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Volume 2: Case Studies of Medical Referrals and Licensing Outcomes in Six States

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16. Abstract

This is the second of three reports examining driver medical review practices in the United States and how they fulfill the basic functions of identifying, assessing, and rendering licensing decisions on medically at-risk drivers. This volume presents the findings of case studies describing the referral sources, medical review requirements, and licensing outcomes for a random sample of 500 passenger vehicle drivers referred for initial medical review/reexamination in six States in 2012: Maine, Ohio, Oregon, Texas, Washington, and Wisconsin. Results, presented on a State-by-State basis, include (1) sampling methodology, (2) referral sources and proportions of the sample referred by each, (3) the proportions of drivers required to submit medical statements from their treating physicians and/or undergo vision, knowledge, and road testing as a result of medical review, and (4) licensing outcomes by each referral source sampled, including no change in license status; licensed with a periodic review requirement and/or driving restrictions; loss of licensure; or voluntarily license cancellation. Following the State-by-State summaries of referral sources and medical review outcomes, the report compares medical review outcomes organized by referral source, and describes differences in medical review processes and guidelines that may explain observed differences.

Conclusions based on observations support recommendations for practices that may: (1) increase appropriate referrals for medical review; (2) improve the medical review process with the goal of maintaining individual and public safety while preserving mobility among those with declining functional abilities; and (3) ensure that licensing agency resources applied to medical review are focused on the subset of drivers most needing to be medically reviewed and tested.

Report appendices provide detailed summaries of the medical review process and outcomes for each State's 500-driver sample, including a comparison of case study driver demographics to those of the population of licensed drivers in the State, reasons for referral by referral source, a flow chart showing the medical review process and where drivers lost licensure at each stage in the process, case disposition times, feedback to reporting source, case cost (where available), proportion of drivers that appealed the licensing agency's decision, and additional analyses where data were provided for unique situations.

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For their perseverance, friendliness, and thorough work, TransAnalytics sincerely thanks:

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- Washington DOL – Teresa Berntsen, director; and
- Wisconsin DMV – Lynne Judd, administrator, and Alison Lebwohl, DMV Qualifications and Issuance chief.

Executive Summary

This project focused on the referral sources, medical review requirements, and licensing outcomes for drivers referred to six State driver license agencies for medical review or reexamination due to concerns about their ability to drive safely. Maine, Ohio, Oregon, Texas, Washington, and Wisconsin participated in this case study. In each State the researchers collected data on a systematic random sample of 500 drivers referred for initial medical review in 2012. Analyses identified the most common sources of driver referrals and licensing outcomes by referral source. The researchers compared the licensing outcomes by State, for each referral source, to learn how differences in medical review processes and educational outreach might have affected the outcomes of medical review.

Substantial sources of referrals for medical review/reexamination in one or more of the six States included self-referral (driver acknowledged a medical condition or functional impairment during license application or renewal); physicians; license agency employees; law enforcement officers; family members; concerned citizens; other medical professionals; and crash reports.

The medical review process could result in the following outcomes:

1. new restriction(s) on where and when the person could drive;
2. periodic review, requiring a driver to submit medical information and/or pass a road test on a periodic basis to maintain licensure;
3. new restriction(s) plus periodic review;
4. removal of licensure for failure to meet licensing agency medical standards, or based on the opinion of the driver's treating physician that the medical condition was not under sufficient control for safe driving;
5. removal of licensure for failure to pass required licensing agency tests;
6. removal of licensure for failing to comply with medical review/reexamination requirements;
7. voluntary surrender of the license; and
8. no change in license status.

The following table summarizes the most common referral sources and outcomes for the six States:

State	Modal Referral Sources (Percentage With Known Source)	Modal Outcomes (Percentage With Known Outcome)
Maine	Self (91%)	2. Periodic Review Only (72%)
Ohio	Self (59%)	2. Periodic Review Only (42%)
Oregon	Physician (74%)	4. License Removal – Medically Unfit (67%)
Texas	Crash Reports (29%) Law Enforcement (28%)	6. License Removal – Failure to Comply (47%) *Excludes license alarmed cases.*
Washington	Physician (33%) Law Enforcement (28%)	6. License Removal – Failure to Comply (42%)
Wisconsin	Law Enforcement (66%)	4. License Removal – Medically Unfit (26%) 6. License Removal – Failure to Comply (22%)

The eight licensing outcomes were then grouped into three broad categories, as follows:

A. licensing action based on medical guidelines, opinion of the treating physician, or licensing agency test performance (outcome numbers 1, 2, 3, 4, and 5);
B. driver opts out of licensing (outcome numbers 6 and 7); and
C. no change in license status (outcome number 8).

Comparing results across the six States, in two States (Oregon and Texas) almost every case (greater than 99%) resulted in a change of license status regardless of referral source. In the remaining four States, physician referrals resulted in a change of status ranging from 90% in Washington to 97% in Maine. In addition to Oregon and Texas, three other States had substantial proportions of referrals from law enforcement with results ranging from a change of status in 77% in Washington to 84% in Wisconsin. Two other States had considerable portions of self-referrals resulting in a change of status 70% of the time in Ohio and 78% in Maine.

Focusing specifically on referrals by physicians in the six case study States, referrals by physicians in Maine, Oregon, and Wisconsin had the highest probability of a licensing action based on medical guidelines, opinion of the treating physician, or licensing agency test performance, i.e., Outcome A (91% of the known values for Maine, 87% for Oregon, and 80% for Wisconsin). This compares to 33% of the physician referrals in Texas, 41% of the physician referrals in Washington, and 55% of the physician referrals in Ohio with Outcome A.

In the five States with substantial proportions of law enforcement referrals, the percentage that resulted in a licensing action based on medical guidelines, opinion of the treating physician, or licensing agency test performance (Outcome A) ranged from 23% in Washington to 64% in Oregon.

Findings from the analyses of licensing outcomes by referral source are discussed in terms of the similarities and differences among the case study States in reporting requirements, medical review procedures, and education and outreach efforts, which may have led to the differing outcomes. Recommendations are provided for better targeting referrals for medical review, and to improve the medical review process with the goal of increasing efficiency by reducing the proportion of referrals that result in no change in license status.

Introduction

The case studies in this project were conducted in two phases. Phase I documented the structure of the driver medical review programs in seven States, and described their guidelines and practices for assessing fitness to drive. Volume I of this three-volume series presents the results of Phase I through a detailed summary of each case study State's medical review structure and process (including forms each licensing agency used to collect information about drivers' medical conditions), and compares and contrasts the medical review structures and processes across Maine, North Carolina, Ohio, Oregon, Texas, Washington, and Wisconsin.

Phase II focused on evaluation outcomes for drivers referred for medical review/reexamination by different sources (law enforcement, physicians, licensing staff, self-report of medical conditions on licensing application, family, etc.). This report (Volume II) describes data collection and analysis of a systematic random sample of 500 drivers referred for initial medical review in 2012 in six of the seven case study States: Maine, Ohio, Oregon, Texas, Washington, and Wisconsin.[1] Researchers collected data tracking each driver throughout the medical review process to document the referral source, the medical review/reexamination requirements, and the licensing outcomes to answer the following research questions:

- What were the most common reporting sources of driver referrals?
- What were the outcomes of referrals for each source?
- Were there differences in outcomes across sources?

This report compares and contrasts reporting sources and referral outcomes at the State level. Reporting sources include self, physicians, licensing agency employees, law enforcement, other professionals, crash reports, family members and concerned citizens. Referral outcomes are classified in terms of:

- drivers who received new license restrictions and the type of restriction;
- drivers put on periodic medical review;
- drivers who lost licensure (received suspension/cancellation/revocation) due to severity of a medical condition (deemed medically unfit to drive);
- drivers who lost licensure due to failing licensing agency tests (knowledge test or road test);
- drivers who voluntarily cancelled their licenses;
- drivers who received suspensions due to non-compliance with medical review requirements (e.g., did not return a medical or vision form or complete required licensing agency testing); and
- drivers for whom the referral did not result in a licensing action.

[1] North Carolina was unable to provide data for the case study analyses, so is not included in this group.

Methods

Retired medical review staff in Maine, Oregon, Wisconsin, and Washington worked for the contractor as consultants to enter data in these four States. (These efforts were funded as part of the project – there was no cost to these States for data collection staff.) In Ohio and Texas, the licensing agencies permitted current medical review employees to work on the project, either during the work day or on overtime on the weekends. The licensing agencies in these two States paid the data collectors and were reimbursed using project funds for the time their employees spent working on the project.

The research team provided each licensing agency with a sampling plan to obtain a target sample of 500 cases. Generally, cases were selected by first sorting the entire pool of drivers referred for medical review in 2012 by referral or case opened date (whichever was available in the licensing agency database), dividing the total referral pool by 500, and selecting every n^{th} driver, based on that dividend. Exclusion criteria included:

- drivers referred by the courts as adjudicated mentally incompetent;
- alcohol- or drug-abuse related referrals;
- resubmitted referrals (only the first referral for a person referred multiple times was used);
- drivers already on periodic review;
- drivers who also had a commercial driver license (CDL) or motorcycle endorsement who were operating a commercial motor vehicle, a school bus, a motorcycle, or a passenger transport van at the time they were referred;
- drivers who died or moved out of State before completing their medical review process;
- drivers who were referred with out-of-State licenses who would not be medically reviewed by the licensing agency of interest; and
- drivers whose licenses were already suspended/cancelled/revoked or expired at the time they were referred for medical review.

If one of the n^{th} drivers needed to be excluded, the principal investigator instructed the data collectors to select the prior driver on the list.

Appendix A presents the data elements collected in each of the case study States with definitions and coding. The research team developed a Microsoft Access database and data entry form and provided these to each licensing agency, either installed on a laptop computer provided for the duration of the project, or for installation on a licensing agency computer. The research team's data management instructor traveled to each licensing agency and trained the data collectors how to use the database and how to interpret and code the data for entry. Figure 1 presents the form used for data entry.

The database assigned a unique study ID to the record as each driver's information was entered. Clicking on the "make file to transfer" button (see Figure 1) initiated a query that included all the data entered for each person with the exception of the license number (the research team had no need for data that were personally identifiable). At the end of each day of data collection, the data collectors performed this query, which extracted the data to an Excel file. The data collectors then emailed only the de-identified data to the Project PI. The PI

reviewed the data entered each day for inconsistencies in coding within records. As questions arose, the PI contacted the data collector, and referred to the driver by study ID. Since the license number was still associated with the study ID in the database on the data collection computer at the licensing agency, the data collector was able to go back into the licensing agency medical review files, as needed, to resolve any data entry questions.

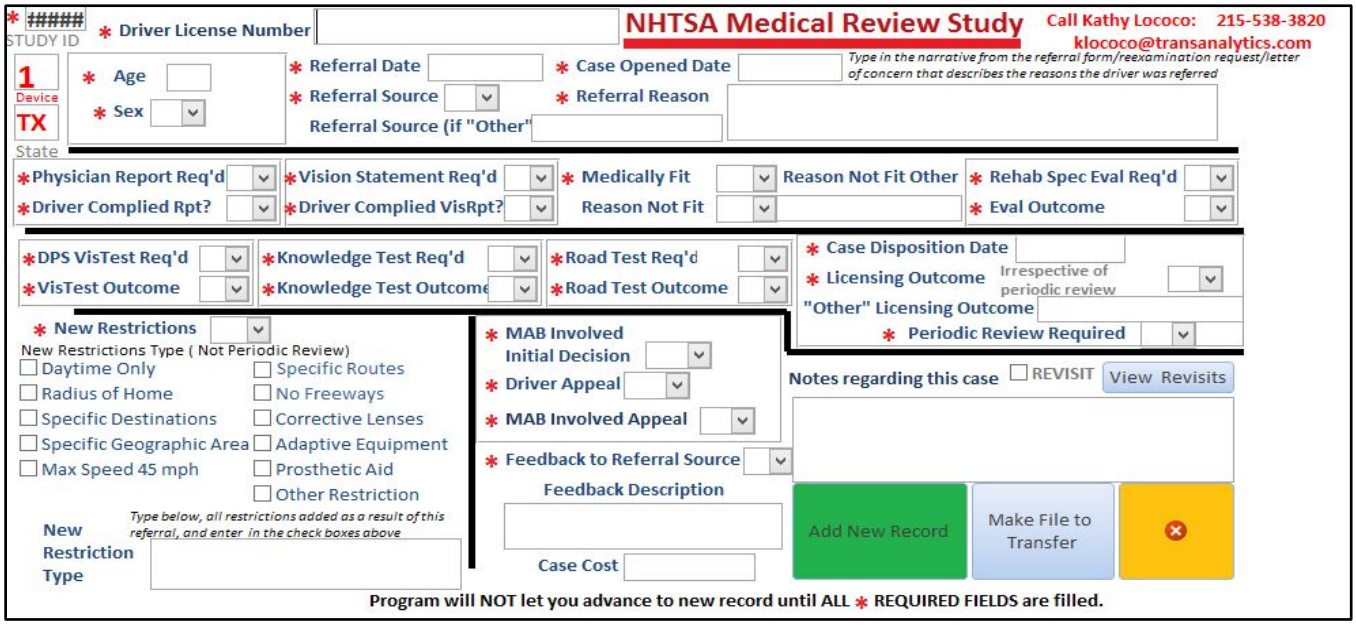

Figure 1. Microsoft Access form used to enter data for the 500 driver case study.

After all 500 entries for each State were reviewed by the PI, the data collectors initiated a final query that replaced the license number with the study ID and emailed the completed (de-identified) databases back to the PI.

Results

Differences in the way licensing agencies tracked and processed drivers referred for medical review precluded obtaining representative samples across all referral sources in all case study States. The pool of referral sources in Wisconsin and Maine differed from those in the other four case study States, as well as from each other. The Wisconsin Department of Motor Vehicles was not able to identify drivers who self-reported a medical condition for sampling in this study. Therefore, Wisconsin data did not support documenting the proportion of medical review cases resulting from self-referrals or describing the resulting licensing outcomes. The Maine Bureau of Motor Vehicles had no process for tracking drivers referred for medical review who were awaiting return of the physician's report. Therefore, this report does not include the percentage of referred drivers from Maine who did not comply with the requirement to submit medical reports. These data were available for the *entire pool* of referred drivers in Ohio, Oregon, Washington, and Texas (including self-referrals and drivers whose licenses were suspended due to failure to return medical statements).

The following sections describe the licensing outcomes for the 500 drivers from each of the study States. The section for each State includes a table showing the number (and percentage) of drivers referred by each referral source, the medical review outcomes associated with each source, and the medical review outcomes across the full sample. The medical review outcomes are described in terms of eight potential licensing actions:

1. new restriction(s);
2. periodic review, requiring a driver to submit medical information or undergo testing on a periodic basis to maintain licensure;
3. new restriction(s) plus periodic review;
4. loss of licensure as medically unfit;
5. loss of licensure for failing the licensing agency tests;
6. loss of licensure for failing to comply with medical review requirements;
7. voluntary cancellation, where the driver chooses to give up driving in lieu of participating in the medical review process, and completes paperwork indicating this choice; and
8. no change in license status.

Following a discussion of referral sources and medical review outcomes supported by the first table and supplemented with graphics, the report presents a table of medical review outcomes for each State condensed into three categories, by major referral sources, to facilitate statistical testing. The eight licensing outcomes are grouped into three broad categories:

- **licensing action based on medical guidelines, opinion of the treating physician, or licensing agency test performance**
    - new license restriction and/or periodic review
    - loss of licensure for drivers deemed medically unsafe to drive
    - loss of licensure upon failing vision, knowledge, or road test

- **opt out of licensure**
    - driver (passively) gives up license by failing to comply with medical reporting or testing requirements
    - driver voluntarily initiates paperwork to cancel license

- **no change in license status**

Drivers with no change in license status (the third category) maintained the same licensing status they had before they were referred for medical review. However, a referral that results in no change in license status following the medical review process *may* serve as a warning flag for diminished driving safety. Because this project focused on initial referrals for medical review, the data could not be used to validate this potential benefit.

Following the State-by-State summary of referral sources and medical review outcomes, the report focuses on referral source as the organizing principle and compares the medical review outcomes for the six case study States. Appendices B through G provide more detailed summaries of the medical review process and outcomes for each State's 500-driver sample, including a comparison of case study driver demographics to those of the population of licensed drivers, reasons for referral by referral source, a flow chart showing the medical review process and where drivers lost licensure at each stage in the process, case disposition times, feedback to reporting source, case cost (where available), proportion of drivers who appealed the licensing agency's decision, and additional analyses where data were provided for unique situations.

Maine

The Maine sample was selected from the set of drivers referred for medical review, who complied with the requirement to have their physicians complete a medical report form (Driver Medical Evaluation Form, referred to as a CR-24). Unlike other States studied, Maine had no hard deadline for returning the completed medical evaluation form to the Bureau of Motor Vehicles (BMV) for most drivers referred for initial medical review. In addition, the Maine licensing agency had no process for tracking drivers referred for medical review who were awaiting return of the CR-24 form. Such people could continue driving, but they were not permitted to obtain or renew licenses until the medical reports were received. (In the other case study States, licenses were suspended within 30 to 60 days following referral if drivers failed to submit a medical report.) Therefore, the information for Maine does not include the percentage of referred drivers who did not comply with the requirement to submit medical reports.

Table 1 presents the licensing outcomes for the 500-driver Maine sample, sorted by referral source. The large majority of these referrals were self-reports of medical conditions made during the initial or renewal licensing process. These were drivers who (1) answered "Yes" to one or more of the medical conditions listed on the license application form and (2) complied with the State requirement to have their physician complete a functional ability profile based on the BMV medical guidelines using the CR-24 form.

Table 1. Medical Review Process Licensing Outcomes, by Referral Source, in the Maine Sample

Referral Source	Number of Drivers (Col. %)	Change in License Status as a Result of Medical Review							
		(1) New Restriction(s) Only (Row %)	(2) Periodic Review Only (Row %)	(3) New Restriction + Periodic Review (Row %)	(4) Loss of Licensure: Medically Unfit (Row %)	(5) Loss of Licensure: Test Failure (Row %)	(6) Loss of Licensure: Fail to Comply With Medical Review/ Re-exam Requirements (Row %)	(7) Voluntary License Cancellation [a] (Row %)	(8) No Change (Row %)
Self	427 (85.4%)	1 (0.2%)	323 (75.6%)	3 (0.7%)	2 (0.5%)	1 (0.2%)	1 (0.2%)	--	96 (22.5%)
Physicians	32 (6.4%)	--	10 (31.3%)	4 (12.5%)	12 (37.5%)	3 (9.4%)	--	2 (6.3%)	1 (3.1%)
Licensing Agency Employee	4 (0.8%)	--	4 (100%)	--	--	--	--	--	--
Law Enforcement	2 (0.4%)	--	1 (50.0%)	--	1 (50.0%)	--	--	--	--
Physical Therapist	1 (0.2%)	--	--	--	--	--	--	1 (100%)	--
Family Member	1 (0.2%)	--	--	--	1 (100%)	--	--	--	--
Unknown	33 (6.6%)	--	22 (66.7%)	1 (3.0%)	3 (9.1%)	4 (12.1%)	--	1 (3.0%)	2 (6.1%)
Total	500	1 (0.2%)	360 (72.0%)	8 (1.6%)	19 (3.8%)	8 (1.6%)	1 (0.2%)	4 (0.8%)	99 (19.8%)

[a] In lieu of complying with testing requirements, or following one or two test failures, the driver completed paperwork to formally cancel their license. In Maine, this was called "cancellation" and in other States, it was called "voluntary surrender." The term "voluntary surrender" in Maine was reserved for drivers who moved out of State, and gave up their Maine license to establish licensure in another State.

Only 32 referrals appeared to have been submitted by physicians. Physicians used the same CR-24 form to refer drivers to the BMV due to concerns about a patient's ability to drive safely. A very small proportion of referrals came from law enforcement, BMV employees, family members, or physical therapists.

The consultant and the Maine BMV Medical Review Coordinator could not determine the source of 33 referrals (i.e., the driver was not renewing, there was no adverse driving report from law enforcement, and no evidence that a physician initiated the case as opposed to completing the form as requested by their patient or the BMV).

