RESEARCH BRIEF

# Medication Use in Older Adult Drivers: Findings from The AAA LongROAD Study

This research brief utilized data from the AAA Longitudinal Research on Aging Drivers (LongROAD) study to examine the amount and types of medications used by older drivers. Many medications - such as antihistamines, narcotic analgesics, central nervous system (CNS) drugs, muscle relaxants and tricyclic antidepressants - have been associated with increased crash risk. [1,2] We found high medication usage, with 97% of participants taking at least one medication; the median number reported taken was seven. In this study, medication usage was categorized by class and type in the cohort of older drivers enrolled in LongROAD. The most frequently used types of medication were cardiovascular medications, CNS agents, electrolyte pills, hormones and vitamins. Usage varied by age, gender and ethnicity.

## METHODS

This study utilized cross sectional baseline data from the AAA LongROAD study, a longitudinal study on aging drivers.[3] LongROAD is a multisite (San Diego, California; Denver, Colorado; Baltimore, Maryland; Ann Arbor, Michigan; and Cooperstown, New York) prospective cohort study designed to collect data on the medical, behavioral, environmental and technological factors influencing older adults' driving safety. Participants were eligible if they were 65-79 years old, possessed a valid driver's license, drove at least once per week on average and had no significant cognitive impairment.

LongROAD collects self-reported and objectively measured information on health status and driving behaviors. The data for this study were based on the medications brought to the study offices for a "brown-bag review" at the baseline in-person assessment. Medication names and dosages were entered into a database and coded based on the American Hospital Foundation Service (AHFS) system.[4] The AHFS classification allows the grouping of drugs with similar pharmacologic, therapeutic and/or chemical characteristics in a four-tier hierarchy. Starting with the most general groupings, each increasing tier provides greater specificity regarding drug class.

## RESULTS

### Quantitative Results of Medication Usage

Among the 2,990 older drivers in the study, 2,949 underwent the brown-bag review. For those drivers, there were 24,690 containers of medication recorded, and 22,856 (92.6%) were coded successfully using the AHFS classification system. Of the older drivers undergoing the brown-bag review, 3.3% reported no medication use. Non-classified medications included foodlike items (e.g., spices or protein), homeopathic products and supplements other than vitamins (e.g. witch hazel, zinc). The distribution of the number of medications taken by participants was positively skewed: The median number reported taken was seven; 10% took two or fewer; 25% took four or fewer; 25% took 11 or more; 10% took 16 or more; and 1% took 26 or more medications (Figure 1). The maximum number of medications taken by an individual participant was 51.

### Qualitative Results: Classes of Medications

Frequencies by drug classifications for the Tier 1 AHFS categories are shown in Table 1. The categories with the highest number of medications reported are cardiovascular medications (n=4,700), accounting for 19.0% of all medications reported; vitamins (3,922; 15.9%); central nervous system agents (CNS) (3,921; 15.9%); electrolytic, caloric and water balance pills (2,355; 9.5%); and hormones and synthetic substitutes (2,189; 8.9%).

Table 2 shows the number and percentage of participants reporting at least one medication in a specific Tier 1 drug category. Seventy-three percent of participants (2,167) took at least one cardiovascular drug, 70% took a CNS agent, 65% took at least one vitamin, 52% took an electrolyte, 44% took a hormonal agent and 34% took at least one medication that was not classified.

Table 3 shows the distribution of the Tier 3 level, providing more specificity within classes of medications. Electrolyte replacement preparations are the most commonly reported type of medication (n=1,624; 6.6%), followed by HMG-CoA reductase inhibitors (1384; 5.6%), vitamin D (1,377; 5.6%), multivitamins (1,297; 5.3%), and salicylates (1,292; 5.2%)

### Demographic Variation

The distribution of drug use varied for most medications by age, sex and ethnicity. For example, at least one cardiovascular medication was used by 73% of the sample, but the rate of use was 10% higher for males (79%) than for females (69%), a statistically significant difference ($p<.0001$). The use of cardiovascular medication also increased significantly with age: a 68% rate of use for those 65-69 years old, 75% for those 70-74 and 81% for those 75-79 ($p<.0001$). Cardiovascular medication use also varied significantly by race ($p<.0001$), with the most frequent use among African-American participants (79.7%), followed by white non-Hispanic participants (73.2%) and Hispanic participants (70.9%).

