHTSA, NTI-130, 1200 New Jersey Avenue SE., Washington, DC 20590, fax 202-366-7394, or download from [www.nhtsa.dot.gov](http://www.nhtsa.dot.gov). John Siegler, Ph.D., was the Contracting Officer's Technical Representative for this project.



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