As Table 1 demonstrates, the medical review process resulted in periodic review only (i.e., no licensing restrictions) for about three-fourths of Maine's case study sample (360 of 500). Only one driver received a licensing restriction without periodic review, and eight received new restrictions plus periodic review. The restriction types for these nine drivers included:

- radius of home (2 drivers with dementia, one a 25-mile radius of home and the other a 50-mile radius of home);
- corrective lenses (2 drivers); and
- adaptive equipment (6 drivers), which included combinations of the following:
    - automatic transmission (6 drivers);
    - power steering (3 drivers);
    - steering knob (3 drivers);
    - hand-operated dimmer switch (3 drivers);
    - hand-operated emergency brake (2 drivers);
    - full hand controls (2 drivers);
    - both outside mirrors (2 drivers);
    - left-foot accelerator (1 driver); and
    - modified directional signals (1 driver).

Thirty-two drivers (6.4%) lost or opted out of licensure as a result of the medical review process. These included:

- 19 found medically unfit to drive (based on the functional ability profile level their physician provided for their medical condition and the licensing agency's medical standards for licensing);
- 8 who failed the licensing agency vision, knowledge, or road test;
- 1 who did not comply with medical review requirements (i.e., did not take required licensing agency tests or return medical or vision forms); and
- 4 who voluntarily cancelled their licenses in lieu of taking the licensing agency vision, knowledge, or road test.

In addition to not having a deadline for referrals to submit medical report forms, Maine was also the only study State that did not have a deadline for complying with licensing agency test requirements. In the other case study States, correspondence describing each driver's testing requirement stated that failure to comply within 30 to 60 days (depending on the State) would result in license suspension. In Maine, a driver had three attempts to pass the knowledge test and three to pass the road test. Because it took approximately 4 to 6 weeks to schedule each exam, 6

to 12 months (or more) might elapse before a driver exhausted all testing opportunities. The lack of suspension in a specified timeframe for failing to complete testing, coupled with the sample including only drivers whose physicians completed a CR-24 form, may explain why so few drivers had their licenses suspended for failure to comply with medical review requirements.

The medical review process resulted in no change in the license status for nearly 20% of the sample; nearly all of these were self-referrals. The only tests required for this set of referrals were those required during the licensing process for new applicants (vision, knowledge, and road tests), or vision tests due to age at renewal or for drivers converting an out-of-State license.

Figure 2 compares proportions of licensing outcomes for self-referrals and physician referrals. Physician referrals were much *more* likely than self-referrals to result in loss of licensure due to drivers determined to be medically unfit or who failed the knowledge and road tests. Self-referrals were more likely than physician referrals to result in no licensing action or only a periodic review requirement. This makes sense given that the self-referral sample was younger than the physician-referred sample (average age 60 and 70, respectively), and included drivers applying for licenses for the first time who indicated having a medical condition. The mere presence of a medical condition does not mean that functional ability is impaired. As an example, diabetes may not result in a functional limitation that would impair driving; however, periodic monitoring could be appropriate to ensure that the condition remained under control.

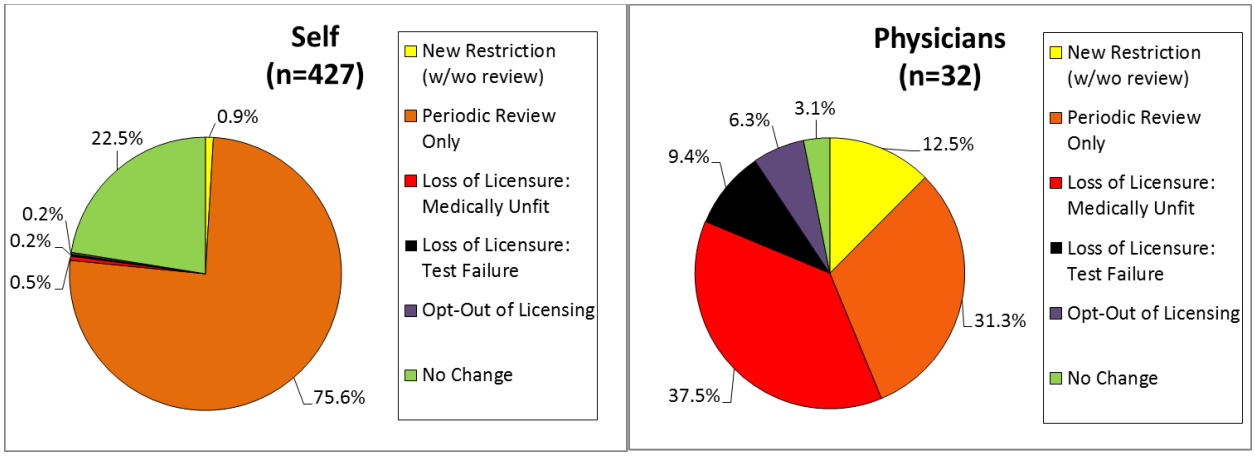

Figure 2. Licensing outcomes in the Maine sample by major referral sources.

As compared to the self-referred sample, the physician-referred drivers had more severe medical conditions (their medical condition was more likely to be profiled at a level precluding driving, such as moderate or severe active impairment). In addition, they more likely had multiple medical conditions, and may have been taking a constellation of medications to treat those conditions. Thus, their functional impairment would likely be greater and have more impact on driving performance, which would be expected to result in larger proportions of physician-referred drivers experiencing loss of licensure as medically unfit.

Table 2 presents the license outcomes condensed into broad categories, as described earlier, for self- and physician-referrals. These two referral sources accounted for 98% of the cases with a known source (459 of 467). The analysis excludes the category of opting out of licensing, which accounted for less than 1% of the cases (3 of 459). Physician referrals were

more likely than self-referrals to result in licensing action based on medical or functional guidelines or test performance and *less likely* to result in no action. These findings underscore that physician referrals indicated more serious impairment than self-referrals. A chi-square test showed a statistically significant difference in outcomes for these two referral sources (X^2 =6.17, d.f.=1, p=0.01). No statistical tests of significance were performed for cases referred by the remaining sources in Table 1 due to the small sample sizes. And as discussed above, the outcome of opting out of licensing rarely occurred and is excluded from Table 2 to permit statistical testing.

Table 2. Condensed Medical Review Outcomes by Referral Source in the Maine Sample

Referral Source	Result of Medical Review on License Status		Total
	License Action (Row %)	No Change in License Status (Row %)	
Self	330 (77.5%)	96 (22.5%)	**426 (100%)**
Physicians	29 (96.7%)	1 (3.3%)	**30 (100%)**

Note: N=456, Excludes unknown (33) and other referral sources (8) and 3 cases of opting out of licensing.

Ohio

Table 3 presents the licensing outcomes for the 500-driver Ohio sample, sorted by referral source. Self-referrals during the license application or renewal process comprised over half of the sample, and law enforcement referrals were over one-fourth. Together, self-referrals initiated when drivers answered "Yes" to the medical questions on the license application, and referrals from law enforcement following a crash or traffic stop, accounted for 88% of the case study referrals.

Nearly half of the Ohio case study sample (237 of 500) maintained licensure with new restrictions and/or a requirement to submit periodic medical or vision reports. Twenty-five drivers received license restrictions including one or more of the following:

- corrective lenses (7 drivers);
- dual outside mirrors (9 drivers);
- daytime only (2 drivers); and
- adaptive equipment (16 drivers, with combinations of the following):
    - all hand controls (8 drivers);
    - spinner knob (12 drivers);
    - modified accelerator (4 drivers);
    - power steering (12 drivers);
    - automatic transmission (10 drivers); and
    - modified turn signals (2 drivers).

Table 3. Medical Review Process Licensing Outcomes, by Referral Source in the Ohio Sample

Referral Source	Number of Drivers (Col. %)	Change in License Status as a Result of Medical Review							
		(1) New Restriction(s) Only (Row %)	(2) Periodic Review Only (Row %)	(3) New Restriction + Periodic Review (Row %)	(4) Loss of Licensure: Medically Unfit (Row %)	(5) Loss of Licensure: Test Failure (Row %)	(6) Loss of Licensure: Fail to Comply With Medical Review/ Re-exam Requirements (Row %)	(7) Voluntary License Cancellation [a] (Row %)	(8) No Change (Row %)
Self	294 (58.8%)	7 (2.4%)	168 (57.1%)	8 (2.7%)	8 (2.7%)	2 (0.7%)	15 (5.1%)	1 (0.3%)	85 (28.9%)
Law Enforcement	146 (29.2%)	--	33 (22.6%)	3 (2.1%)	12 (8.2%)	6 (4.1%)	56 (38.4%)	3 (2.1%)	33 (22.6%)
Physicians	49 (9.8%)	2 (4.1%)	8 (16.3%)	2 (4.1%)	11 (22.4%)	4 (8.2%)	19 (38.8%)	1 (2.0%)	2 (4.1%)
Courts	4 (0.8%)	--	2 (50.0%)	1 (25.0%)	--	1 (25.0%)	--	--	--
Licensing Agency Employee	3 (0.6%)	--	1 (33.3%)	1 (33.3%)	1 (33.3%)	--	--	--	--
Family Member	2 (0.4%)	--	--	--	2 (100.0%)	--	--	--	--
Unknown	2 (0.4%)	1 (50.0%)	--	--	--	--	--	1 (50.0%)	--
Total	500	10 (2.0%)	212 (42.4%)	15 (3.0%)	34 (6.8%)	13 (2.6%)	90 (18.0%)	6 (1.2%)	120 (24.0%)

[a] In lieu of complying with testing requirements, or following one or two test failures, the driver chose to give up driving, and completed paperwork to formally surrender their license, rather than complete the re-examination testing.

Just over one-fourth of the case study sample (143 of 500) lost licensure for one of the following reasons:

- 18% failed to comply with medical review requirements;
- 7% were deemed medically unfit;
- 3% failed the licensing agency vision, knowledge, or road test; and
- 1% voluntarily cancelled their licenses.

The medical review process resulted in no change in the licensing status for nearly one-fourth of the Ohio case study sample (120 of 500). These drivers maintained licensure with no new restrictions or periodic medical or vision reporting requirements.

Figure 3 compares the proportions of licensing outcomes for self-referrals, law enforcement referrals, and physician referrals, and shows that self-referrals were much *more* likely to result in a periodic review requirement. Self-referrals also accounted for the largest proportion of drivers with no change in license status. This is logical, given that the self-referral sample was younger (average age 41.1 years) than the law enforcement and physician-referred samples (72.3 years and 80.5 years, respectively), and included drivers applying for licenses for the first time who responded affirmatively to the medical questions on the licensing application. The mere presence of a medical condition does not mean that functional ability is impaired. Over one-third of Ohio's self-referrals indicated having diabetes. For those whose condition was well controlled, either no action or periodic review to ensure that the condition remained under control may have been more appropriate than suspensions.

Physician referrals were much more likely than self- and law-enforcement referrals to result in a loss of licensure for a medical condition not under sufficient control for safe operation of a motor vehicle. Physician referrals were slightly more likely to result in a driving restriction compared to self- and law-enforcement referrals and were the least likely to result in no change in license status. This is to be expected given that the physician referral sample averaged 80.5 years of age and included a large percentage of drivers with cognitive impairment or dementia. Because many chronic conditions increase in severity over time, it is possible that many of the older drivers in the physician-referred sample were more functionally impaired than the younger self-referred sample. Additionally, because increasing age is associated with co-existing medical conditions, it is likely that the older, physician-referred sample had multiple medical conditions and used a multitude of medications, both likely to affect functional ability and safe driving performance.

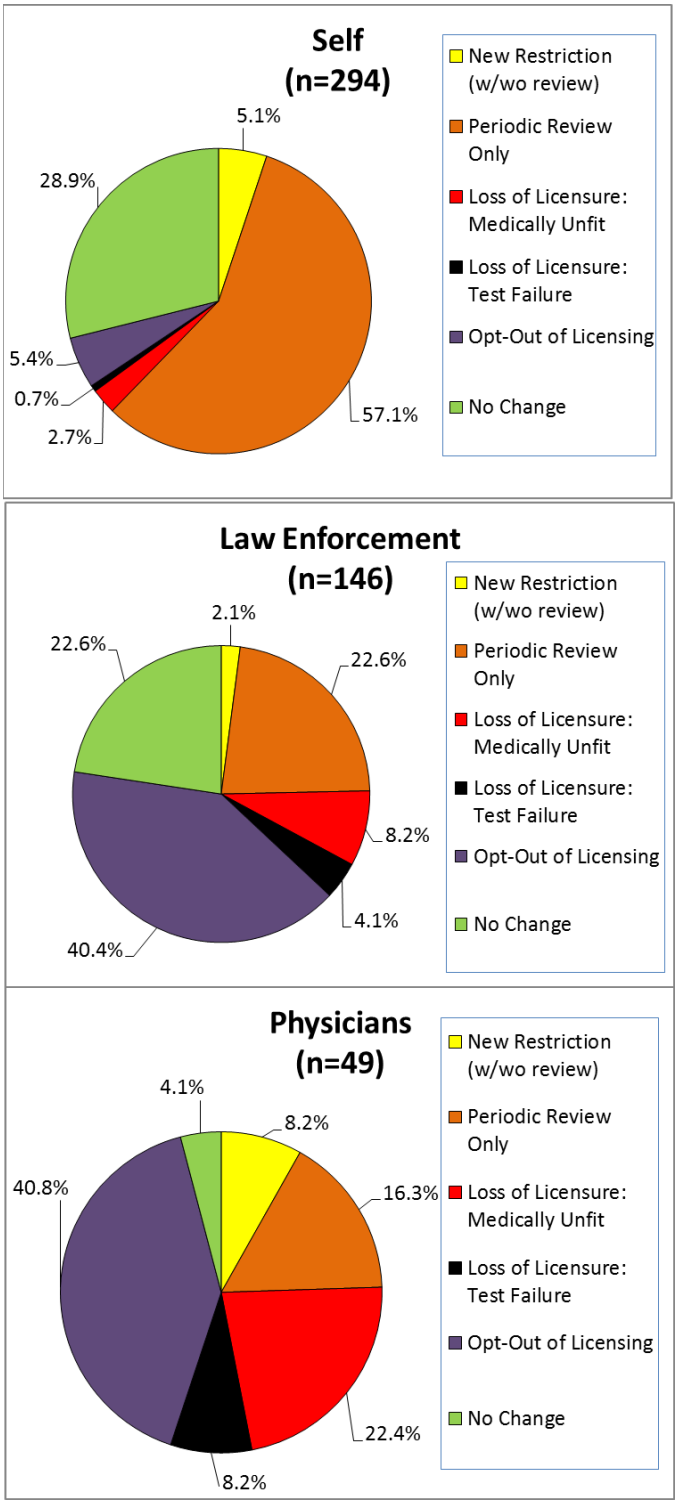

Figure 3. Licensing outcomes in the Ohio sample by major referral sources.

The outcomes of law enforcement referrals fell between those of self-referrals and physician referrals. Law enforcement referrals were less likely than physician referrals but more likely than self-referrals to result in loss of licensure due to uncontrolled medical conditions or to failing licensing agency tests. They were equally as likely as physician referrals to have a loss of licensure for failing to comply with medical review requirements. These findings may also be associated with the proportion of older drivers in the law enforcement sample (71% were 65 or older) and physician-referred sample (88% were 65 or older). It is plausible that these older, and possibly more functionally impaired drivers were more accepting of driving cessation (or to have known they would not be able to pass the tests, and therefore did not comply with the testing requirements) than their younger counterparts in the self-referral sample, with only 17% age 65 or older.

Table 4 shows the condensed licensing outcomes for cases referred by law enforcement, physicians, and self-referrals. These three referral sources accounted for 98% of the cases with a known source (489 of 498). The results indicate that physician referrals were *less likely* than law enforcement and self-referrals to result in no change in licensing status. Physician referrals and self-referrals were *more likely* than law enforcement referrals to result in a change in license status due to medical fitness to drive and performance on licensing agency knowledge and road tests. Referrals by law enforcement and physicians were equally likely to result in a driver opting out of licensure.

A chi-square test using these three medical review outcome categories showed a significant difference in outcomes for referrals by self, law enforcement, and physicians (X^2=99.41, d.f.=4, p<0.01). No statistical tests of significance were performed for cases referred by the remaining sources in Table 3 due to the small sample sizes. However, all cases referred by family members, the courts, and licensing agency representatives resulted in a licensing action.

Table 4. Condensed Medical Review Outcomes by Referral Source in the Ohio Sample

Referral Source	Result of Medical Review on License Status			Total (Row %)
	License Action (Row %)	Opt Out of Licensing (Row %)	No Change in License Status (Row %)	
Self	193 (65.6%)	16 (5.4%)	85 (28.9%)	**294 (100%)**
Law Enforcement	54 (37.0%)	59 (40.4%)	33 (22.6%)	**146 (100%)**
Physicians	27 (55.1%)	20 (40.8%)	2 (4.1%)	**49 (100%)**

Note: N=489, Excludes cases from unknown (2) and other (9) referral sources.

Oregon

Table 5 presents the licensing outcomes for the 500-driver Oregon sample, sorted by referral source. Physicians referred nearly three-fourths of the sample, and law enforcement referred 15%. The average age of physician- and law enforcement-referred drivers was 73 years. Drivers referred by family members and concerned citizens were generally older (averaging 80 years).

The sample included no self-referrals. The DMV medical programs coordinator was not surprised by this finding. The Coordinator advised that the DMV receives few to no self-referrals because customers generally did not self-report medical conditions on the license application or renewal form.

Oregon's mandatory reporting law for health care providers likely accounted for the large proportion of physician referrals, over three-fourths of which resulted in suspension of the driver's license as he or she was found medically unfit to drive. Oregon was the only study State with a mandatory physician reporting law. Oregon Revised Statute 807.710 dictated that designated health care providers must report people whose cognitive and/or functional impairments are likely to affect safe driving ability because they are *severe and uncontrollable*. *Severe and uncontrollable* means the impairment(s) substantially limits a person's ability to perform activities of daily living, including driving, because it cannot be controlled or compensated for by medication, therapy, surgery, or adaptive devices. Physicians who submitted mandatory reports to DMV in good faith, as well as those who chose not to submit reports, were immune from civil liability. As a result of the passage of HB 2195, beginning January 1, 2014, physicians and health care providers were also immune from civil liability for submitting non-mandatory (*voluntary)* reports in good faith to DMV. All mandatory and non-mandatory reports submitted by physicians and health care providers, including the name of the person submitting the report, were kept confidential and could not be admitted as evidence in any civil or criminal action.

Table 5. Medical Review Process Licensing Outcomes, by Referral Source in the Oregon Sample

Referral Source	Number of Drivers (Col. %)	Change in License Status as a Result of Medical Review							
		(1) New Restriction(s) Only (Row %)	(2) Periodic Review Only (Row %)	(3) New Restriction + Periodic Review (Row %)	(4) Loss of Licensure: Medically Unfit (Row %)	(5) Loss of Licensure: Test Failure (Row %)	(6) Loss of Licensure: Fail to Comply With Medical Review/ Re-exam Requirements[a] (Row %)	(7) Voluntary License Cancellation [b] (Row %)	(8) No Change (Row %)
Physicians	368 (73.6%)	2 (0.5%)	15 (4.1%)	3 (0.8%)	289 (78.5%)	11 (3.0%)	45 (12.2%)	3 (0.8%)	--
Law Enforcement	77 (15.4%)	--	3 (3.9%)	1 (1.3%)	36 (46.8%)	9 (11.7%)	25 (32.5%)	3 (3.9%)	--
Family Member	23 (4.6%)	--	3 (13.0%)	--	6 (26.1%)	2 (8.7%)	9 (39.1%)	1 (4.3%)	2 (8.7%)
Licensing Agency Employee	17 (3.4%)	1 (5.9%)	5 (29.4%)	8 (47.1%)	--	--	3 (17.6%)	--	--
Concerned Citizen	8 (1.6%)	--	3 (37.5%)	1 (12.5%)	2 (25.0%)	--	1 (12.5%)	1 (12.5%)	--
Crash Reports	5 (1.0%)	--	2 (40.0%)	--	2 (40.0%)	--	1 (20.0%)	--	--
"Other" (Adult Protective Services; Health Care Provider)	2 (0.4%)	--	--	--	1 (50.0%)	--	1 (50.0%)	--	--
Total	500	3 (0.6%)	31 (6.2%)	13 (2.6%)	336 (67.2%)	22 (4.4%)	85 (17.0%)	8 (1.6%)	2 (0.4%)

[a] Includes 7 drivers suspended for unknown cause (either for failure to test or for test failure).