## DISCUSSION

The high usage of medications found in in this study's brown-bag review of older drivers is consistent with rates reported in previous studies. For example, Qato et al. (2008) found that among community dwelling older adults in New Zealand, 81% used at least one prescription medication and 29% used at least five.[5] Narayan et al. (2015) found that for older adults with an average age of 74.7 years who were receiving at least one prescription medication, the mean number of dispensed medications was 5.46. Kaufman et al. (2002) found 40% of individuals 65 and older reported using five or more medications a week, and 12% used 10 or more.[7]

The high rates of polypharmacy in this study are concerning. The dangers of polypharmacy in older adults extend beyond driving risks.[9,10,11] Medications considered potentially inappropriate for older adults include drugs that impair physical or mental function, such as narcotic pain medications; anti-anxiety drugs such as benzodiazepines; and sleep medications. In addition to their driving impairing side effects, these medications are also associated with adverse effects such as hip fractures, depression and incontinence.[12] Neutal et al. (2002) found the odds of an older driver falling are 6.1 times higher if they are using 10 or more medications.[13]

Medications taken by a high percentage of the study population included cardiovascular drugs (73%); CNS agents (70%); vitamins (65%); electrolytes (52%); hormones (44%); gastrointestinal drugs (32%); ear, eye, nose and throat preparations (24%) and autonomic drugs (22%). All medications reported by LongROAD participants at the baseline evaluation were fully classified using the hierarchical AHFS categorizations. More detailed evaluations of the effects of individual drugs on driving will be provided in future AAA LongROAD reports.

Given the high rate of medications, physicians and pharmacists need to play a role in both cautious prescribing as well as counseling. Yet studies of older drivers and physician counseling about medications and driving have demonstrated a lack of knowledge on the part of both parties. A 2009 AAA Foundation for Traffic Safety study found that only 17.6% of drivers 55 and older had received a warning from a health care provider about the possible effect of medications on their ability to drive; only a slightly higher percentage of those taking five or more medications received a warning about driving (18.8%).[8] Similarly, in a study of older drivers who visited the emergency room and who had driven in the last 30 days, none of those using sedating medications reported receiving counseling about driving.[15]

Drivers, their families and their prescribers need to increase their vigilance to improve medication safety in older drivers. Drivers and their families can help facilitate communication between treating clinicians by keeping a list of medications, and not adding new medications without having their physicians and pharmacists check for drug interactions. Alternatively, resources such as the Roadwise Rx program (www.roadwiserx.com) are available to help drivers assess the potentially impairing side effects of their medications. Physicians should prescribe the fewest medications necessary and the lowest

dose needed to achieve therapeutic results, and keep track of the all medications taken by a given individual, irrespective of prescriber. Physicians and pharmacists should alert drivers about potentially impairing side effects.

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## ABOUT THE AAA FOUNDATION FOR TRAFFIC SAFETY

The AAA Foundation for Traffic Safety is a 501(c)(3) nonprofit, publicly supported charitable research and education organization. It was founded in 1947 by the American Automobile Association to conduct research to address growing highway safety issues. The organization's mission is to identify traffic safety problems, foster research that seeks solutions and disseminate information and educational materials. AAA Foundation funding comes from voluntary, tax-deductible contributions from motor clubs associated with the American Automobile Association and the Canadian Automobile Association, individual AAA club members, insurance companies and other individuals or groups.