[b] In lieu of complying with testing requirements, or following one or two test failures, the driver chose to complete paperwork to voluntarily surrender his or her license.

Oregon Administrative Rule 735-074-0080 defined a Mandatory Reporter as:

- a physician or health care provider acting in the capacity of a person's primary care provider;
- a physician or health care provider rendering specialized or emergency health care services to a person who does not have a primary care provider; or
- an ophthalmologist or optometrist providing health care services to a person who does not meet DMV vision standards (OAR 735-062-0050).

Only 2 of the 500 drivers in the Oregon case study sample experienced no change in license status, and both were referrals from family members. An additional 47 drivers received license restrictions and/or were required to submit periodic medical/vision reports. The types of new restrictions (all vision-related) applied to the licenses of 16 drivers included combinations of the following:

- daytime only (11 drivers);
- corrective lenses (9 drivers); and
- bioptic telescopic lenses (1 driver).

Ninety percent of the study sample (451 of 500) lost licensure as a result of medical review, for one of the following reasons:

- 67% were deemed not medically fit;
- 17% failed to comply with medical review requirements;
- 4% failed the licensing agency vision, knowledge, or road test; and
- 2% voluntarily cancelled their licenses.

Figure 4 compares the licensing outcomes proportionately, for referrals by physicians and law enforcement. Just over three-fourths of the physician referrals resulted in loss of licensure as the drivers were found medically unfit to drive, as were nearly half of the referrals by law enforcement. Referrals by law enforcement were more likely to result in loss of licensure for test failure and voluntary license cancellation, compared to referrals by physicians. New restrictions and periodic review were very infrequent outcomes of referrals by these two sources.

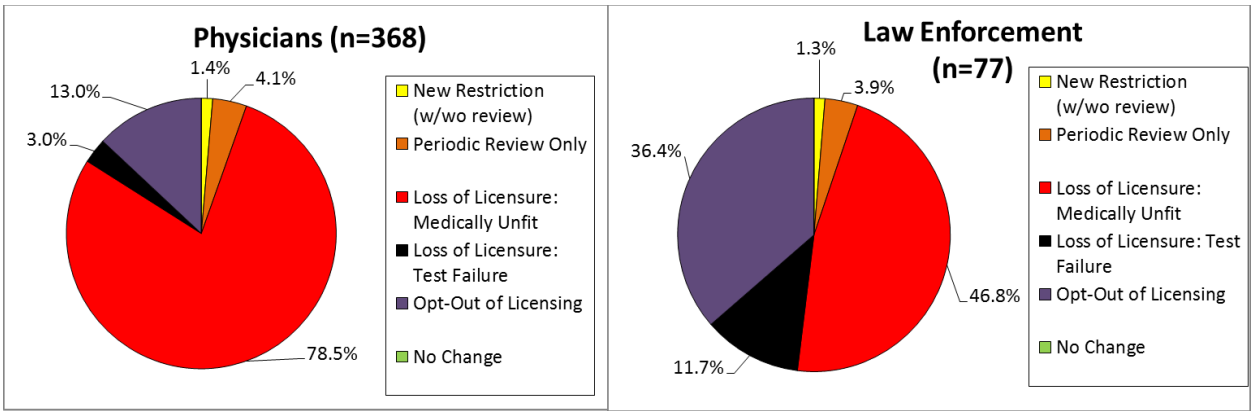

Figure 4. Licensing outcomes in the Oregon sample by major referral sources.

Table 6 shows the results of the condensed analysis performed using two medical review outcomes (licensing action based on medical fitness to drive and DMV test performance vs. opting out of licensing) and the three most common referral sources (physicians, law enforcement and family members). These three referral sources accounted for 94% of the cases with a known source (468 of 500). The analysis also excludes the category of no change, which accounted for less than 1% of the cases (2 of 468).

The chi-square test showed a significant difference in medical review outcomes for these referral sources (X^2=35.44, d.f.=2, p<0.01). Referrals from physicians were more likely to result in license action than referrals by law enforcement or family members. Referrals by family members were more likely to result in drivers opting out than referrals by law enforcement or physicians. This may be related to the fact that the family member referrals were on average 7 years older than the physician and law-enforcement referrals. The drivers referred by family may have been more medically/functionally impaired and either more accepting of voluntarily cancelling their licenses or less willing to attempt licensing agency tests.

Table 6. Condensed Medical Review Outcomes by Referral Source in the Oregon Sample

Referral Source	**Result of Medical Review on License Status**		**Total**
	License Action (Row %)	**Opt Out of Licensing (Row %)**	
Physicians	320 (87.0%)	48 (13.0%)	**368 (100%)**
Law Enforcement	49 (63.6%)	28 (36.4%)	**77 (100%)**
Family Members	11 (52.4%)	10 (47.6%)	**21 (100%)**

*Note***:** N=466. Excludes 32 cases with other referral sources and 2 cases with no change in license status.

Texas

Table 7 presents the licensing outcomes for the 500-driver Texas sample, sorted by referral source; Drivers identified for medical review via information coded in crash reports comprised the plurality of the case study sample, followed closely by referrals from law enforcement officers. Together, crash reports (Form CR-3) and referrals from law enforcement following a crash or traffic stop (Form DL-76) accounted for over half of the case study referrals. Drivers identified for medical review via crash reports were younger on average compared to those referred by law enforcement officers (55.2 years vs. 70.6 years). Those referred by physicians averaged 70.5 years, similar to the law enforcement sample.

In a practice unique to Texas, the Department initiated a field investigation when it received information concerning a possible medical/physical condition and either:

- the source of the information was considered unreliable (i.e., an anonymous referral, or a referral by a concerned citizen or family member); or
- there was uncertainty about the medical/physical condition, (i.e., the referral indicated the driver "may have/possibly has" a medical condition).

In these cases, the Department conducted a preliminary investigation rather than referring such drivers to the Medical Advisory Board. To initiate an investigation, the Enforcement and Compliance Services Department (ECS), within the Department of Public Safety (DPS) mailed a notice directing the driver to schedule an appointment at a local driver license office to discuss the information or possibly demonstrate driving ability.

There was no deadline by which the driver had to comply with the medical investigation interview and any further requirements that might arise from the investigation. If the driver did not comply with the investigation or only partially complied, the license was "alarmed for non-renewal." Such drivers could legally continue driving until their licenses expired, but were not permitted to renew their licenses (or obtain a duplicate misplaced license) until they complied with the investigation.

Table 7. Medical Review Process Licensing Outcomes (including license alarmed cases) by Referral Source in the Texas Sample

Referral Source	Number of Drivers (Col. %)	Change in License Status as a Result of Medical Review							(8) Not Reviewed/ No Change[b] (Row %)
		(1) New Restriction(s) Only (Row %)	(2) Periodic Review Only (Row %)	(3) Loss of Licensure: Medically Unfit (Row %)	(4) Loss of Licensure: Test Failure (Row %)	(5) Loss of Licensure: Fail to Comply With Medical Review/ Re-exam Requirements (Row %)	(6) Voluntary License Cancellation [a] (Row %)	(7) No Change (Row %)	
Crash Reports	143 (28.6%)	--	--	56 (39.2%)	3 (2.1%)	39 (27.3%)	5 (3.5%)	--	40 (28.0%)
Law Enforcement	139 (27.8%)	--	--	30 (21.6%)	15 (10.8%)	37 (26.6%)	10 (7.2%)	--	47 (33.8%)
Physicians	96 (19.2%)	--	--	25 (26.0%)	6 (6.3%)	61 (63.5%)	2 (2.1%)	--	2 (2.1%)
Self	46 (9.2%)	--	1 (2.0%)	15 (32.6%)	2 (4.3%)	25 (54.3%)	--	--	3 (6.5%)
Family Members	33 (6.6%)	1 (3.0%)	--	1 (3.0%)	8 (24.2%)	2 (6.1%)	5 (15.2%)	--	16 (48.5%)
Licensing Agency Employees	20 (4.0%)	--	--	4 (20.0%)	2 (10.0%)	10 (50.0%)	--	1 (5.0%)	3 (15.0%)
Concerned Citizens	11 (2.2%)	--	--	--	--	1 (9.1%)	3 (27.3%)	--	7 (63.6%)
Other (APS, nurse)	9 (1.8%)	--	--	1 (11.1%)	1 (11.1%)	2 (22.2%)	--	--	5 (55.6%)
Unknown	3 (0.6%)	--	--	--	--	--	--	--	3 (100%)
Total	500	1 (0.2%)	1 (0.2%)	132 (26.4%)	37 (7.4%)	177 (35.4%)	25 (5.0%)	1 (0.2%)	126 (25.2%)

[a] In lieu of complying with medical reporting or testing requirements, the driver completed paperwork to formally surrender licensure.

[b] Driver did not comply with investigation; license alarmed for non-renewal. Licensure continues until license expires. Driver not permitted to renew license until he/she participates in the field investigation and any subsequent requirements.

DPS did not take licensing action for these cases, as it was unable to gather the necessary information; therefore, the cases remained open. The license renewal cycle was 6 years for drivers up to 84, and 2 years for drivers 85 and older, so cases may have remained open for up to 6 years, for drivers younger than 85. Of the 500 case study drivers, 180 were required to participate in a field investigation, and 126 of these did not comply so had their licenses alarmed for non-renewal. These 126 drivers represent 25% of the case study sample. The time period these drivers were legally permitted to drive before their licenses expired ranged from 4 days to 6 years and averaged 2.9 years (*SD*=1.9 years).

The research team excluded the 126 license alarmed cases in the investigation of medical review outcomes by referral source. Table 8 shows the licensing outcomes of the 374 drivers who underwent medical review/reexamination by referral source, and proportions of the case study sample with each outcome. Figure 5 compares the licensing outcomes shown in Table 8 for referrals initiated by crash reports, law enforcement, physicians, and drivers during the licensing or renewal process.

Medical review/reexamination resulted in no change in the license status for only one of the 374 drivers in the case study sample. One driver received license restrictions and another was required to submit periodic medical reports. The driver with new restrictions, a 93-year-old, was restricted to daytime driving, no expressways, and driving within a 4-mile radius of home.

Ninety-nine percent of those who underwent medical review/reexamination lost licensure for one of the following reasons:

- 47% did not comply with medical review/reexamination requirements;
- 35% were deemed medically ineligible;
- 10% failed the licensing agency vision, knowledge, or road test; and
- 7% voluntarily cancelled their licenses.

The plurality of referrals across all referral sources, and the majority from physicians, DPS employees, and self-referrals, resulted in loss of licensure for failing to submit medical information to the MAB or for not taking the licensing agency comprehensive exam (vision, knowledge, road test).

The next most frequent medical review/reexamination outcome across all referral sources was loss of licensure for not meeting medical standards for driver fitness. Drivers identified through crash reports were the most likely to have this medical review outcome. Loss of licensure for medical ineligibility to drive was associated with approximately one-third of the referrals by law enforcement and self-referrals, and approximately one-fourth of the referrals by physicians, licensing agency employees, and others.

Table 8. Medical Review Process Licensing Outcomes by Referral Source in the Texas Sample (excluding license alarmed cases)

Referral Source	Number of Drivers (Col. %)	Change in License Status as a Result of Medical Review						
		(1) New Restriction(s) Only (Row %)	(2) Periodic Review Only (Row %)	(3) Loss of Licensure: Medically Unfit (Row %)	(4) Loss of Licensure: Test Failure (Row %)	(5) Loss of Licensure: Fail to Comply With Medical Review/ Re-exam Requirements (Row %)	(6) Voluntary License Cancellation (Row %)	(7) No Change (Row %)
Crash Reports	103 (27.5%)			56 (54.4%)	3 (2.9%)	39 (37.9%)	5 (4.9%)	
Law Enforcement	92 (24.6%)			30 (32.6%)	15 (16.3%)	37 (40.2%)	10 (10.9%)	
Physicians	94 (25.1%)			25 (26.6%)	6 (6.4%)	61 (64.9%)	2 (2.1%)	
Self	43 (11.5%)		1 (2.3%)	15 (34.9%)	2 (4.7%)	25 (58.1%)		
Family Members	17 (4.5%)	1 (5.9%)		1 (5.9%)	8 (47.1%)	2 (11.8%)	5 (29.4%)	
Licensing Agency Employees	17 (4.5%)			4 (23.5%)	2 (11.8%)	10 (58.8%)		1 (5.9%)
Concerned Citizens	4 (1.1%)					1 (25.0%)	3 (75.0%)	
Other (APS, nurse)	4 (1.1%)			1 (25.0%)	1 (25.0%)	2 (50.0%)		
Total	374	1 (0.3%)	1 (0.3%)	132 (35.3%)	37 (9.9%)	177 (47.3%)	25 (6.7%)	1 (0.3%)

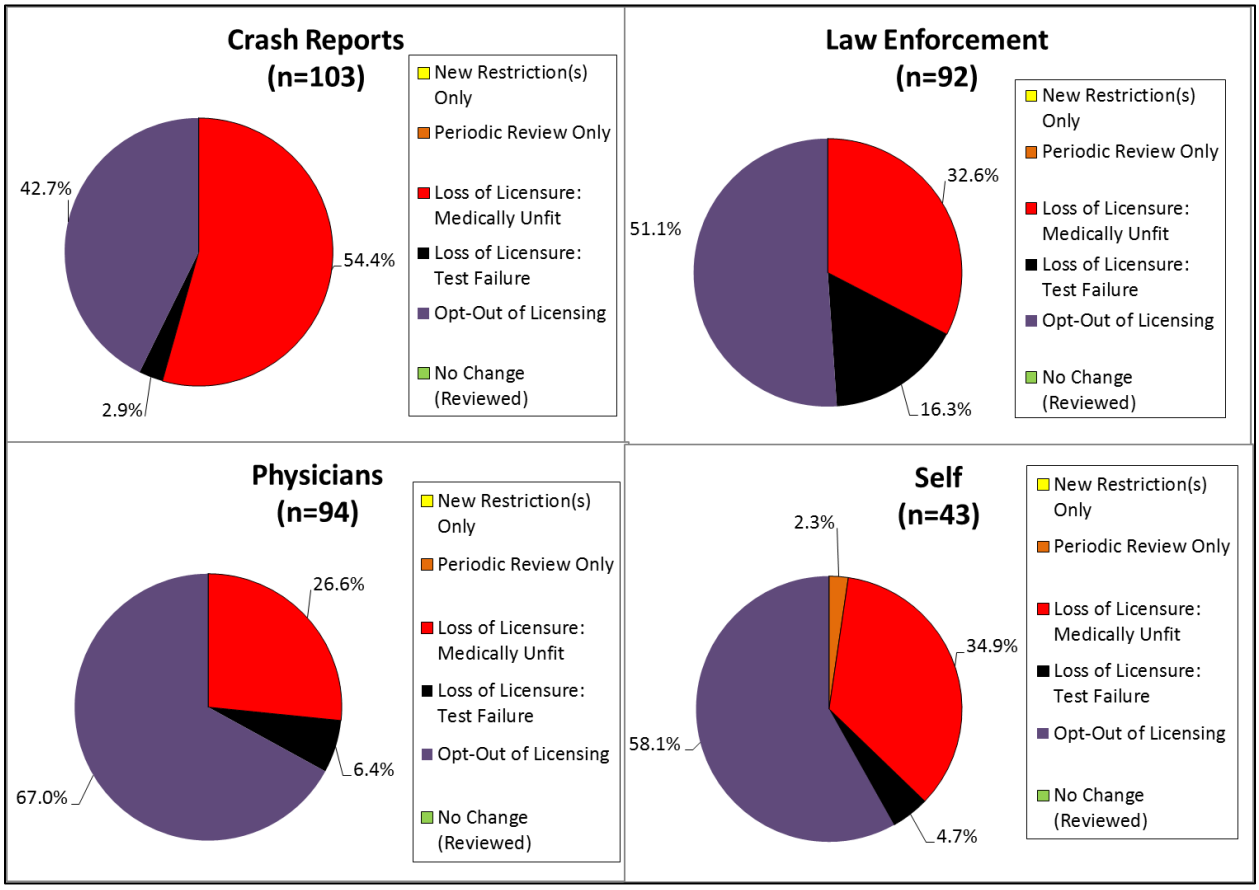

Figure 5. Licensing outcomes in the Texas sample by major referral source.

Table 9 compares the condensed licensing outcomes for six of the eight referral sources: crash reports, law enforcement, physicians, self, family members, and licensing agency employees. These referral sources accounted for 98% of the cases where drivers underwent medical review (366 of 374). In addition, the analysis excluded one case that resulted in "no change" (1 of 366). A chi-square test using the two outcome categories showed a significant difference for these six referral sources (X^2=13.9, d.f.=5, p=0.02). Crash report and family referrals were more likely to result in a license action based on medical guidelines or test performance than other referral sources. Physician, self, and licensing agency employee referrals were more likely to result in a driver opting out of licensure than the other referral sources.

Table 9. Condensed Medical Review Outcomes by Referral Source in the Texas Sample

Referral Source	Result of Medical Review on License Status		Total
	License Action (Row %)	Opt Out of Licensing (Row %)	
Crash Reports	59 (57.3%)	44 (42.7%)	**103 (100%)**
Law Enforcement	45 (48.9%)	47 (51.1%)	**92 (100%)**
Physicians	31 (33.0%)	63 (67.0%)	**94 (100%)**
Self	18 (41.9%)	25 (58.1%)	**43 (100%)**
Family	10 (58.8%)	7 (41.2%)	**17 (100%)**
Licensing Agency Employees	6 (37.5%)	10 (62.5%)	**16 (100%)**

Note: N=365. Excludes 126 license alarmed cases, 8 cases from other referral sources, and 1 case with "no change."

Washington

Table 10 presents the licensing outcomes for the 500-driver Washington sample, sorted by referral source. As to medical review outcomes, 12% of the drivers in the sample retained their licensing status; they received no new restrictions or periodic medical and/or vision report requirements. An additional 8% received new restrictions and/or were required to submit periodic medical/vision reports. The types of new restrictions applied to the licenses of 16 drivers included combinations of the following:

- corrective lenses (9 drivers);
- outside mirror on both sides (7 drivers);
- seat cushion (2 drivers);
- inside rearview mirror (2 drivers); and
- automatic transmission (2 drivers).

There were no time of day, geographic, roadway type, or maximum posted speed limit restrictions placed on case study drivers as a result of medical review.

Nearly 80% of the study sample cases lost licensure as a result of medical review, for the following reasons:

- 42% did not comply with the medical review/reexamination requirements;
- 14% voluntarily cancelled their licenses;
- 14% were deemed not medically fit; and
- 9% failed the licensing tests.

Table 10. Medical Review Process Licensing Outcomes, by Referral Source in the Washington Sample

Referral Source	Number of Drivers (Col. %)	Change in License Status as a Result of Medical Review							
		(1) New Restriction(s) Only (Row %)	(2) Periodic Review Only (Row %)	(3) New Restriction + Periodic Review (Row %)	(4) Loss of Licensure: Medically Unfit (Row %)	(5) Loss of Licensure: Test Failure (Row %)	(6) Loss of Licensure: Fail to Comply With Medical Review/ Re-exam Requirements (Row %)	(7) Voluntary License Cancellation [a] (Row %)	(8) No Change (Row %)
Physicians	164 (32.8%)	4 (2.4%)	3 (1.8%)	1 (0.6%)	50 (30.5%)	9 (5.5%)	64 (39.0%)	16 (9.8%)	17 (10.4%)
Law Enforcement	142 (28.4%)	6 (4.2%)	8 (5.6%)	2 (1.4%)	7 (4.9%)	10 (7.0%)	66 (46.5%)	10 (7.0%)	33 (23.2%)
Licensing Agency Employees	91 (18.2%)	1 (1.1%)	1 (1.1%)	--	1 (1.1%)	22 (24.2%)	26 (28.6%)	38 (41.8%)	2 (2.2%)
Other Medical Professionals	49 (9.8%)	--	1 (2.0%)	--	6 (12.2%)	3 (6.1%)	28 (57.1%)	4 (8.2%)	7 (14.3%)
Concerned Citizens	25 (5.0%)	1 (4.0%)	6 (24.0%)	--	--	1 (4.0%)	14 (56.0%)	1 (4.0%)	2 (8.0%)
Family Members	24 (4.8%)	--	5 (20.8%)	1 (4.2%)	5 (20.8%)	1 (4.2%)	11 (45.8%)	1 (4.2%)	--
Self	5 (1.0%)	--	--	--	--	1 (20%)	2 (40.0%)	1 (20.0%)	1 (20%)
Total	500	12 (2.4%)	24 (4.8%)	4 (0.8%)	69 (13.8%)	47 (9.4%)	211 (42.2%)	71 (14.2%)	62 (12.4%)

[a] In lieu of complying with testing requirements, or following one or two test failures, the driver chose to complete paperwork to formally surrender his or her license. Includes 1 new applicant (age 48) referred by a DOL employee. The applicant failed the road test and was therefore not given a license, so she obtained an ID card. This driver was never licensed, so license suspension was not possible.

Figure 6 compares medical review outcomes proportionately by referral source and shows that large proportions of drivers referred by all sources resulted in drivers opting out of licensure. Approximately one-third of physician referrals resulted in loss of licensure following being deemed medically unfit. Drivers referred by department of licensing (DOL) employees comprised the largest proportion of drivers who lost licensure due to test failure.

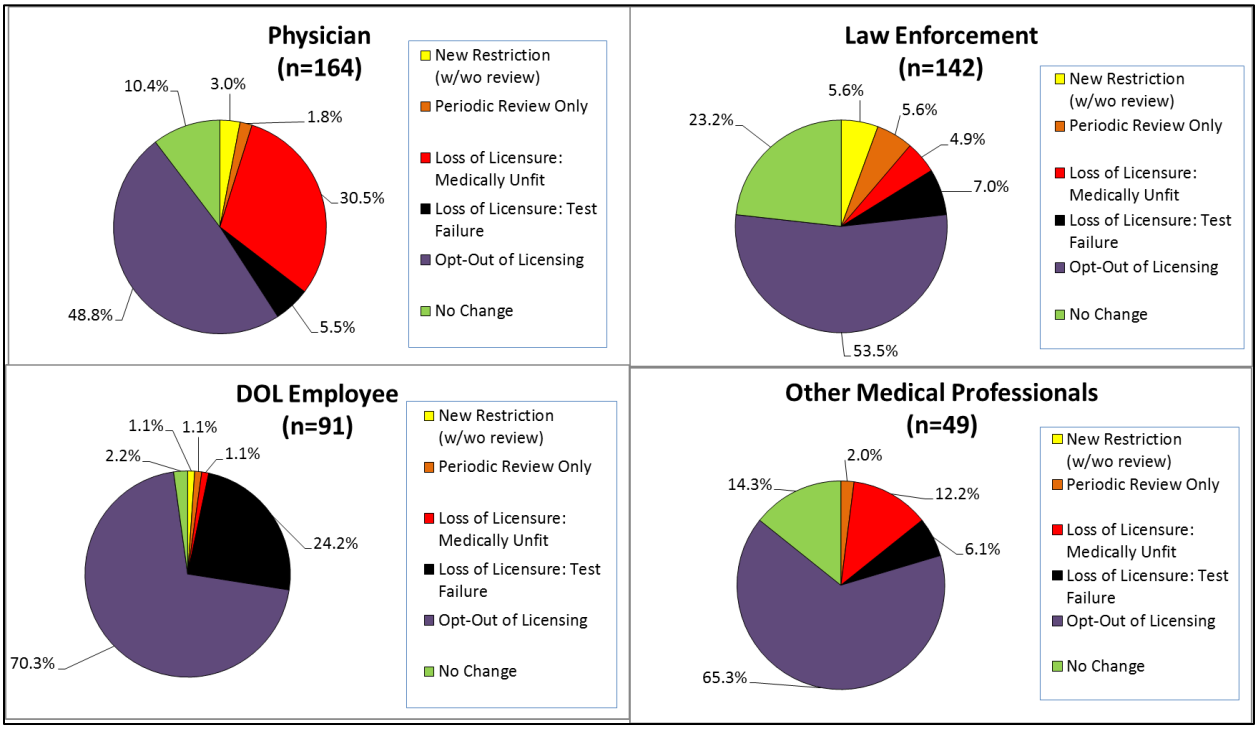

Figure 6. Licensing outcomes in the Washington sample by major referral source.

Table 11 presents the condensed licensing outcomes for referrals by physicians, law enforcement, licensing agency employees, other medical professionals, concerned citizens and family members. These referral sources accounted for 99% of the cases with a known referral source (495 of 500). A chi-square test using the three outcome categories showed a significant difference for these six referral sources (X^2=43.9, d.f.=10, p<0.01). The results indicate that referrals by physicians and family members were most likely to results in license action while referrals by law enforcement and other medical professionals were least likely to result in license action. Referrals by licensing agency employees were most likely to result in opting out while referrals from physicians and family members were least likely to result in opting out. Finally, referrals from law enforcement were most likely to result in no change while referrals from physicians, concerned citizens and family members were least likely to result in no change.

Table 11. Condensed Medical Review Outcomes by Referral Source in the Washington Sample

Referral Source	Result of Medical Review on License Status			Total
	License Action (Row %)	Opt Out of Licensing (Row %)	No Change (Row %)	
Physicians	67 (40.9%)	80 (48.8%)	17 (10.4%)	**164 (100%)**
Law Enforcement	33 (23.2%)	76 (53.5%)	33 (23.2%)	**142 (100%)**
Licensing Agency Employees	25 (27.5%)	64 (70.3%)	2 (2.2%)	**91 (100%)**
Other Medical Professionals	10 (20.4%)	32 (65.3%)	7 (14.3%)	**49 (100%)**
Concerned Citizens	8 (32.0%)	15 (60.0%)	2 (8.0%)	**25 (100%)**
Family Members	12 (50.0%)	12 (50.0%)	0 (0.0%)	**24 (100%)**

*Note***:** N=495. Excludes 5 self-referral cases.

Wisconsin

The Wisconsin sample was selected from the pool of drivers referred via a *Driver Behavior or Condition Report*. The behavior report queue included only people reporting concerns about another individual; these reports received heightened priority. This queue did not include applicants who responded in the affirmative to the medical question on the Wisconsin licensing and renewal form (i.e., self-referrals). Applicants who self-reported medical conditions were provided with a medical examination form for completion by their treating physician. The completed form went into the Department of Motor Vehicles (DMV) general processing queue and not the behavior report queue. It was not possible for the Wisconsin DMV to identify drivers who self-reported a medical condition for sampling in this study.

Table 12 presents the licensing outcomes for the 500-driver Wisconsin sample, sorted by referral source. Law enforcement officers contributed almost two-thirds of the referrals in the sample; these drivers' average age was 69, and 78% were 55 or older. Physicians accounted for slightly over one-fourth of the referrals; these drivers' average age was 73, and 85% were 55 or older.

Table 12. Medical Review Process Licensing Outcomes, by Referral Source in the Wisconsin Sample

Referral Source	Number of Drivers (Col. %)	Change in License Status as a Result of Medical Review							
		(1) New Restriction(s) Only (Row %)	(2) Periodic Review Only (Row %)	(3) New Restriction + Periodic Review (Row %)	(4) Loss of Licensure: Medically Unfit (Row %)	(5) Loss of Licensure: Test Failure (Row %)	(6) Loss of Licensure: Fail to Comply With Medical Review/ Re-exam Requirements (Row %)	(7) Voluntary License Cancellation [a] (Row %)	(8) No Change (Row %)
Law Enforcement	331 (66.2%)	11 (3.3%)	51 (15.4%)	11 (3.3%)	41 (12.4%)	27 (8.2%)	90 (27.2%)	46 (13.9%)	54 (16.3%)
Physicians	142 (28.4%)	--	15 (10.6%)	7 (4.9%)	85 (59.9%)	7 (4.9%)	13 (9.2%)	9 (6.3%)	6 (4.2%)
Family Member	14 (2.8%)	--	--	4 (28.6%)	1 (7.1%)	1 (7.1%)	4 (28.6%)	3 (21.4%)	1 (7.1%)
"Other" (Physical Therapists, Nurse, and Private Investigator)	6 (1.2%)	--	3 (50.0%)	--	1 (16.7%)	--	2 (33.3%)	--	--
Licensing Agency Employee	4 (0.8%)	--	1 (25.0%)	--	--	1 (25.0%)	1 (25.0%)	--	1 (25.0%)
Other Concerned Citizen	2 (0.4%)	--	1 (50.0%)	--	1 (50.0%)	--	--	--	--
Courts	1 (0.2%)	--	1 (100%)	--	--	--	--	--	--
Total	500	11 (2.2%)	72 (14.4%)	22 (4.4%)	129 (25.8%)	36 (7.2%)	110 (22.0%)	58 (11.6%)	62 (12.4%)

[a] In lieu of complying with testing requirements, or following one or two test failures, the driver completed paperwork to formally surrender his or her license.

There was no change in the license status for 12% of the drivers in the case study sample; they neither received new restrictions nor were required to submit periodic medical and/or vision reports. An additional 21% maintained licensure but had new restrictions and/or were required to submit periodic medical/vision reports. The types of new license restrictions included combinations of the following:

- daytime only (16 drivers);
- radius of home (12 drivers), including:
  - 5 miles (1 driver);
  - 8 miles (1 driver);
  - 10 miles (4 drivers);
  - 15 miles (1 driver);
  - 20 miles (3 drivers);
  - 30 miles (1 driver); and
  - 35 miles (1 driver);
- no freeway (11 drivers);
- corrective lenses (10 drivers);
- max speed 45 mph (7 drivers);
- specific geographic areas (3 drivers), including:
  - only on roads in the State of Wisconsin; and
  - only within town/city limits (2 cases);
- adaptive equipment (2 drivers), including:
  - hand operated accelerator and hand operated brake pedal (1 driver); and
  - complete hand controls, steering knob, automatic transmission, and a hand-operated dimmer switch (1 driver); and
- other restrictions (12 drivers), including combinations of the following:
  - max speed 55 mph (5 drivers);
  - automatic transmission (6 drivers);
  - right outside mirror (4 drivers);
  - right outside wide angle mirror (1 driver); and power steering (1 driver).

Nearly 67% of the drivers in the sample lost licensure as a result of medical review for one of the following reasons:

- 26% were deemed medically unfit;
- 22% failed to comply with medical review requirements;
- 12% voluntarily cancelled their licenses in lieu of submitting medical/vision reports or attempting licensing agency tests; and
- 7% failed agency tests.

Figure 7 compares medical review outcomes proportionately by key referral sources. Referrals by physicians were much more likely than referrals by law enforcement to result in a loss of licensure for a medical condition not under sufficient control for safe driving. A much larger proportion of drivers with no change in license status resulted from law enforcement referrals.

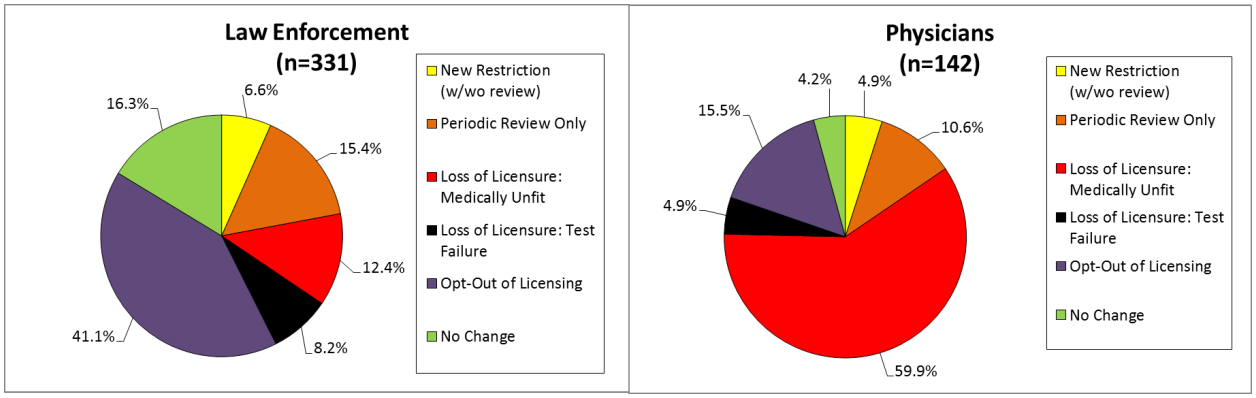

Figure 7. Licensing outcomes in the Wisconsin sample by major referral sources.

Table 13 presents the condensed licensing outcomes for cases referred by law enforcement and physicians. These two referral sources accounted for 95% of the cases with known referral sources (473 of 500). A chi-square test using the three outcome categories showed a significant difference for these two referral sources (X^2=58.9, d.f.=2, p<0.01). No statistical tests of significance were performed for cases referred by the remaining sources in Table 12 due to the small sample sizes. Overall the results indicate that referrals from physicians were more likely to result in license action than referrals from law enforcement. Referrals from law enforcement were more likely to result in opting out and in no change in license status than physician referrals.

Table 13. Condensed Medical Review Outcomes by Referral Source in the Wisconsin Sample

Referral Source	Result of Medical Review on License Status			Total
	License Action (Row %)	Opt-Out of Licensing (Row %)	No Change (Row %)	
Law Enforcement	141 (42.6%)	136 (41.1%)	54 (16.3%)	**331 (100%)**
Physicians	114 (80.3%)	22 (15.5%)	6 (4.2%)	**142 (100%)**

Note: N=473. Excludes 27 cases from other referral sources.

Comparison of Referral Sources by State

This section compares and contrasts driver medical review referral sources across the six case study States. Table 14 presents the proportion of case study referrals by referral source and State. Accompanying age statistics are included in Appendices H (by referral source) and I (by medical review outcome). The discussion that follows is organized by referral source for each State with a sufficient sample size.

Table 14. State-by-State Comparison of Case Study Referrals by Referral Source

State	Referral Source							
	Physician (Row %)	**Law Enforcement (Row %)**	**Self (Row %)**	**Family Member (Row %)**	**License Agency Employee (Row %)**	**Concerned Citizen (Row %)**	**Crash Report (Row %)**	**Other (Row %)**
Maine (n=467)	**7% (32)**	<1% (2)	**91% (427)**	<1% (1)	1% (4)	-- (0)	-- (0)	<1% (1)
Ohio (n=498)	**10% (49)**	**29% (146)**	**59% (294)**	<1% (2)	1% (3)	-- (0)	-- (0)	1% (4)
Oregon (n=500)	**74% (368)**	**15% (77)**	-- (0)	**5% (23)**	3% (17)	2% (8)	1% (5)	<1% (2)
Texas (n=497)	**19% (96)**	**28% (139)**	**9% (46)**	**7% (33)**	**4% (20)**	2% (11)	**29% (143)**	2% (9)
Washington (n=500)	**33% (164)**	**28% (142)**	1% (5)	**5% (24)**	**18% (91)**	**5% (25)**	-- (0)	**10% (49)**
Wisconsin (n=500)	**28% (142)**	**66% (331)**	-- (0)[1]	3% (14)	1% (4)	<1% (2)	-- (0)	1% (6)

Note: **Bold** cells denote States where the referral source had sufficient sample size for statistical significance testing. [1] The Wisconsin sample frame did not include self-referrals.

Referrals from physicians were a substantial source of referrals in all six States and ranged from 7% in Maine to 74% in Oregon. Maine, Oregon, Texas, and Wisconsin provided legal immunity to physicians who voluntarily reported an at-risk driver, while neither Ohio nor Washington did so. Having immunity did not appear to increase physician referrals in Maine. Conversely, the lack of immunity did not appear to deter physicians from referring drivers in Washington. Physicians referred a substantial proportion of the sample in Wisconsin, but it is unknown to what extent this outcome was simply a factor of the pool of drivers from which the sample was selected (Driver Behavior or Condition Reports). Physicians referred the majority of the sample in Oregon. However, Oregon had a mandatory physician-referral law, so the effect of physician immunity could not be considered in isolation. The low referral rate exhibited by physicians in the Ohio sample may have been influenced by the State's lack of immunity for reporting or other barriers not investigated in this study.

Only Maine and Oregon reported conducting training for physicians relevant to referring drivers for medical review in the year before these data were collected (2011-2012). In Maine the MAB conducted seven presentations to over 260 medical providers on the topic of referring drivers to the licensing agency. However, the physician referral proportion is relatively small compared to the proportions referred by physicians in Oregon, Wisconsin, and Washington. In Oregon, four presentations were made to physicians, physician assistants, and vision specialists regarding the mandatory reporting requirement.

Table 14 shows that Wisconsin had the largest proportion of law enforcement referrals of the six case study States (66%). This is likely due, in part, to the fact that the sample was drawn from all referrals in the behavioral report queue (high-priority cases), which did not include drivers who self-reported medical conditions on their license applications or renewal forms (general processing queue). Wisconsin has also devoted considerable resources towards educating its law enforcement community about the medical review process and has made it easy for officers to report a potentially at-risk driver by adding the Driver Condition and Behavior Report form to its TraCS (Traffic and Criminal Software) system. TraCS is a suite of programs for automated reporting by law enforcement agencies.[2]

Almost 30% of the case study drivers in Ohio, Washington, and Texas were referred by law enforcement, while the proportion of referrals by law enforcement in Maine was negligible. Some proportion of law-enforcement referrals in Maine may have been among the set of drivers who did not return physician's statements and were therefore not part of the pool of sampled drivers. An adverse report of driving submitted by a Maine law enforcement officer may have resulted in a license being immediately suspended pending the outcome of medical review. If a medical report was not received, the license would have remained suspended, and the case would not have been available for the sample.

The case study States varied widely in the proportion of medical review cases identified through self-reports, ranging from a high of over 91% for the Maine sample to 1% or less in Oregon and Washington. (As discussed previously, the Wisconsin sample frame did not include self-referrals.) Differences in the depth and breadth as well as administration of the medical questions on the licensing applications likely contributed to these differences. For example, Washington and Wisconsin asked renewal applicants questions that focused on "conditions causing losses of conscious or control" within the past 6 to 12 months (focusing on the most severe manifestation of a condition rather than on the diagnosis itself, which would minimize self-referral counts). In contrast, the other States provided a list of conditions and/or posed a general question about physical or mental conditions that could affect safe driving ability (focusing on diagnoses, and/or assuming drivers are cognizant of the link between medical conditions, functional impairment, and safe driving ability, which would maximize self-referral counts). In Oregon and Texas, driver license examiners interacted with drivers to obtain more information about medical conditions to further screen drivers who provided an affirmative answer regarding a medical condition, whereas in Maine, Ohio, Washington, and Wisconsin an affirmative answer always prompted a medical review/reexamination.

[2] See AAAFTS Licensing Policies and Practices database at http://lpp.seniordrivers.org/lpp/index.cfm?selection=ni&state=Wisconsin

Initial and renewal applicants in **Maine** were required to answer the following question when they completed their license application:

> Initial Application: *Do you have any of the following medical conditions?*
> Renewal Application: *Have you developed any of the following medical conditions or have any changes occurred in your present medical condition since your last renewal? If yes, please check which conditions below.*
>
> ☐ Epilepsy/Seizures
> ☐ Limb Amputation
> ☐ Blackouts/Loss of Consciousness
> ☐ Heart Trouble
> ☐ Diabetes
> ☐ Stroke/Shock
> ☐ Parkinson's Disease
> ☐ Mental/Emotional
> ☐ Paralysis
> ☐ Other Disability_____

If an applicant responded in the affirmative, he or she was given a Driver Medical Evaluation form (CR-24) to take to his or her treating physician for completion and return to the Medical Review Coordinator. The physician was required to provide a diagnosis for each medical condition and identify a Functional Ability Profile level, based on the *FAP – II* booklet.

In **Ohio**, first-time and renewal applicants were required to respond to the following three questions:

- *Do you have a condition that results in episodic impairment of consciousness or loss of muscular control?*
- *Do you have a physical or mental condition that prevents you from exercising reasonable and ordinary control of a motor vehicle? If Yes, _____ (nature and extent); _____ (name of treating physician).*
- *Are you chemically dependent on alcohol or a drug of abuse and currently using alcohol or a drug of abuse?*

Applicants who responded in the affirmative were given a medical form to take to their physicians for completion and return to the BMV.

In **Oregon**, initial and renewal license applicants were required to answer the following three questions:

1) Do you have a vision condition or impairment that has not been corrected by glasses, contacts or surgery that affects your ability to drive safely?
2) Do you have any physical or mental conditions or impairments that affect your ability to drive safely?