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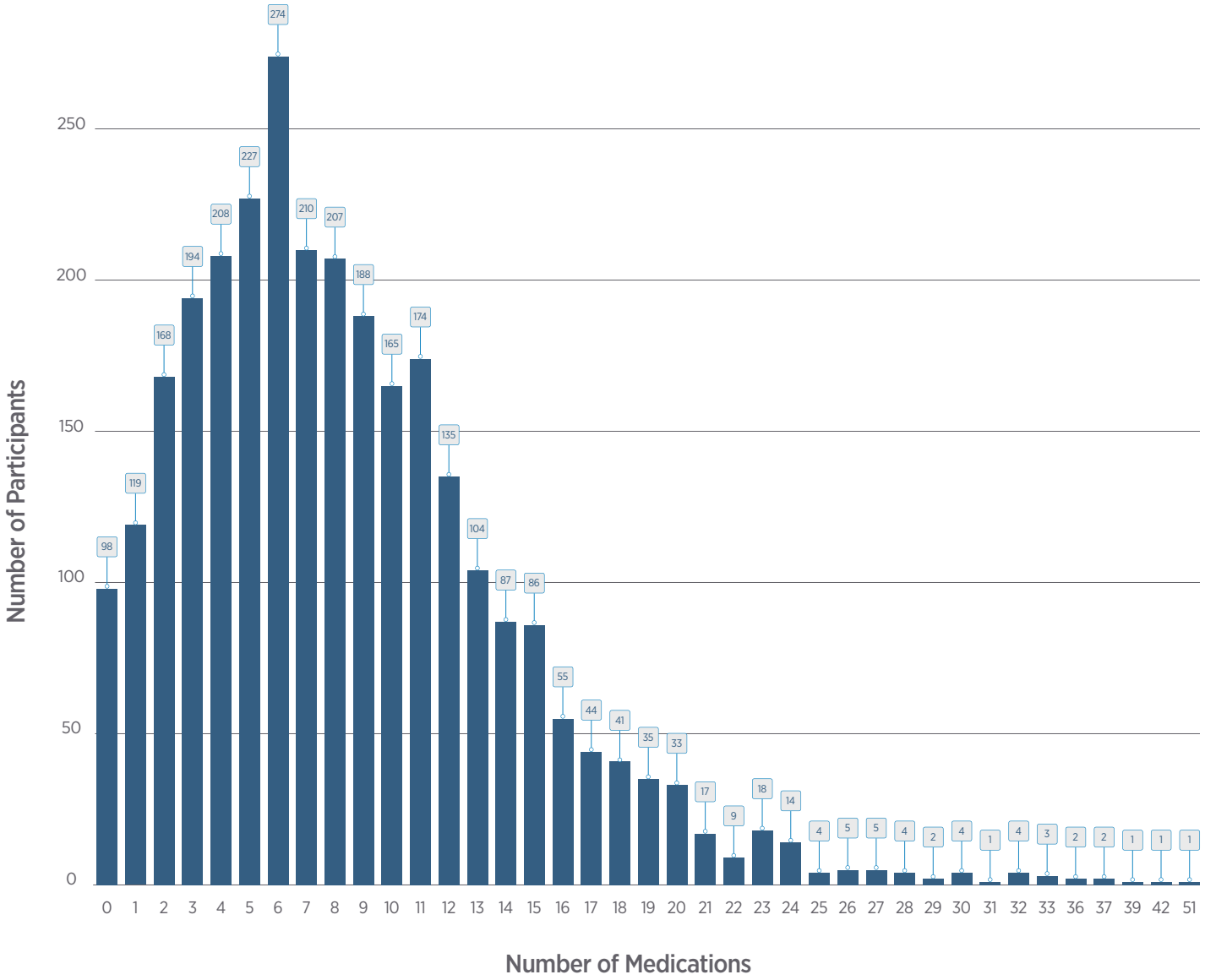


**Figure 1: Number of Participants by Number of Medications Used (N=2,949)**

**Table 1. Frequency of AHFS Tier 1 Medications Reported by LongROAD Participants (N=24,697 Medications)**

| | Frequency | % |
|---|---|---|
| Cardiovascular Drugs | 4700 | 19.0 |
| Vitamins | 3922 | 15.9 |
| Central Nervous System Agents | 3921 | 15.9 |
| Electrolytic, Caloric, and Water Balance | 2355 | 9.5 |
| Hormones and Synthetic Substitutes | 2189 | 8.9 |
| Gastrointestinal Drugs | 1219 | 4.9 |
| Eye, Ear, Nose, and Throat (EENT) Preparations | 1047 | 4.2 |
| Autonomic Drugs | 834 | 3.4 |
| Skin and Mucous Membrane Agents | 658 | 2.7 |
| Blood Formation, Coagulation, and Thrombosis Agents | 450 | 1.8 |
| Antihistamine Drugs | 436 | 1.8 |
| Miscellaneous Therapeutic Agents | 419 | 1.7 |
| Anti-infective Agents | 353 | 1.4 |
| Respiratory Tract Agents | 119 | .5 |
| Antineoplastic Agents | 116 | .5 |
| Smooth Muscle Relaxants | 90 | .4 |
| Local Anesthetics | 27 | .1 |
| Diagnostic Agents | 5 | .0 |
| Antitoxins, Immune Globulins, Toxoids, and Vaccines | 3 | .0 |
| Total Classified | 22863 | 92.6 |
| Not Classified | 1834 | 7.4 |
| Total | 24697 | 100.0 |