   If Yes: a) What is the condition or impairment?
   b) Describe how this affects your ability to drive safely:

3) Do you use alcohol, inhalants, or controlled substances to a degree that affects your ability to drive safely?

   If Yes: a) Describe how your use affects your ability to drive safely:

The applicant was only required to report ongoing medical conditions, impairments and use of alcohol, inhalants or controlled substances that made them unable to safely operate a motor vehicle. The applicant was not required to report a temporary medical issue such as a broken arm, a condition that occurred only once and no longer affected their driving, or a medical issue that increased their ability to drive safely such as a new pair of glasses. DMV reviewed all "Yes" answers with the applicant. The applicant was permitted to change a "Yes" answer to "No" at any point in the process; however, the license application included a perjury statement that any false statement would result in cancellation or suspension of the license, and if convicted, a fine and/or jail sentencing.

In **Texas**, first-time and renewal applicants were required to answer the following questions when they completed the license application form:

- *Do you currently have or have you ever been diagnosed with or treated for any medical condition that may affect your ability to safely operate a motor vehicle? Examples, including but not limited to: diagnosis or treatment for heart trouble, stroke, hemorrhage or clots, high blood pressure, emphysema (within past two years); progressive eye disorder or injury (i.e., glaucoma, macular degeneration, etc.); loss of normal use of hand, arm, foot, or leg; blackouts, seizures, loss of consciousness or body control (within the past two years); difficulty turning head from side to side; loss of muscular control; stiff joints or neck; inadequate hand/eye coordination; medical condition that affects your judgment; dizziness or balance problems; missing limbs.*
  - *Initial application: Please explain and identify medical condition: _____*
  - *Renewal application: If you answered Yes above, has your condition ( ) improved or ( ) deteriorated since your last application for an original/renewal of your driver license?*
- *Within the past two years, have you been diagnosed with, been hospitalized for, or are you now receiving treatment for a psychiatric disorder?*
- *Have you ever had an epileptic seizure, convulsion, loss of consciousness, or other seizure?*
- *Do you have diabetes requiring treatment by insulin?*
- *Do you have any alcohol or drug dependencies that may affect your ability to safely operate a motor vehicle or have you had any episodes of alcohol or drug abuse within the past two years?*
- *Within the past two years, have you been treated for any other serious medical conditions? Explain _____.*
- *Have you EVER been referred to the Texas Medical Advisory Board for Driver Licensing?*

For each question answered "Yes" or corrected to "Yes" by examining personnel, the applicant was questioned carefully to determine if he or she met criteria for referral to the Medical Advisory Board. The DPS Administrative Rules outlined criteria the License Examiner used to determine whether a referral was warranted. The Supplemental Medical History Form (DL-45) was used to gather medical information from the driver and determine whether a referral to the MAB was warranted. The driver completed page 1 of the form, and the Examiner completed page 2 (the

back side of the form, which listed the medical conditions and criteria for referral, and contained check boxes to guide the Examiner in the referral determination).

In **Washington**, the License Service Representative (LSR) read the following question from the license application screen of the Driver Field System to drivers renewing in person at a license service office: "*Do you have any mental or physical condition or are you taking any medications, which could impair your ability to operate a motor vehicle*?" If the driver answered, "Yes," the LSR issued a Physical Examination Report to the driver in an envelope addressed to the issuing License Service Office, and advised the driver that the form must be returned in 30 days to avoid license suspension. LSRs did not inquire further into a customer's medical condition, and no license or instruction permit was issued at that time. When drivers renewed online or by mail, the only medical question they were required to answer was: "*In the last six months, have you had a loss of consciousness or control which could impair your ability to operate a motor vehicle*?" Drivers were required to sign a statement of perjury that the information entered was true and correct.

In **Wisconsin**, first-time and renewal applicants were required to respond to the following question as they completed the licensing application form:

> *In the past year, have you had a loss of consciousness or muscle control, caused by any of the following conditions? If Yes, check condition(s) and give date _____.*
>
> *( ) Traumatic Brain or Head Injury; ( ) Diabetes; ( ) Heart; ( ) Lung;*
> *( ) Mental; ( ) Muscle or Nerve; ( ) Seizure Disorder; ( ) Stroke.*

Drivers who answered in the affirmative were required to have their physician complete a Medical Examination Report based on an exam not more than 90 days old, and return the report to the Department within 30 days.

Family members were a minor referral source in three of the case study States. Texas had about 7% of referrals from family members followed by Oregon and Washington with about 5% of referrals. License agency employees in Washington accounted for 18% of the referrals; the proportion for Texas was 5%. Concerned citizens in Washington accounted for 5% of the referrals. Crash reports were only a substantial referral source in Texas, accounting for 29% of the referrals. However, four of the six case study States did not have any referrals from crash reports. Only Washington had a non-trivial number of referrals not captured by a major category previously discussed. The other category in Washington included a physical therapist, nurse and private investigator.

Washington was the only State with a substantial number of referrals from license agency employees. Washington's License Service Representatives (LSRs) were trained to observe customers in the lobby and as they approached their counter for obvious physical impairments that could impair their ability to drive, such as limited mobility or strength, tremors, paralysis, use of a wheelchair or assistive device, or loss of a limb. LSRs also looked for signs of visual or mental impairments as they interviewed drivers during the application and renewal process, conducted the vision screening, and asked the medical question. The licensing agency had guidelines that all LSRs used to select drivers for reexamination and to determine what evaluation

or testing was required. The guidelines included the following sections: physical impairments, temporary physical impairments, mental impairments, and vision impairments. Within each area, several impairments were described and classified as either mild (requiring no additional screening), moderate (requiring an in-vehicle assessment for physical impairments, and reexamination testing plus issuance of physical or visual examination reports for mental and visual impairments), or severe (requiring a reexamination test and the issuance of physical or visual examination reports). Customers who showed signs of confusion, memory loss, or difficulty responding to routine questions were selected for reexamination and were issued a physical examination report. Customers who used a walker, crutches, or wheelchair, had other limited motor function or loss of limbs, severe tremors resulting in an inability to grip an object, and who had no restrictions or had not been tested since their original license, were selected for reexamination (on-road test). Customers who exhibited some difficulty gripping an object due to tremors or hand deformity, or had limited range of motion and/or strength in limbs, torso, head, or neck were required to undergo an in-vehicle assessment (which differed from the reexamination/on-road test).

Like Washington, Oregon and Wisconsin provided guidelines to help license examiners identify drivers who may be medically or functionally at risk, and should undergo medical review or reexamination prior to licensing. When an Oregon DMV employee witnessed questionable driving ability or a medical condition that caused the employee to question the customer's ability to safely operate a motor vehicle, the employee submitted a Driver Evaluation Request. The At-Risk Driver Training for DMV employees included examples of when it was appropriate to submit a Driver Evaluation Request, including:

- The employee just helped a customer and observes that same customer leaving the parking lot and having considerable trouble negotiating a vehicle out of the parking space onto the street.
- The customer doesn't give right-of-way to pedestrians in the parking lot or to the traffic on the street.
- While in the office, the customer appears visibly confused, unable to track normal conversation and/or is unable to follow simple directions needed to complete the issuance process.
- When approaching the counter, the customer stumbles or has a noticeably unsteady gait.
- When completing a form, the customer exhibits shakiness (beyond what may be attributed to normal nervousness), or cannot complete the form legibly.

Driver Evaluation Request forms were not required for Oregon customers who had undergone a physical change, such as an amputation or were confined to a wheelchair or who used a prosthetic device. In most of these cases, the DMV employee required the customer to complete a drive test, and added restrictions to the driver license as necessary.

Section 235 of the Wisconsin *Driver Licensing Manual* provided standards that licensing personnel employed when observing customers to determine whether they had the functional ability to drive safely. Customers who did not meet the standards and whose licenses were not properly restricted were required to undergo a special exam of their driving ability (knowledge,

highway signs, and skills tests), file a medical report, or both. When there was good reason to believe a functional impairment or medical condition could impair driving, licensing personnel in Wisconsin were instructed to take the customer aside, or if that was not possible, to talk quietly when discussing personal information such as the status of a medical condition to determine how the condition could affect driving ability. Questions that a license examiner may have asked to determine whether a medical evaluation was required are listed below:

- It appears you have a medical or physical condition, is it progressive or temporary?
- It appears you have a medical or physical condition, are you receiving treatment for it? If yes, explain to me what kind of treatment (i.e., medication, counseling)?
- I see you need assistance and/or use a wheelchair, walker, etc. Do you have a medical condition that is progressive (multiple sclerosis/MS, Parkinson's disease, etc.) or is it a permanent disability (i.e., amputations, arthritis, etc.)? Are you receiving any treatment for it?
- You indicated you had an episode of altered consciousness or loss of body control. What was the date of the last episode? Was it a single episode? What caused the episode? Was it due to a head or brain injury (playing football, fell and hit your head, motor vehicle accident) or due to a medical condition (stroke, epilepsy, etc.)? Did your physician indicate that no treatment is needed?

Maine and Texas did not report guidelines similar to those provided for Washington, Wisconsin, and Oregon for observing applicants for functional impairments. Ohio had no specialized training for observing applicants for conditions that could impair their ability to drive safely.

Comparison of Referral Outcomes by Source and State

Physician referral outcomes. Table 15 summarizes medical review outcomes for physician referrals in each State, condensed into the three categories described earlier in this report and reported in each State summary. In all States studied, 90% or more of physicians' referrals resulted in a change in license status. Comparing a licensing action to a driver opting out of licensing, more referrals resulted in a licensing action based on medical review guidelines or test performance in Maine, Oregon, Wisconsin, and to a lesser extent, Ohio. In Texas, substantially more drivers opted out of licensure. In Washington, these two outcomes were about equally likely.

Table 15. Condensed Outcomes for Physician Referrals by Case Study State

State	Physician Referrals: Result of Medical Review on License Status			
	Percentage of Referrals (N)	License Action: Periodic Review, Restriction, or Cancellation for Medically Unfit or Test Failure (Row %)	Opt Out of Licensing: Suspension for Failure to Comply With Medical Review Requirements or Voluntary License Cancellation (Row %)	No Change in License Status (Row %)
Maine	7% (32)	97% (29)	NA (2)	3% (1)
Ohio	10% (49)	55% (27)	41% (20)	4% (2)
Oregon	74% (368)	87% (320)	13% (48)	0% (0)
Texas	19% (96)	33% (31)	67% (63)	NA (2)
Washington	33% (164)	41% (67)	49% (80)	10% (17)
Wisconsin	28% (142)	80% (114)	16% (22)	4% (6)

Note: The outcome of "opting out" in Maine is not included in the denominator for calculating outcome proportions because it was too rare for statistical significance testing. The outcome of "no change" in Texas is not included because it described almost all license alarm cases.

Physicians accounted for relatively small proportions of the case study samples in Maine and Ohio. However, when physicians in these States did refer patients, the result was nearly always a change in license status (97% and 96% respectively).

Oregon had the highest proportion of physician-referred drivers among the case study States at 74%. This outcome was likely the result of Oregon's mandatory reporting law for healthcare providers. There was no mandatory physician-reporting law in any of the remaining five case study States. In fact, about three-fourths of the physician referrals in Oregon resulted in loss of licensure upon finding the person not medically fit to drive. This result is not surprising as the mandatory reporting law in Oregon required reporting of people whose cognitive/functional impairments were severe, uncontrollable and likely to affect driving ability.

Nineteen percent of the Texas case study sample consisted of physician-referred drivers. Of these, 26% lost licensure upon being found medically unfit to drive. However, the most common outcome was opting out, usually for failing to comply with medical review or re-exam requirements.

Physicians accounted for nearly one-third of the referrals in Washington. Thirty percent of these drivers were found to be medically unfit, and they lost licensure as a result. There was no change in license status for 10% of the physician-referred drivers in Washington, the highest proportion across the six States for physician-referred drivers with this outcome.

Physicians accounted for just over one-fourth of the case study referrals in Wisconsin. As stated earlier, the case study sample in Wisconsin was selected from the pool of drivers referred by a "Driver Condition or Behavior Report," which was a heightened priority queue. Nearly 60% of the physician-referred drivers in Wisconsin lost licensure as a result of being found medically unfit to drive, while only 4% had no licensure change following medical review.

Law enforcement referral outcomes. Table 16 shows medical review outcomes for law enforcement referrals in each State condensed into three categories. The vast majority of law enforcement referrals in each State resulted in a change in license status. There was no change to the license status for 23% of the drivers referred by law enforcement in both Ohio and Washington and 16% in Wisconsin. In Oregon, all law enforcement referrals resulted in a license status change. Nearly half of the drivers referred by law enforcement in Oregon were found medically unfit, so they lost licensure as a result of medical review. This was a much higher proportion than in any of the other States.

Only in Oregon did substantially more referrals result in a licensing action based on medical review guidelines or test performance compared to a driver opting out of licensure. In Washington, a markedly larger proportion of drivers opted out compared to a license action. In Ohio, Texas, and Wisconsin, the proportions with these two outcomes were relatively equal.

Table 16. Condensed Medical Review Outcomes for Law Enforcement Referrals by Case Study State

State	Law Enforcement Referrals: Result of Medical Review on License Status			
	Percentage of Referrals (N)	License Action: Periodic Review, Restriction, or Cancellation for Medically Unfit or Test Failure (Row %)	Opt Out of Licensing: Suspension for Failure to Comply With Medical Review Requirements or Voluntary License Cancellation (Row %)	No Change in License Status (Row %)
Ohio	29% (146)	37% (54)	40% (59)	23% (33)
Oregon	15% (77)	64% (49)	36% (28)	0% (0)
Texas	28% (139)	49% (45)	51% (47)	NA (47)
Washington	28% (142)	23% (33)	54% (76)	23% (33)
Wisconsin	66% (331)	43% (141)	41% (136)	16% (54)

Note: The outcome of "no change" in Texas is not included because it almost always described license alarm cases.

None of the case study States reported conducting training for law enforcement personnel relevant to referring drivers for medical review in the year before these data were collected (2011-2012). However, Oregon indicated plans to deliver state-wide training for law enforcement. Such training might improve officers' ability to document a driver's behavior or condition that triggered the referral for medical review or reexamination. In Texas, improved documentation

might reduce the number of field investigations (and therefore the number of drivers whose licenses were alarmed for non-renewal because they did not participate in the investigation).

Detailed descriptions of the officer's observations of physical and/or mental impairment, as well as documentation of information provided by the driver or passengers regarding medical conditions and medications, could prove valuable to licensing agency personnel in determining the path the medical review/reexamination should take. Since the officer has interacted with and observed the driver during the traffic stop or at a crash scene, a detailed referral from law enforcement should be considered a reliable referral and acted upon by the licensing agency (i.e., not require a field investigation).

Self-referral outcomes. Table 17 shows medical review outcomes for self-referrals in each State condensed into three categories where self-referrals were a substantial source. The majority of the self-referrals in Maine and Ohio resulted only in a periodic review requirement. Very few self-referrals in Maine and Ohio received restrictions, and even fewer lost licensure as medically unfit or because they failed the licensing agency tests. Approximately a quarter of the self-referrals in Maine and Ohio resulted in no change in license status. This result is likely due to the fact that it is the level of severity of a medical condition, and not just the presence of a medical condition, that affects physical or cognitive function, which in turn adversely affects driving performance. Maine and Ohio, with the largest proportions of self-referrals in the case study sample, also had the lowest average case study sample age (see Appendix H), and the drivers with no change in license status or who received only a periodic review requirement were among the youngest in these two States (see Appendix I). In contrast, nearly a third of self-referrals in Texas resulted in a loss of licensure upon being found medically unfit to drive. Texas's practice of further questioning drivers who responded affirmatively to medical questions based on the State's medical guidelines for licensing, as opposed to automatically requiring those responding positively to have their physician submit a medical report, likely contributed to this higher percentage of license revocations.

Although Maine and Ohio had the highest proportions of referrals resulting in licensing actions, as noted above, these mostly resulted in periodic review only. Texas, with a much smaller (and likely more selective) sample of self-referrals, had both a high percentage of cases resulting in license action related to medical fitness or testing results (almost all of these cancellations as medically unfit) as well as those opting out of licensure (mostly for failure to comply with re-exam requirements).

Table 17. Condensed Outcomes for Self-Referrals by Case Study State

State	Self-Referrals: Result of Medical Review on License Status			
	Percentage of Referrals (N)	License Action: Periodic Review, Restriction, or Cancellation for Medically Unfit or Test Failure (Row %)	Opt Out of Licensing: Suspension for Failure to Comply With Medical Review Requirements or Voluntary License Cancellation (Row %)	No Change in License Status (Row %)
Maine	91% (427)	78% (330)	NA (1)	23% (96)
Ohio	59% (294)	66% (193)	5% (16)	29% (85)
Texas	9% (46)	42% (18)	58% (25)	NA (3)

Note: The outcome of "opting out" in Maine is not included in the data analysis because it is too rare for statistical significance testing. The outcome of "no change" in Texas is not included because it almost always described license alarm cases.

Family member referral outcomes. Table 18 shows medical review outcomes for family member referrals in each State with a non-trivial number of family referrals condensed into three categories. Notwithstanding the small sample sizes for many of the States, it appears that family referrals were almost equally as likely to result in a license action based on medical fitness or test performance as they were to a driver opting out of licensure, and nearly always resulted in a change in license status. Within each State, referrals by family members had the highest average age of all the referral sources (see Appendix H).

Table 18. Condensed Outcomes for Family Member Referrals by Case Study State

State	Family Member Referrals: Result of Medical Review on License Status			
	Percentage of Referrals (N)	License Action: Periodic Review, Restriction, or Cancellation for Medically Unfit or Test Failure (Row %)	Opt Out of Licensing: Suspension for Failure to Comply With Medical Review Requirements or Voluntary License Cancellation (Row %)	No Change in License Status (Row %)
Oregon	5% (23)	52% (11)	48% (10)	NA (2)
Texas	7% (33)	59% (10)	41% (7)	NA (16)
Washington	5% (24)	50% (12)	50% (12)	0.0% (0)

Note: The outcome of "no change" in Oregon is not included in the data analysis because it is too rare for statistical significance testing. The outcome of "no change" in Texas is not included because it almost always described license alarm cases.

In Oregon and Washington, family members accounted for just fewer than 5% of the case study referrals. In Oregon, 6 of 23 of these referred drivers were found medically unfit and lost licensure, 3 maintained licensure, but with a periodic review requirement, and 2 lost licensure for failing licensing agency knowledge or road tests. Nine of the Oregon family-member referrals lost licensure for failing to comply with medical review requirements and an additional driver voluntarily cancelled his or her license. (Two of the Oregon family member referrals resulted in no change in license status, which were the only cases of no change in the entire Oregon sample.) In Washington, 5 of the 24 family member referrals resulted in loss of licensure as the drivers were found to be medically unfit, another 5 received a periodic review requirement, 1 a new restriction plus periodic review, and 1 lost licensure after failing the knowledge or road test. Eleven of the Washington family-member referrals lost licensure because they did not comply with medical review requirements and an additional driver voluntarily cancelled his or her license. All of the Washington family member referrals resulted in a change in license status.

Eight of the family member referrals in Texas resulted in loss of licensure for test failure. However, a substantial number of family member referrals resulted in "license alarms," which meant that the outcome was unknown since the State did not complete the medical review. Reports by family members were among those that the licensing agency considered unreliable because the referrals were anonymous or they did not contain enough information about the medical condition to warrant referral of the driver for review or testing. (Texas was the only State among the case study States that accepted anonymous referrals.) It is unknown whether any of the family member referrals were sent to the licensing agency without a signature.

Licensing agency employee referral outcomes. Washington had the largest proportion of referrals from licensing agency employees of all the case study States. As seen in Table 19, all but 2 of the 91 referrals by licensing agency employees in this State had a change in license status following medical review. The plurality of drivers referred by Washington licensing agency employees voluntarily cancelled their licenses (42%), and another 29% lost licensure because they failed to comply with medical review requirements. Almost one-fourth of the drivers referred by licensing agency employees in Washington lost licensure because they failed the licensing tests.

Texas had the next highest proportions of referrals from licensing agency employees at 4%. The most common outcome in Texas, similar to Washington, was opting out.

These findings suggest that licensing agency employees can appropriately flag drivers for review, although, with the exception of Washington they provided small proportions of the case study State referrals. Washington, Oregon and Wisconsin had guidelines to help license examiners identify drivers who may be medically or functionally at risk, and should undergo medical review or reexamination prior to licensing. Additionally, Washington provided ongoing training to License Service Representatives on observing applicants for medical and functional impairments, selecting applicants for reexamination, and conducting reexaminations. Similarly, in Oregon a Field Services Trainer (also an employee of the licensing agency) conducted ongoing training for licensing agency staff that included initial and refresher training in an At-Risk Driver Program. One of the modules in the 7.5-hour training in the At-Risk Program included observations of driver behavior that could prompt a field employee to file a driver evaluation request, such as a customer stumbles or approaches the counter with an unsteady gait, appears

visibly confused, or cannot complete a form legibly due to shakiness. Training also included how to process applications when a driver answered "Yes" to the medical eligibility questions, and when it was appropriate to add a restriction to a license. However, while Washington, Wisconsin, and Oregon had examiner guidelines, and ongoing training was provided in Washington and Oregon, it appears that these programs in Washington were more successful in producing referrals.

Table 19. Condensed Outcomes for Licensing Agency Employee Referrals by Case Study State

State	Licensing Agency Employee Referrals: Result of Medical Review on License Status			
	Percentage of Referrals (N)	License Action: Periodic Review, Restriction, or Cancellation for Medically Unfit or Test Failure (Row %)	Opt Out of Licensing: Suspension for Failure to Comply With Medical Review Requirements or Voluntary License Cancellation (Row %)	No Change in License Status (Row %)
Texas	4% (20)	37% (6)	63% (10)	NA (4)
Washington	18% (91)	28% (25)	70% (64)	2% (2)

Note: The outcome of "no change" in Texas is not included because it almost always described license alarm cases.

Concerned citizen referral outcomes. There were no referrals from concerned citizens among the case study samples in Maine and Ohio. Referrals from concerned citizens in the remaining four States, accounted for 5% or less of the sample. Only Washington produced enough cases for statistical analysis. As shown in Table 20, such referrals in Washington most frequently resulted in a driver opting out of licensure. No change in license status was an infrequent result.

Table 20. Condensed Outcomes for Concerned Citizen Referrals by Case Study State

State	Concerned Citizen Referrals: Result of Medical Review on License Status			
	Percentage of Referrals (N)	License Action: Periodic Review, Restriction, or Cancellation for Medically Unfit or Test Failure (Row %)	Opt Out of Licensing: Suspension for Failure to Comply With Medical Review Requirements or Voluntary License Cancellation (Row %)	No Change in License Status (Row %)
Washington	5% (25)	32% (8)	60% (15)	8% (2)

Crash report referral outcomes. Table 14 showed that only in Texas and Oregon were drivers identified for medical review based on information contained in crash reports, and it was only a substantial referral source in Texas. Texas drivers identified by crash reports had the

lowest average age of all referral sources in the State (see Appendix H). In Texas, law enforcement officers who investigated a crash that resulted in injury or death, or property damage of $1,000 or more were required to submit a crash report to the Texas Department of Transportation within 10 days of the crash. Sections of the report contained codes for factors the officer believed contributed and may have contributed to the crash. These included drivers' physical and mental conditions, such as fatigued or asleep, physical handicap, physical or mental illness, and taking prescription or over-the-counter medication. In crashes where the driver's physical or mental condition caused an officer to question the person's ability to drive safely (e.g., the officer suspected the driver of being asleep, ill, blacking out, etc.), the officer coded the condition in the *contributing* or *may have contributed factors* fields, and also described the factor in the narrative field of the report. The DPS Enforcement and Compliance Services unit reviewed crash reports with such coded conditions, and determined whether to refer drivers for MAB review (requiring a physician's statement), require comprehensive testing, or request a field investigation to gather more information about the medical condition prior to determining whether to open a medical review case and what path it should take.

Just over three-quarters of the cases referred in Texas via crash reports mentioned a loss of consciousness or control while driving, such as a seizure, blackout, diabetic reaction, stroke, or the driver falling asleep behind the wheel. Law enforcement officers at the crash site either observed an indication that a medical condition or functional impairment may have contributed to the crash, or were advised of a condition by the driver. As shown in Table 21, the Texas sample included 40 drivers with no change in licensing status other than having their licenses alarmed for non-renewal because they did not comply with a requested field interview. Excluding these drivers, 57% of the crash reported referrals resulted in a licensing action based on medical guidelines or test performance and 43% resulted in a driver opting out of licensure.

Table 21. Condensed Outcomes for Crash Report Referrals by Case Study State

State	Crash Report Referrals: Result of Medical Review on License Status			
	Percentage of Referrals (N)	License Action: Periodic Review, Restriction, or Cancellation for Medically Unfit or Test Failure (Row %)	Opt Out of Licensing: Suspension for Failure to Comply With Medical Review Requirements or Voluntary License Cancellation (Row %)	No Change in License Status (Row %)
Texas	29% (143)	57% (59)	43% (44)	NA (40)

Note: The outcome of "no change" in Texas is not included because it almost always described license alarm cases.

Other referral outcomes. There were few referrals by "other" sources, with the exception of Washington, where 49 drivers were referred by other healthcare or geriatric care providers. Referral sources included: geriatric regional assessment teams, accredited registered nurse practitioners or registered nurses, occupational therapists, certified physician assistants, social workers, adult protective services, geriatric case manager, geriatric mental health crisis evaluator, licensed mental health counselor, medical administrator, mental health crisis responder, physical therapist, psychiatrist, and a manager of a retirement/assisted living facility. As Table 22 shows,

the majority of drivers referred by others in Washington had their licenses suspended for failing to comply with the medical review process. All but 14% of these referrals resulted in a change in license status.

Table 22. Condensed Outcomes for Other Referrals by Case Study State

State	Other Referrals: Result of Medical Review on License Status			
	Percentage of Referrals (N)	License Action: Periodic Review, Restriction, or Cancellation for Medically Unfit or Test Failure (Row %)	Opt Out of Licensing: Suspension for Failure to Comply With Medical Review Requirements or Voluntary License Cancellation (Row %)	No Change in License Status (Row %)
Washington	10% (49)	20% (10)	65% (32)	14% (7)

Condensed Licensing Outcomes by State Across the Full Sample

Table 23 summarizes medical review outcomes across all referral sources, overall and by State. Oregon had the smallest proportion of referrals with no change in license status, and the largest proportion with a change in license status based on medical guidelines or test performance. Specifically, Oregon had the highest proportion of drivers suspended as medically unfit. These outcomes appear tied to Oregon's mandatory physician and healthcare provider reporting requirement for people with *severe and uncontrollable* cognitive and/or functional impairments that would likely affect safe driving ability. Physicians accounted for 74% of the case study sample in Oregon.

Following Oregon, Wisconsin and Washington had the next smallest proportions of referrals with no change in license status. In Wisconsin this may reflect the sample frame, which excluded drivers who self-reported medical conditions. The Wisconsin sample was largely referred by law enforcement and physicians. The plurality of cases in Wisconsin resulted in cancellation as medically unfit. In Washington, the majority of the referrals were from physicians, law enforcement, and licensing employees.

Case study samples from Oregon, Washington, and Wisconsin had the highest average ages of the case study States (see Appendix I). While the plurality of Washington referrals resulted in cancellation for failure to comply with medical review/reexamination requirements, Washington also had the largest percentage of drivers who voluntarily cancelled their licenses. Table 23 shows that while Washington and Wisconsin had equal proportions of referrals that resulted in no change in license status, the majority of the remaining cases in Washington opted out of driving. However, in Wisconsin the majority had licensing actions based on medical guidelines or test performance.

Table 23. Condensed Outcomes across All Known Referral Sources by Case Study State

State	Referrals Across All Known Sources: Result of Medical Review on License Status			
	N	License Action: Periodic Review, Restriction, or Cancellation for Medically Unfit or Test Failure (Row %)	Opt Out of Licensing: Suspension for Failure to Comply With Medical Review Requirements or Voluntary License Cancellation (Row %)	No Change in License Status (Row %)
Maine	467	79% (367)	1% (3)	20% (97)
Ohio	498	57% (283)	19% (95)	24% (120)
Oregon	500	81% (405)	19% (93)	<1% (2)
Texas	374	46% (171)	54% (202)	<1% (1)
Washington	500	31% (156)	57% (282)	12% (62)
Wisconsin	500	54% (270)	34% (168)	12% (62)

Note: The outcome of "no change" in Texas does not include the 123 drivers alarmed for non-renewal for which the outcome is unknown.

Maine and Ohio had relatively large proportions of cases with no change in license status. They also had the largest proportions of self-referrals among the case study sample and had the two youngest average ages among the case study States. Maine and Ohio also had the highest proportions of cases resulting in a periodic review requirement and the smallest proportions of drivers suspended as medically not fit. Thus it appears that the manner in which the medical questions were asked on the initial and renewal applications in Maine and Ohio resulted in capturing a large proportion of drivers who did not need to undergo medical review. It also brought drivers to the attention of the licensing agency whose conditions were not severe enough to warrant suspension or restriction at the time of the review, but whose conditions *could* put the drivers at risk at some point in the future, and monitoring/medical follow-up was deemed the appropriate requirement in these two agencies (e.g., for diabetes, COPD, heart conditions).

While Texas may appear to have the largest proportion of referrals that resulted in no change in license status (see Table 7), this was due to that State's practice of requesting drivers to participate in an investigation at a field office to answer questions about medical conditions and possibly take licensing tests, before the agency referred a driver for MAB review. There was no consequence to licensure if a driver did not comply with the investigation, other than they would not be able to renew their license. Texas had a 6-year renewal cycle for drivers up to 85, so a driver could be referred in the same year they renewed, and continue licensure for 5 more years. In other States, a driver referred with concerns about a medical condition was generally required to have their treating physician complete a medical examination form within a given interval. In these States, drivers whose medical forms were not returned by the deadline received license suspension. Therefore, the medical review outcome for these cases is really unknown. Excluding the 123 drivers with known referral sources whose licenses were alarmed for non-renewal (and who did not actually undergo medical review or reexamination), the medical review outcomes in Texas indicate no change in license status for less than 1%.

One other interesting point about Texas' medical review outcomes is the fact that 26% of referred drivers' licenses were revoked because the driver was deemed medically unfit. This proportion is higher (35%) if the license alarmed cases that did not undergo medical review/reexamination are excluded. Texas referrals were most frequently initiated by crash reports, law enforcement, and physicians. When the Texas licensing agency had a concern about a medical condition affecting driving safety, the case was referred to Texas' MAB. The MAB reviewed materials submitted by drivers' treating physicians, and either approved or denied licensure. Thus, Texas' medical review process resulted in MAB physicians reviewing a large number of its referrals (n=138). Medical determination officers (MDOs) played a similar role in Oregon's medical review process, reviewing 51 of its 500 cases. While Wisconsin had an MAB, its physicians were only involved in medical review cases when a driver appealed a licensing agency decision. Maine's MAB has assisted in review of individual cases, but it provided consultation in only two of the sample referrals.

Finally, restrictions were rarely applied in any of the case study States. Wisconsin had the highest proportion (33 of 500, or 6.6%). Ohio followed with 25 drivers receiving restrictions (5% of the sample). Wisconsin applied the largest variety of restrictions.

Appeals

There was no apparent pattern in the proportion of drivers who appealed the licensing agency's decision following medical review, based on a State's medical review structure or process. Only in Maine and Ohio were the proportions of drivers appealing related to the proportion of drivers suspended as medically unfit or because they failed licensing tests.

Texas had the largest proportion of case study drivers who contested the licensing agency's decision (18.2% of the total sample). Excluding the subset of drivers who did not undergo medical review, but had their licenses alarmed for non-renewal, 24% appealed the licensing agency decision. The licensing agency's decision was sustained in 39% of the appeals. Nearly 34% of drivers in the case study drivers were suspended as medically unfit or because they failed licensing tests. There were no immediate suspensions based on referrals; in Texas, drivers were required to submit medical information from their treating physician, take the licensing tests, or both before a licensing determination was made. Texas did not have medical professionals on the case review staff; however, the MAB reviewed all cases that required a physician's report and the licensing agency based its decision on the MAB physician's recommendation. The agency had detailed medical guidelines regarding vision, loss of consciousness/control, and for various medical conditions to guide licensing decisions.

In Washington and Wisconsin, similar proportions of the case study samples contested the licensing agency's decision (3% in Wisconsin and 4% in Washington). In Wisconsin, the licensing agency's decision was sustained in all 15 cases, as a result of the appeal, the driver's failure to submit requested medical information or failure to appear for the hearing. In Washington, the licensing agency's decision was sustained for 16 of the 19 appeals. Both States could immediately suspend a driver's license based on the information in a physician-submitted referral, without requesting additional information from the driver's treating physician. A subset of the drivers who requested a hearing in both States had their licenses immediately suspended based on a physician referral. Washington's medical guidelines for licensing were limited to vision and losses of consciousness or control, while Wisconsin's addressed vision, losses of

consciousness/control, and various medical conditions. Neither State had medical professionals on their case review staff. Wisconsin had an MAB and Washington did not. In Wisconsin, 33% of the case study drivers were suspended as medically unfit or because they failed licensing tests. This proportion was 23% in the Washington sample.

In Oregon, 2.2% of the sample drivers appealed the licensing agency's decision, and in 8 of the 11 cases, the licensing agency's decision was sustained, either as a result of the appeal or the driver's failure to appear for the hearing. Oregon could immediately suspend a driver's license based on the information in a physician/healthcare provider-submitted referral. A subset of the drivers who requested a hearing had their licenses immediately suspended based on a healthcare provider referral. Oregon did not have an MAB, but had physicians on the case-review staff, as well as detailed medical guidelines for licensing drivers with various medical conditions, based on a functional ability profile. The State had a mandatory reporting requirement for designated healthcare providers whose patients had a severe and uncontrollable cognitive or functional impairment. In Oregon, 72% of the case study sample was suspended as medically unfit or because they failed licensing tests.

None of the drivers in the Ohio sample, and only one in the Maine sample appealed the licensing agency's decision. The suspension in Maine was not sustained upon appeal. It is not surprising that appeals were virtually non-existent in these two States as there were relatively few suspensions due to test failure or failing to meet licensing agency's medical guidelines or the treating physician's opinion of medical fitness to drive (5% in Maine and 9% in Ohio). In both States, all drivers referred for medical review were required to submit a medical statement from their treating physician prior to a licensing decision. While Maine had detailed medical guidelines for licensing based on the information the treating physician provided on the functional ability profile, Ohio had no medical standards for licensing beyond those for vision. In Ohio, the licensing decision was based solely on the treating physician's opinion regarding whether the driver's medical condition was under sufficient control to allow him or her to drive safely and whether the driver passed the licensing tests (if the physician indicated testing should be conducted).

Feedback to Referral Source Regarding Medical Review Outcome

Oregon was the only case study State that provided feedback regarding the medical review outcome to the referral source. Feedback on the medical review outcome was limited to physicians and only when their patient received a suspension or when a suspension was lifted. The licensing agency mailed a general letter to all referral sources acknowledging the referral, however. More detail about the feedback provided to the physician referrals in Oregon is provided in Appendix D.

Conclusions and Recommendations

Phase I of this project (see Volume I) classified States into four groups based on the structural aspects of their medical review programs, focusing on two key variables (see Figure 14):

- whether the State had an MAB or other formal liaison with a State Health Department that functioned as such; and
- whether there were in-house medical professionals who performed case review.

	Medical Professionals On Licensing Agency Case Review Staff **(At Least 1 Staff Member Who Was a Nurse or Physician)**	**Administrative Staff Perform Case Reviews** **(No Medical Professionals)**
MAB	**Group:** **MAB and MP** Maine North Carolina[a]	**Group:** **MAB and Admin** Texas Wisconsin
No MAB	**Group:** **MP Only** Oregon	**Group:** **Admin Only** Ohio Washington

[a]North Carolina, would have joined Maine in the MAB plus medical professionals on staff category, but was unable to participate in the 500-Case Study portion of the project.

Figure 8. Classification of States participating in case study.

While one of the goals of the project was to describe strengths and limitations of each structure based on the licensing outcomes of the 500-driver referrals in each of the case study States, there were two barriers to achieving this goal. The first barrier was the small sample representing each structure and that sometimes processes for States within a structure were more similar to States from another structure than they were to each other (as described in Volume I).

The second barrier was the manner in which the cases were sampled (by necessity). The inability to sample from among the self-referrals in Wisconsin, and the inability to document the proportion of drivers who failed to return their physician's statements in Maine, were likely to affect the medical review outcomes for these States' case samples relative to the other States. For example, in Maine, only 3.8% of the sample was suspended as medically unfit, compared to nearly 26% of the sample in Wisconsin. A large proportion of Maine's sample was drivers who had responded on their license application or renewal form that they had a particular medical condition. Because such self-reports were keyed to a diagnosis and not a functional impairment, the severity of the self-reported medical conditions in Maine was likely to be less than that of drivers referred in Wisconsin by physicians and law enforcement via a *Driver Behavior or Condition Report*.

Differences in States' medical review processes unrelated to the classification variables also likely affected the case study outcomes, further confounding comparisons across the four medical review structures. For example, the distribution of licensing outcomes was different in States that suspended a license for failure to comply with medical review requirements versus States that did not. License outcomes also differed for States that had a deadline for completing medical review reporting and testing (and suspended the license in 30 to 60 days if the driver did not comply) versus those that did not. Such processes are unrelated to the presence of an MAB or medical professionals on the case review staff.

Therefore, these conclusions are based on observations about what appears to work in some States. Suggestions are presented in terms of what might be done to better target referrals for medical review and to improve the medical review process with the goal of increasing efficiency by reducing the proportion of referrals that result in no change in license status.

First, licensing agencies might consider **identifying referral sources and tracking their outcomes**. This information would be useful in identifying where educational efforts should be focused to increase referrals, and to increase the quality of the information in referrals. To facilitate these efforts, States could include a code in their medical review databases to characterize the source requesting medical review/reexamination. Categories could include those used in this study. A code for licensing outcome may be more difficult, because medical review cases are often in flux (opening and closing several times over the period of licensure), depending on improvement or deterioration in a driver's medical condition, guidelines such as seizure-free periods, time limits for completing medical review requirements, and number of test opportunities provided for drivers undergoing reexamination. But for the purposes of research and informed decision-making within a driver medical review program, the licensing outcome following medical review could be coded based on the date that all medical review activities must be completed for States that set limits for medical reporting and testing (i.e., in 60 days from the date the driver is notified of the requirements), or based on the final test opportunity provided, where no specified time limits are set (i.e., the license status based on the 3rd road test). A new licensing outcome code could then be added with each case re-opening, for example, following submission of an acceptable medical report after a seizure-free period.

In addition, the results of the current project suggest that placing a near-term licensing action (i.e., suspension in 30 to 60 days) when referred drivers fail to comply with medical review/reexamination requests may identify an at-risk driver in need of an intervention who would otherwise be permitted to continue driving. While every effort should be made to ensure that drivers are treated fairly and are not unnecessarily burdened by such a requirement, most States appear to have given priority to public safety by implementing such practices.

With regard to **physicians**, continuing efforts by licensing agencies to provide education regarding medical and functional fitness to drive, including assessing fitness to drive, and procedures for reporting potentially at-risk patients to the licensing agency, could improve individual and public safety. Increasing physicians' awareness and understanding of their State's driver medical review process may increase their willingness to refer their functionally and medically impaired patients to the licensing agency for medical review and reexamination.

Regarding **law enforcement** referrals, participation in NHTSA's 4-hour *Older Driver Law Enforcement Course*[3] may enhance law enforcement officers' ability to identify potentially risky older drivers on the road, and to articulate their concerns to facilitate the medical review process. This 4-hour course was designed specifically for law enforcement, and aims to:

- educate how the aging process affects older drivers;
- provide guidance on conducting traffic stops with older drivers and how to effectively communicate with this population;
- provide cues for identifying medically or functionally at-risk drivers;
- describe how to make referrals to licensing agencies; and
- describe appropriate enforcement actions for at-risk drivers.

In addition, making the reporting process easier for law enforcement may facilitate referrals. As reported in the Licensing Policies and Practices database (Stutts & Wilkins, 2009), providing the law enforcement reporting form within the TraCS system results in the following advantages: (1) the form is more visible and accessible to the law enforcement community; (2) reporting is easier, quicker, and more accurate; and (3) the completed reports reach the Medical Review Unit faster, since everything is handled electronically.