**Table 2. Number and Percentage of Participants Using Each Tier 1 Category Medication (N=2,949 Participants with Brown Bag Review Data)**

| | N of Participants* | % of Participants |
|---|---|---|
| Cardiovascular Drugs | 2167 | 73% |
| Central Nervous System Agents | 2078 | 70% |
| Vitamins | 1909 | 65% |
| Electrolytic, Caloric, and Water Balance | 1548 | 52% |
| Hormones and Synthetic Substitutes | 1311 | 44% |
| Gastrointestinal Drugs | 952 | 32% |
| Eye, Ear, Nose, and Throat (EENT) Preparations | 710 | 24% |
| Autonomic Drugs | 641 | 22% |
| Skin and Mucous Membrane Agents | 486 | 16% |
| Blood Formation, Coagulation, and Thrombosis Agents | 390 | 13% |
| Miscellaneous Therapeutic Agents | 379 | 13% |
| Antihistamine Drugs | 392 | 13% |
| Anti-infective Agents | 291 | 10% |
| Respiratory Tract Agents | 106 | 4% |
| Antineoplastic Agents | 112 | 4% |
| Smooth Muscle Relaxants | 89 | 3% |
| Local Anesthetics | 25 | 1% |
| Diagnostic Agents | 5 | <1% |
| Antitoxins, Immune Globulins, Toxoids, and Vaccines | 3 | <1% |
| Not Classified | 989 | 34% |

*Note: a given participant may take medications in 2 or more categories

**Table 3. Most Common AHFS Classified Medications Reported: Detailed Tier Specification***

| | N: reported use | % |
|---|---|---|
| 40:12 Electrolyte Replacement Preparations | 1624 | 6.6 |
| 24:06.08 HMG-CoA Reductase Inhibitors | 1384 | 5.6 |
| 88:16 Vitamin D | 1377 | 5.6 |
| 88:28 Multivitamin Preparations | 1298 | 5.3 |
| 28:08.04.24 Salicylates | 1293 | 5.2 |
| 88:08 Vitamin B Complex | 789 | 3.2 |
| 24:24 Beta-Adrenergic Blocking Agents | 733 | 3.0 |
| 68:04 Adrenals | 670 | 2.7 |
| 56:28.36 Proton-pump Inhibitors | 647 | 2.6 |
| 24:32.04 Angiotensin-Converting Enzyme Inhibitors | 608 | 2.5 |
| 24:06.92 Antilipemic Agents, Miscellaneous | 590 | 2.4 |
| 68:36.04 Thyroid Agents | 519 | 2.1 |
| 40:28.20 Thiazide Diuretics | 516 | 2.1 |
| 28:08.04.92 Other Nonsteroidal Anti-inflammatory Agents | 498 | 2.0 |
| 28:16.04.20 Selective Serotonin-reuptake Inhibitors | 380 | 1.5 |
| 52:08 Anti-inflammatory Agents | 354 | 1.4 |
| 28:08.92 Analgesics and Antipyretics, Miscellaneous | 338 | 1.4 |
| 68:20.04 Biguanides | 330 | 1.3 |
| 04:08 Second Generation Antihistamines | 318 | 1.3 |
| 24:32.08 Angiotensin II Receptor Antagonists | 317 | 1.3 |
| 52:08.08 Corticosteroids | 304 | 1.2 |
| 24:28.08 Dihydropyridines | 299 | 1.2 |
| 88:12 Vitamin C | 299 | 1.2 |
| 12:12.08.12 Selective Beta-2-Adrenergic Agonists | 291 | 1.2 |
| 28:12.92 Anticonvulsants, Miscellaneous | 241 | 1.0 |
| 84:92 Skin and Mucous Membrane Agents, Miscellaneous | 234 | .9 |
| 84:06 Anti-inflammatory Agents | 217 | .9 |
| 56:12 Cathartics and Laxatives | 214 | .9 |
| 12:16.04.12 Selective alpha-1-Adrenergic Blocking Agents | 205 | .8 |
| 56:28.12 Histamine H2-Antagonists | 194 | .8 |
| 28:08.08 Opiate Agonists | 177 | .7 |
| 68:20.08 Insulins | 177 | .7 |
| 68:16.04 Estrogens | 168 | .7 |
| 20:12 Antithrombotic Agents | 149 | .6 |
| 52:40.28 Prostaglandin Analogs | 143 | .6 |
| 28:24.92 Anxiolytics, Sedatives, and Hypnotics; Miscellaneous | 141 | .6 |

*Excludes nonclassified medications; numbers preceding the drug description represent the most detailed AHFS tier specification for that medication: three numbers (e.g. 52:08:08) indicate that three tiers are used in the classification; two numbers (e.g. 88:12) indicate that only two tiers are required for AHFS classification; each medication may be designated by up to four tier codes; the 36 most commonly reported medications are shown; denominator for percentages is total number of AHFS-classified medications (N=22863)