Next, unnecessary **self-referrals** may be reduced by focusing the licensing application and renewal medical questions on conditions which have caused loss of consciousness or control since the last renewal period (or within the past year, for new applicants), rather than merely the presence of a medical condition. Such a change should also reduce the number of drivers required to undergo periodic review, whose functional ability supports safe driving. This could reduce the burden in time and cost to the driver, the treating physician, and licensing agency case review staff. However, in States that have small driver populations and guidelines that support deciding most cases administratively without road testing (such as in Maine), detailed medical questions on the licensing application allow the licensing agency to monitor the medical condition over time. Alternatively, further screening drivers who respond affirmatively to questions about specific medical conditions on applications may reduce the proportion of drivers who undergo medical review/reexamination with no resulting change in license status. It appears that Texas examiners' use of a form that includes criteria for determining when a medical review is necessary may accomplish this goal.

Referrals by **family members** may be improved through educational efforts that describe the licensing agency medical review program and demonstrate how to write adequate descriptions of impaired physical or mental functioning or unsafe driving behavior when requesting a medical review/reexamination. Family-member reporting *may* be facilitated by providing a form and instructions for completion online. Further, in States that require a field investigation for non-expert or anonymous referrals prior to determining the path for medical review, it is important to provide a near-term consequence when drivers fail to comply with the investigation (e.g., loss of licensure if they do not respond in 30 to 60 days). This should encourage participation in field investigations, which would likely lead to a requirement for the driver to have his or her treating physician present a medical statement and/or knowledge and road testing, with licensing

[3] www.iadlest.org/Projects/NLEARN/LibraryInformationPortal/NHTSATrainingCurricula.aspx

outcomes of periodic review, restriction, or suspension as medically unfit. As Table 19 shows, the majority of family-referred drivers who underwent medical review in Texas received a licensing action based or medical guidelines or testing, and the balance opted out of licensure.

For **licensing agency employees**, implementing guidelines for observing drivers with functional impairments and training in how functional impairments affect safe driving performance may increase referrals, particularly those by employees who interact directly with licensees. In Cobb and Coughlin's 1997 survey of State driver licensing agencies to identify license renewal practices and the tools used to identify impaired older drivers, several respondents indicated that the single most important criteria for identifying an impaired driver was "how they looked coming through the door." In 2003, there were 20 of the 51 U.S. licensing agencies that reported their licensing personnel received training in how to observe for impairing conditions, and 5 jurisdictions (4 from a set of 20) responded that they provide specialized training for licensing personnel relating to older drivers (Lococo & Staplin, 2005).

A public information and education campaign may increase **citizen reporting** of potentially at-risk drivers, which was only a substantial source of referrals in Washington. The licensing agency websites of all case study States, with the exception of Ohio, contained information for the public about how to report unsafe drivers. WisDOT's website contained information about driving with medical conditions, the medical review process, and links to brochures for the public, law enforcement, and medical professionals for reporting drivers to the DMV in the "Be Safe, Not Sorry" series.[4]

Only in Texas were a substantial proportion of drivers identified for medical review through a review of **crash reports** (separate from a law enforcement referral). Implementing a process for collecting data on crash reports to identify drivers who may be medically or functionally at-risk may bring at-risk drivers into the medical review program who might otherwise go unnoticed. Drivers identified as potentially medically at risk via crash reports would undergo the same medical review process as other referred drivers. Automation of the process to forward crash reports to medical review would facilitate processing such cases for review.

Only in Ohio and Wisconsin were the **courts** a source or referrals among the case study samples. Educational efforts targeted at courts may increase the frequency of their referrals. Judges and attorneys have the opportunity to observe and question drivers in court for traffic violations and crashes. When they observe or otherwise uncover evidence suggesting that a medical condition or functional impairment may have affected driving safety, their awareness and understanding of the medical review program and procedures for requesting medical review/reexamination may increase the likelihood they will refer a potentially at-risk driver. None of the case study States reported providing driver referral education to the courts.

In Washington referrals from **other medical professionals** such as occupational and physical therapists and nurses, and from others who work closely with older adults in the community (e.g., adult protective services, social workers, geriatric assessment teams, managers of retirement communities) overall resulted in some change in license status among the case study drivers sampled. Educational efforts aimed at this group, focusing on raising awareness of the

[4] www.dot.wisconsin.gov/drivers/drivers/medical/index.htm

referral and medical review process, including detailed documentation of their reasons for concern, may increase the likelihood they will refer their at-risk patients or clients.

References

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Cobb, R. W., & Coughlin, J. F. (1997). Regulating older drivers: How are the states coping? *Journal of Aging and Social Policy, 9*(4), 71-87.

Appendix A: Variable List for the 500-Driver Case Study (Tailored for Texas)

[ID] **De-identified Driver Number**	Auto number will assign a number from 1 to 500 to the driver, based on order of entry into the database
[State] **State** **(Pre-filled with TX)**	Case Study State (2-Letter Abbreviation)
[DriverLicenseNumber] **Driver License Number**	Alphanumeric Driver License Number (this field will be stripped off of the electronic file transmitted to the PI, but maintained in the database on DPS premises, until data collection is complete)
[BirthDate] **Birth Date** **(Prefill with X)**	mm/dd/yyyy We are NOT collecting DOB in TX
[Age] **Age**	Age at date of referral (subtract birth year from 2012).
[Sex] **Sex**	M=Male; F=Female; U=Unknown
[ReferralSource] **Referral Source**	1=Law Enforcement Request for Reexamination 2=Crash Report (e.g., if Medical Review Unit reviews all crash reports, or where law enforcement has checked a box on the form indicating a possible medical cond.) 3=Physician 4=Driver self-report (license application/renewal form) 5=DPS representative (following observation of potential impairment) 6=Family member 7=Other concerned citizen 8=Dept. Blind and Visually Impaired 9=Court 10=Other (e.g., not 1-9 above) 11=Unknown
[ReferralSourceOther] **"Other" Referral Source**	If Referral Source=10, fill in the source (e.g., Hospital)
[ReferralDate] **Referral Date**	Date that the driver was referred to DPS for reexamination/medical review (e.g., date on the letter of concern or referral form) mm/dd/yyyy
[CaseOpenedDate] **Case Opened Date**	Date that the DPS opened the case (e.g., the date the letter was sent to the driver advising of the first requirement in the medical review process). mm/dd/yyyy

[ReferralReason] **Referral Reason Description**	Narrative provided in the letter of concern or referral form describing driver's behavior that led to referral (the level of specificity may differ by referral source, but enter enough information to summarize why the referring person thinks the driver needs to be reexamined/medically reviewed, e.g., driver crashed or was cited for driving the wrong way on a freeway, driver frequently gets lost in familiar areas, driver is showing progressive signs of confusion and has had multiple fender benders, driver self-reported a medical condition or medication on license renewal form, driver was disoriented and could not answer simple questions or produce requested documentation at license renewal, counter license personnel noted driver had difficulty walking even with a cane, driver does not comply with medication regime and therefore has an uncontrolled medical condition that is dangerous for continued driving).
[PhysicianReportRequired] **Physician Report Required**	Is the DPS requiring a physician to complete a medical report? Y=Yes; N=No
[DriverCompliancePhysicianRept] **Driver Compliance With DPS Ordered Medical Report**	Did the driver comply with DPS requirement for a physician report? Y=Yes; N=No; X= not applicable (none ordered)
[VisionStatementRequired] **Vision Statement Required**	Is the DPS requiring a vision statement from an eye care/vision specialist? Y=Yes; N=No
[DriverComplianceVisionRept] **Driver Compliance With DPS Ordered Vision Specialist Report**	Did the driver comply with DPS requirement for a vision specialist report? Y=Yes; N=No; X=not applicable (none ordered)
[MedicallyFit] **Is Driver Medically Fit to Drive**	Is the driver deemed medically fit to drive (*based only on physician, vision specialist recommendations, and DPS medical guidelines*)? In other words, is the driver eligible to be licensed and/or to take the knowledge and road tests if required as part of medical review/reexam? DO NOT include DPS test results here. Y=Yes N=No X= not applicable (driver was not required to submit physician or vision report OR did not comply with report requirements)

[ReasonNotFit] **Reason Driver is Not Medically Fit**	If the driver was deemed not medically fit to drive, select the primary condition (or most serious) to describe why: 1=Vision 2=Seizures/Epilepsy 3=Cerebral Vascular Accident (Stroke) 4=Traumatic Brain Injury (Head Hit) 5=Alzheimer's or Other Dementia 6=Pulmonary/Respiratory Disorder (e.g., Asthma, COPD) 7= Sleep Disorder (Narcolepsy, Sleep Apnea) 8=Cardiovascular Disorder (Heart Diseases) 9=Diabetes or Other Metabolic Disorder 10=Parkinson's Disease 11=Psychiatric or Emotional Conditions (e.g., ADD/ADHD, depression, bipolar, anxiety, psychotic) 12=Multiple Sclerosis 13=Musculoskeletal Conditions (e.g., Arthritis, limitations in strength or range of motion) 14=Cancer and related treatment 15=Substance Abuse 16=Vertigo 17=Other Medical/Functional Condition
[ReasonNotFitOther] **"Other" Reason Driver is Not Medically Fit**	If 17 "Other" was selected, fill in the medial condition/functional impairment resulting in the driver being considered not medically fit
[DMVVisionTestReq] **DPS Vision Test Required**	Is the DPS requiring driver to take the DPS vision test as part of the medical review/reexam process?* Y=Yes N=No *If all renewing drivers and new applicants must take a vision test as part of the licensing/re-licensing process and the case study driver is a new applicant or referral who must take the vision test as part of the licensing/re-licensing process, the answer to this question should be "no." We want to know what was required as a part of medical review, apart from what the driver would have had to do if they weren't undergoing medical review/reexamination.
[VisionTestOutcome] **Vision Test Outcome**	DPS Vision Test Outcome: P=Pass F=Fail X=not applicable (driver was not required to test OR did not comply with test requirement)
[DMVKnowledgeTestReq] **DPS Knowledge Test Required**	Is the DPS requiring driver to take the DPS knowledge test as part of the medical review/reexam process? * Y=Yes N=No *If this is a new applicant who must take the knowledge test only because it is a part of the licensing requirement for new drivers, the answer to this question should be "no." We want to know what was required as a part of medical review/reexamination, apart from what the driver would have had to do if they weren't undergoing medical review/reexamination. This should only be "Yes" if it was a medical review requirement resulting from their referral due to a medical condition or functional impairment.
[KnowledgeTestOutcome] **Knowledge Test Outcome**	DPS Knowledge test outcome (Final testing opportunity if more than once): P=Pass F=Fail X= not applicable (driver was not required to test OR did not comply with test requirement)

[DMVRoadTestReq] **DPS Road Test Required**	Is the DPS requiring driver to take the DPS Road test as part of the medical review/reexam process?* Y=Yes N=No *If this is a new applicant who must take the road test only because it is a part of the licensing requirement for new drivers, the answer to this question should be "No." We want to know what was required as a part of medical review, apart from what the driver would have had to do if they weren't undergoing medical review/reexamination. This should only be "Yes" if it was a medical review requirement resulting from their referral due to a medical condition or functional impairment.
[DMVRoadTestOutcome] **DPS Road Test Outcome**	DPS road test outcome (Final testing opportunity if more than once): P=Pass F=Fail X=not applicable (driver was not required to test OR did not comply with test requirement)
[RehabSpecialistEvalReq] **Driver Rehabilitation Specialist Evaluation Required before a Licensing Determination will be Made**	In States where a CDRS determination may be required before a driver can take DPS tests: Is the DPS requiring driver to have outside evaluation of driving ability (road or simulator tests administered by OT, CDRS, or driver rehab specialist) before they will make a licensing decision? Y=Yes N=No X = not applicable (State does not require outside evaluations before licensing decision can be made)
[RehabSpecialistEvalOutcome] **Rehabilitation Specialist Evaluation Outcome**	Driver evaluation specialist outcome: P=Pass F=Fail X = not applicable (driver was not required to test OR did not comply with test requirement)
[CaseDispositionDate] **Case Disposition Date**	Date the licensing decision is made by DPS. Signifies the end of the referral process. mm/dd/yyyy Notes: • If a road test was required, this is the date they passed it and were licensed, or the date they failed their final test opportunity and were therefore suspended. (It is not the suspension effective date, if there is a time lag between the test failure and the official suspension). • If they fail to comply with the medical report or testing and are therefore suspended, this is the date they must have complied by. (It is not the suspension effective date if there is a lag between the due date and the suspension date. It is not the date the letter is mailed to them telling them they must comply with a report and/or testing requirements by a certain date or be suspended). • If only a medical or vision statement was required, this is the date that the statement was reviewed and the decision was made to allow continued licensure or to suspend because they were not medically or visually fit (according to DPS standards or their treating physician's assessment of their ability to drive safely). • For new applicants who get a temporary permit (i.e., following approval of their medical statement), enter the temporary permit date, and not the road test date. We don't want to confound permit holding time (6 months to1 year) with medical review/testing time, for new applicants. Notate the last field "Notes" to describe what can't be captured with coding here. If something is quirky, type the details in the notes section)

[LicensingOutcome] **Licensing Outcome**	1=Full licensure; 2=Restricted licensure; 3=Suspension/revocation/cancellation due to unacceptable medical info rec'd (either treating physician states driver should not drive, or state guidelines prohibit driving based on severity of condition) 4=Suspension/revocation/cancellation for non-compliance with medical review requests (e.g., failure to submit a physician report or to take required DPS tests or go to rehab specialist for evaluation if ordered) 5=Suspension/revocation/cancellation for failing DPS-ordered test(s) or based on recommendation for no driving from driver rehabilitation specialist 6=Other 7=Voluntary Surrender
[LicensingOutcomeOther] **Licensing Outcome Other**	If "Licensing Outcome" = 6, enter description
[NewRestrictions] **New Restrictions Placed on License as a Result of This Referral**	Were any **new** restrictions placed on the driver's license as a result of this referral? (e.g., daylight only, roadway type, speed, radius of home, adaptive equipment). Y=Yes N=No X=not applicable (Driver suspended as a result of this medical review)
[NewRestrictionsType] **New Restrictions Placed on License as a Result of This Referral**	If a **new** restriction resulted from this referral, type in the kind(s) of all new restriction(s) imposed on driver: *(e.g., must drive within a 10-mile radius of home, and only during daytime)* _____ Also, check the boxes for each new restriction imposed on the driver as a result of this referral ☐ Daytime only ☐ Radius of Home ☐ Specific Destinations ☐ Specific Routes ☐ Specific Geographic Area (only in the city, town, county) ☐ Maximum Speed 45 mph ☐ No Freeways ☐ Corrective Lenses* ☐ Adaptive Equipment ☐ Prosthetic Aid ☐ Other *If corrective lenses are required as a result of a vision screen for initial application or license renewal and NOT for medical review, do not check. Only check if corrective lenses resulted from vision test required for medical review.
[PeriodicReviewReq] **Periodic Review Required as a Result of this Referral**	Is the driver required to have his/her physician submit periodic medical or vision reports, or required to periodically road test as a result of this referral? Y=Yes N=No X= not applicable (Driver suspended as a result of this medical review)

Feedback Given to Reporting Source	Was feedback given to the person who referred the driver? Y=Yes N=No U=Unknown/can't determine X = not applicable (Licensing Agency does not provide feedback to reporting source)
[FeedbackDescription] Feedback Description	Type in the nature of the feedback to the reporting source (i.e., letter, phone call identifying the driver by name and the license outcome, including a description of any restrictions; anonymous count of referred drivers and outcomes given to law enforcement agency, or list of driver names and outcomes provided to law enforcement agency)
[MABInvolvedInitialDecision] MAB Review for Initial Licensing Decision	Was the case referred to the MAB for the initial fitness to drive determination? (do not include MAB involvement for appeal, if there was an appeal) Y=Yes N=No X= not applicable (No MAB in State, or MAB does not review individual cases)
[DriverApeal] Driver Appeal	Did the driver appeal the licensing decision? Y=Yes N=No
[MABInvolvedAppeal] MAB Review for Appeal	Was the case referred to the MAB as part of the appeals process? Y=Yes N=No X =not applicable (No MAB in State, or MAB does not review cases; or driver did not appeal case)
[CaseCost] Estimated cost to DPS for medical review activities	If possible, estimate the cost to the DPS for this case review (DPS employee time x salary combined for all employees involved: case reviewers, hearing officers, license examiners, MAB physician costs to DPS if referred)
[Notes] Notes	Notes to qualify any fields where the selections did not accurately fit the case, or where narrative detail will help in understanding the case when analyses are performed. (i.e., if multiple testing opportunities explain a long case disposition time, give dates of tests and failures). If you receive death notices and are dates are entered into your system, please notate if the driver died following case disposition and when.

Appendix B: Detailed Summary of 500-Driver Case Study in Maine

Case Study Sample Selection

The Maine Bureau of Motor Vehicles (BMV) supplied a de-identified data file to the principal investigator containing a list of 8,604 passenger vehicle drivers initially referred for medical review in 2012. Drivers on periodic review, those referred because of alcohol abuse, and CDL/motorcycle-licensed only drivers had already been excluded from the count. It contained drivers referred from all sources, both within and outside of the BMV, where either an Adverse Driving report or a Driver Medical Evaluation Form was submitted to the BMV. However, the list only included drivers who had complied with the requirement to have their physicians complete a medical report, because the Maine BMV had no process for tracking drivers referred for medical review who were awaiting a physician's report (Driver Medical Evaluation Form, referred to as a CR-24). Therefore, in Maine, researchers were not able to report the percentage of referred drivers who did not comply with the requirement to submit medical reports.

The file contained date of request for medical review, driver age at the time of the request, and driver sex. The BMV did not track referral source, removing any possibility of developing a stratified sampling plan based on referral source. The PI reviewed referral counts to determine whether there were variations by month, age, or sex. The number of referrals by month ranged from 557 to 837, and averaged 717 (*SD*=83). The monthly proportion of referrals ranged from a low of 6.5% in December, to a high of 9.7% in July; all other months accounted for approximately 7 to 9% of the total referrals. Across the year, referrals were evenly split by sex, with monthly variations no larger than 7%.

Proportions of medical referrals by month, age group, and sex were stable, so there was no need to adjust the sampling strategy to account for fluctuations in referral counts. The BMV Information Technology Services Department sorted the list by date of referral; there were no criteria applied to the order in which the drivers were listed within referral date. The ITS Department numbered drivers from 1 to 8,604, and then selected the systematic random sample of 500 drivers by selecting every 17th driver on the list (driver 17, 34, 51, 68, etc.), until 500 cases were obtained. Because the list of drivers already excluded drivers on periodic review, CDL/motorcycle-endorsement only drivers, and drivers referred because of alcohol abuse, the only manual exclusions were for cases involving adverse driving by a dually-licensed driver while operating a commercial motor vehicle or motorcycle, drivers who were referred for medical review and died before they could submit their medical reports, drivers whose licenses were cancelled because they moved out of State and did not complete medical review requirements, and drivers whose licenses were already suspended at the time of their referral for medical review. If one of the "every 17th" drivers selected for case study met these exclusion criteria, then the *previous* driver on the list was selected (the 16th driver in the current set of 17 drivers). The Maine BMV Medical Review Department did not receive referrals from the courts for people adjudicated as mentally incompetent (an exclusion criterion for this study in States where this occurred).

Data Entry

A recently retired Maine BMV Medical Review Department employee served as a consultant to research case information and enter data into the case study database. The BMV ITS Department provided the consultant with the list of 500 drivers selected as indicated above.

The consultant gathered data from BMV driver records, medical files, and files filmed in central records and driver's license services. Since Maine did not identify or track referral sources, several data fields required educated guesses. For example, referral source was generally assumed to be a physician when there was no evidence that the driver self-reported a medical condition upon license application or renewal, or when there was no adverse driving report or other letter of concern submitted. However, cases where the source was truly unknown were coded as "unknown." Referral date was not always available. In these cases the date the CR-24 was received in the Department was entered as both the referral and the case opened date. Referral date and case opened date were also the same for drivers who self-reported a medical condition and were given a CR-24 by a branch employee on the date they applied for their initial or renewal license. Referral reason was generally entered as the medical condition the driver self-reported on the license application, or the diagnosis the physician provided on the CR-24. If the referral was initiated by an adverse report of driving (law enforcement) or a report from a concerned citizen, then the information provided in the report narrative was summarized and entered into the database as the reason for referral; the diagnosis from the CR-24 was also entered. As a consequence of all cases having a completed physician's report in the driver's file with a diagnosis, researchers were able to characterize the kinds of medical conditions affecting all 500 drivers in the case study sample.

Case disposition date was often difficult to determine for drivers who failed a required road test as a part of the medical review process. A driver was permitted three attempts to pass the knowledge and road tests, with no deadline by which a driver must complete all three knowledge and road test attempts. Because it took approximately 4 to 6 weeks to schedule an exam, 6 to 12 months (or more) may have elapsed before a driver exhausted all testing opportunities. The PI, consultant, medical review coordinator, and supervisor of the clerical medical review staff teleconferenced to determine a reasonable and representative timeframe the data collector should look in the medical review files to determine when a case was complete and the licensing outcome at that point. Since data were collected in 2014 for drivers referred in 2012, there were potentially 2 years of medical review notes to consider. The PI wanted to avoid imposing artificial time limits on describing Maine's medical review process and coding licensing outcomes inaccurately. The timeframe selected could mean the difference between a driver being coded as failing the BMV road test and having their license suspended, versus a driver passing a test on a later attempt and being licensed (fully or with restrictions, and with or without periodic review). The final road test result was the outcome of interest for the study. Because the process could result in 7 or more BMV visits, each potentially spaced up to 6 weeks apart, the study team agreed that end-point for documenting the medical review process and outcome for such cases in Maine should be the point where a driver would be required to have his or her physician complete another medical form based on the functional ability profile (FAP) guidelines for their particular medical condition. Because there was no formal time limit imposed on when a driver must attempt and pass BMV tests, the total time for a medical review case to reach a licensing disposition in Maine was likely longer than for drivers in the other case study

States that had requirements for completing reexamination testing (e.g., within 30 to 60 days of initial notification).

Case disposition time may have also been affected by delays in physician submissions of CR-24 forms to the Medical Review Unit. Drivers referred by family members or other concerned citizens were generally given 30 days to return a completed CR-24 before a suspension notice was sent. Drivers reported via an Adverse Driving report by law enforcement were mailed a CR-24 form for completion by their physician and a notice of suspension, which was effective within 10 days; the suspension may have been reversed based on receipt of an acceptable CR-24. Occasionally, a driver received an immediate (hand-delivered) suspension as a result of a law enforcement referral or in extreme situations for an adverse medical condition. There was no time limit for returning the CR-24 physician form when applicants self-reported a medical condition when applying for or renewing licenses. However, new applicants were not licensed and renewals were not re-licensed until the Medical Review Unit received the form. This resulted in license expiration for renewal drivers who failed to return the form (as opposed to a suspension for failing to comply with medical review requirements). Renewing drivers whose licenses expired before submission of their completed CR-24 form may have exhibited longer medical review case disposition times than other drivers in the sample, as well as drivers who underwent medical review in other States. In hindsight, the consultant could have coded the case disposition date as the date the license expired (and not collected any medical review activity that occurred following license expiration), for consistency with coding in States where the license was suspended for failure to submit a physician's statement. Alternatively, to avoid losing outcome data for that subset of cases, we could have replaced such cases with cases in which the license did not expire during medical review. But since cases in Maine were selected from the pool of drivers who returned a completed physician's form, inclusion of these drivers in the case study and documenting their medical review and testing outcomes prevented any unintentional skewing of the driver characteristics, medical review process, and licensing outcomes that may have occurred by excluding them.

The consultant provided notes for cases that required vision, written, and/or road testing as a part of the licensing process (and not part of the medical review process). For example, all new applicants were required to pass a vision test before obtaining a permit, and renewal applicants were required to pass a vision test after attaining age 40 and at every second renewal after that. A vision test was also required at every license renewal after 62, and when drivers converted an out-of-State license to a Maine license. For any cases where a vision test was conducted at renewal or upon initial application or conversion from out-of-State, the vision test was not considered in the analysis of medical review requirements (i.e., these drivers were excluded from the numerator in analyses of medical review cases requiring the BMV vision test or a requirement to obtain a statement from a vision specialist for failing the BMV vision test). The consultant also noted when a corrective lens restriction was imposed as a result of the licensing vision test, and this restriction was not included in the analysis of medical review-applied restrictions. For example, a new applicant whose vision was tested and was issued a corrective lens restriction as a result of that test, and who also self-reported having deep-vein thrombosis, was coded as having no new restrictions applied as a result of medical review for deep vein thrombosis.

New applicants were also required to pass a knowledge test before they could obtain their permit, and a road test before they could be licensed; however, these tests may not have been required as a result of their particular medical condition. The consultant noted when testing was required as a condition of licensing and not as a medical review requirement, and these cases were excluded in analyses of tests required for medical review. In addition, for such applicants, the disposition date was entered as the date the Medical Review Department completed review of the physician's medical statement (CR-24), in place of the date these drivers passed their road test and received their actual license. The disposition date for all other drivers required to road test as a result of medical review was the date they passed or failed their final opportunity for testing, or the point at which they chose not to complete additional tests after failing the first or second attempt and had their licenses suspended or voluntarily gave up licensure.

Sample Demographics

Table B1 presents the age and sex distribution of the 500 drivers selected for the case study. Overall, females represented 56% of the sample, and larger percentages of females were present in most age groups. The average age of drivers in the case study sample was 61 (range 16 to 92 years, *SD*=16.9); the median was 63.

Table B2 presents the demographics of the entire pool of drivers referred to the Maine BMV for medical review in 2012 (*n*=8,604). Males and females were equally represented among all referrals. This indicates that the case study sample was just slightly skewed toward females. The average age of the 8,604 referrals in 2012 was 59 years (range 15 to 98 years, *SD*=18.6); the median was 63.

Figure B1 compares the proportion of medical referrals by age group for the entire referral population (green bars) and the case study sample (red bars) to their respective proportions within the licensed driver population in 2012 (blue bars). This figure shows that drivers in all age groups younger than 55 were *underrepresented* in the medical referral population (as well as in the case study sample), and that drivers in all age groups 55 and older were *overrepresented* among the medical referral population (and the case study sample) compared to their proportion in the population of licensed drivers. Drivers 65 and older accounted for 45% of the medical referrals in 2012 (and 45% of the case study sample), but only 19.6% of the licensed population of drivers in the same year. Figure B1 also shows that the case study driver age distribution was representative of the age distribution of the population of drivers referred in 2012.

Table B1. Maine Case Study Sample Demographics (n=500)

Age Group	Case Study Total	Age Group Percentage of Sample	Number of Males	Number of Females	Percent Male	Percent Female
15-24	21	4%	8	13	38%	62%
25-34	20	4%	10	10	50%	50%
35-44	39	8%	20	19	51%	49%
45-54	66	13%	29	37	44%	56%
55-64	126	25%	57	69	45%	55%
65-74	115	23%	49	66	43%	57%
75-84	87	17%	35	52	40%	60%
85-94	26	5%	13	13	50%	50%
95+	0	0%	0	0	0%	0%
Total	500	100%	221	279	44%	56%

Table B2. Demographics of All Referrals to Maine BMV for Reexamination in 2012 (n=8,604)

Age Group	Total Referrals in 2012	Age Group Percentage of Sample	Total Referrals 2012 With Sex Known	Number of Males	Number of Females	Percent Male	Percent Female
15-24	834	10%	827	395	432	48%	52%
25-34	267	3%	267	122	145	46%	54%
35-44	466	5%	465	236	229	51%	49%
45-54	1140	13%	1140	552	588	48%	52%
55-64	2050	24%	2050	1059	991	52%	48%
65-74	2243	26%	2243	1151	1092	51%	49%
75-84	1173	14%	1173	581	592	50%	50%
85-94	420	5%	420	212	208	50%	50%
95-98	11	0%	11	6	5	55%	45%
Total	8604	100%	8596	4314	4282	50.2%	49.8%

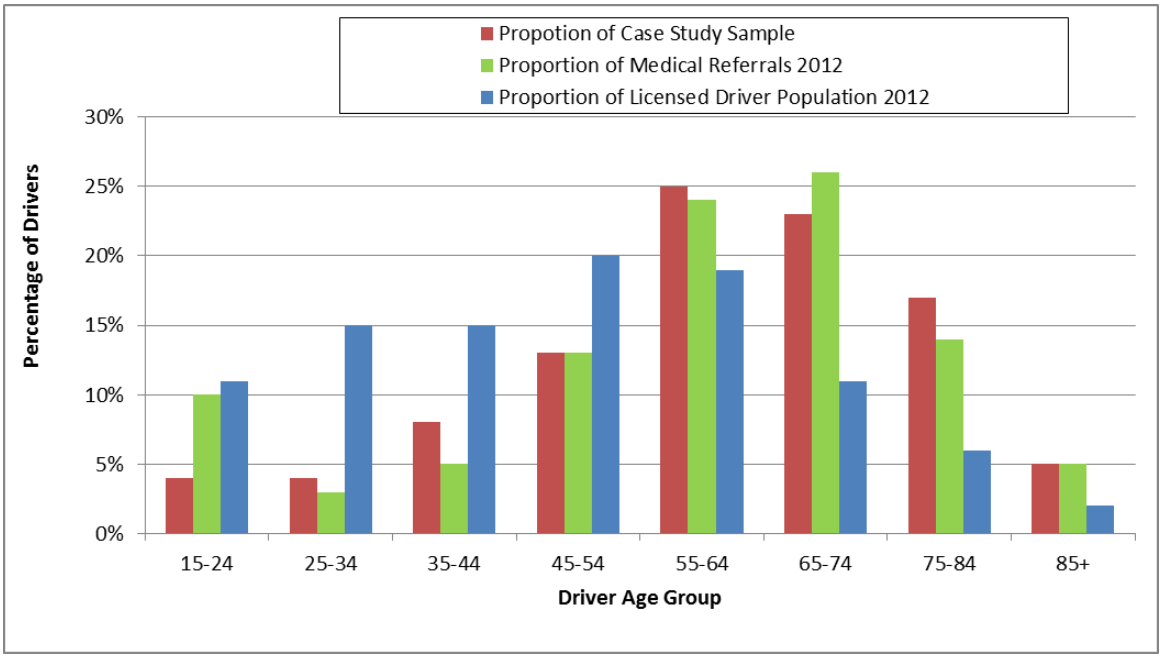


Figure B1. Comparison of case study population and medical referral population (where a completed medical statement was submitted), and licensed driver population in Maine in 2012, by driver age group.

Referral Source

Table B3 presents the proportion of referrals by referral source, and the average and median age within each sample. Maine BMV did not track referral sources or dates, so the consultant reviewed license application and renewal forms for each case study driver to determine whether they had renewed, were original license applicants, or had applied for a duplicate license and may have self-reported a medical condition at the time the case was opened. Maine's 2012 renewal application (Figure B2) asked drivers to indicate whether they had developed any of 10 listed medical conditions or other disability, or changes in a present medical condition since their last renewal. As shown in Table B3, the majority of referrals in the case study sample were self-reports of medical conditions either during the initial or renewal licensing process.

Table B3. Proportion of Referrals by Referral Source in the Maine Case Study Sample

Referral Source	Number in Sample (%)	Average Age (SD)	Median Age
Self (license application or renewal form)	427 (85.4%)	60.0 (16.7)	62
Physician	32 (6.4%)	69.8 (15.4)	75
Licensing Agency Representative	4 (0.8%)	57.5 (23.1)	54.5
Law Enforcement	2 (0.4%)	55.0 (28.3)	55
Family Member	1 (0.2%)	78.0 (0)	78
Other (Physical Therapist)	1 (0.2%)	79.0 (0)	79
Unknown	33 (6.6%)	64.3 (17.6)	64
Total	**500**	**61.0 (16.9)**	**63**

Within the sample were 32 referrals assumed to have been submitted by physicians. Since referral source was not tracked in Maine, there was limited information available for the consultant to investigate. Physicians used the CR-24 form to refer their patients to the BMV when they had concerns about their ability to drive safely. This was the same form that the BMV provided to drivers for completion by their physicians to assist the BMV with a determination of eligibility for licensure (based on the FAP provided by the physician for each diagnosis and associated BMV medical guidelines for the profile level indicated). Since the BMV received a CR-24 form for all 500 drivers selected for case study, it was difficult in some cases for the consultant and the Medical Review Coordinator to determine which were initiated by physicians. The physician-referred drivers were on average 10 years older than the self-referred drivers. Eighty-eight percent of the physician referrals were55 or older, and 66% were 65 or older. Within the self-referred sample, 70% were55 or older and 44% age 65 or older.

Referrals from law enforcement, licensing agency employees, family members, and others comprised less than 2% of the case study sample. There were 33 additional cases for which the consultant and the Maine BMV medical review coordinator could not determine the source of the referral (i.e., the driver was not renewing, there was no adverse driving report from law enforcement, and no evidence that a physician initiated the case). Sixty-seven percent of the referrals from unknown sources were 55 or older, and 49.5% were 65 or older.

VISION SCREENING RESULTS

Passed without corrective lenses ☐ Passed with corrective lenses ☐

Visual Field: L _____ R _____ T _____ Referred ☐

Examiner: _____ Date: _____

PLEASE ANSWER ALL QUESTIONS BELOW:

	Yes	No	
1.	☐	☐	Is your privilege to operate a motor vehicle now under revocation or suspension in this state or any other state or province? If yes, which state(s) or province(s)? _____
2.	☐	☐	Have you developed any of the following medical conditions or have any changes occurred in your present medical condition since your last renewal? ☐ Seizures ☐ Blackouts/Loss or Alteration of Consciousness ☐ Diabetes (medication) ☐ Heart Trouble ☐ Stroke/Traumatic Brain Injury ☐ Limb Amputation ☐ Mental Illness ☐ Parkinson's Disease ☐ Paralysis ☐ COPD ☐ Other Disability _____
3.	☐	☐	Do you have a driver's license from **another** state or province, valid or recently expired? State/Province: _____ Expiration Date: _____
4.	☐	☐	Are you now on active duty with the U.S. armed services and declaring Maine as your legal residence?
5.	☐		If you wish to be an organ and tissue donor, check "Yes" to consent to organ and tissue donation.

Your social security number: _____ Telephone number: _____

Would you like to donate to the Maine Organ and Tissue Donation Fund? If yes, ☐ $2 or ☐ Other $_____

Please sign within the box below in black ink

Signature of person having custody of applicant if applicant is less than 18 years of age:

"I understand that knowingly supplying false information on this form is a Class D crime under Title 17-A, punishable by confinement of up to 364 days or monetary fine of up to $2000.00 or both"

MVL2 Please correct mailing address if different from above
Rev 11/13

Figure B2. Maine license renewal application.

Reason for Referral

Law enforcement officers submitted two Adverse Driving reports. One stated that the driver seemed lost and confused, and the other report included a non-specific reference to a possible medical condition. The medical statement returned by these drivers' physicians indicated that one driver had memory impairment and the other a schizoaffective disorder.

Of the four referrals from BMV licensing personnel, two resulted from observations by the licensing clerk of movement disabilities, one due to arthritis and the other an unspecified musculoskeletal condition. The other two resulted from information obtained during hearings. During a hearing for failing to file insurance a driver told the hearing officer that he was being treated for back problems and optic neuritis. In the other case, a driver told the hearing officer that she was being treated for severe anxiety and panic attacks. In both cases, the BMV employee gave the drivers a CR-24 form to have completed by their physicians.

A physical therapist referred one driver as a result of substantial memory impairment, including inability to remember appointments and to find the clinic or pharmacy. The therapist expressed concerns about the person's ability to drive safely. One driver was referred by a family member due to a severe sleep disorder.

Since Maine did not identify or track referral information, the only information available to the consultant to determine the reason for referral for the remaining cases was the diagnosis provided by the physician on the completed CR-24 form, or the medical condition the driver reported on the license application or renewal form. The medical conditions underlying the referrals for the 500 cases are presented in Table B4. Seventy-five drivers (15% of the cases) had diagnoses in multiple categories, which generally included combinations of diabetes, heart conditions, and chronic obstructive pulmonary disease (COPD). The FAP profile level (severity) was not collected for this study. Therefore, for drivers with multiple conditions, only the condition listed first was included in Table B4, unless it also included stroke, sleep apnea, seizures, Parkinson's disease, dementia, or musculoskeletal conditions (such as spinal cord injury and osteoarthritis). As shown in this table, the plurality of referrals was associated with diabetes, followed by heart conditions, and COPD.

Table B4. Medical Conditions Associated With Case Study Referrals in Maine

Medical Condition[a]	Number of Cases	Percentage of Cases
Diabetes	179	35.8%
Heart Conditions (including Atrial fibrillation, coronary artery disease, atherosclerotic heart disease, cardiomyopathy, superventricular tachycardia, sick sinus syndrome, pacemaker implants, congestive heart failure, and other non-specified heart conditions)	103	20.6%
Chronic Obstructive Pulmonary Disease (COPD)	66	13.2%
Mental/Emotional (including anxiety, attention deficit hyperactivity disorder, bipolar, depression, mood disorder, obsessive-compulsive disorder, panic attacks, post-traumatic stress disorder, Tourette Syndrome, schizoaffective disorder, and other non-specified psychiatric disorders)	40	8.0%
Dementia	21	4.2%
Musculoskeletal Problems (including back pain, multiple sclerosis, arthritis, radiation plexopathy, scoliosis, spinal cord injury, fibromyalgia, sciatica, and other non-specified musculoskeletal conditions)	26	5.2%
Stroke	19	3.8%
Seizures	14	2.8%
Parkinson's Disease	6	1.2%
Sleep Apnea	6	1.2%
Memory Impairment	4	0.8%
Head Injury	3	0.6%
Syncope	2	0.4%
Asthma	2	0.4%
Deep Vein Thrombosis (DVT)	1	0.2%
Hypoglycemia	1	0.2%
Hypothyroidism	1	0.2%
Kidney Failure	1	0.2%
Limb Amputation	1	0.2%
Lymphedema	1	0.2%
Migraines	1	0.2%
Myasthenia Gravis	1	0.2%
Vertebral Artery Dissection	1	0.2%

[a] for drivers with multiple conditions cited, only the condition listed first is included in Table B4, unless the FAP also included stroke, sleep apnea, seizures, Parkinson's disease, dementia, or musculoskeletal conditions (such as spinal cord injury and osteoarthritis), as most likely to impair safe driving ability.

Medical Review Requirements

By virtue of the fact that the pool of drivers identified as having been referred for medical review in 2012 all returned a completed medical statement from their physicians (a CR-24 form), one cannot determine the proportion of drivers who chose not to comply with this medical review requirement. However, the records identified which drivers were deemed not medically fit to drive and therefore had their licenses suspended or had other medical review requirements imposed. These included a requirement to submit an eye examination form from a vision specialist, and/or to take BMV vision, knowledge, and road tests. The records documented which drivers complied with these medical review requirements and their testing outcomes.

Among the 500 referrals were 23 initial license applicants who were required to take the BMV vision test as a part of the license process and 291 drivers required to vision test because of their age at renewal or because they were new Maine residents with a valid out-of-State license

applying for a Maine driver's license. Because these 314 drivers would have been required to take the vision test whether or not they were referred for medical review, they were excluded from (the numerator in) analysis of proportions of drivers required to take the BMV vision test, or to obtain a statement from a vision specialist (ophthalmologist or optometrist) if they failed the BMV vision test.

Requirement to submit a vision specialist's statement. Five drivers (1% of the total sample of 500) were required to submit a statement from a vision specialist as part of their medical review process, and all five complied.

Medical fitness to drive. Based on the information provided in the medical and vision statements (e.g., the diagnosis and severity of the condition), 19 of the 500 drivers (3.8%) were deemed *not* medically fit, and were suspended without any further testing. They ranged in age from 42 to 88, and averaged 72.5 (*SD*=12.2; *Mdn*= 76). The medical conditions associated with these drivers were:

- dementia (10 drivers);
- stroke (3 drivers);
- head injury (1 driver);
- seizure (1 driver);
- bipolar (1 driver);
- sleep disorder (1 driver);
- cardiomyopathy (1 driver); and
- uncontrolled diabetes (1 driver).

The referral sources for these 19 drivers were:

- physicians (12 drivers);
- self (2 drivers);
- family (1 driver);
- law enforcement (1 driver); and
- unknown (3 drivers).

The remaining 481 drivers were deemed medically fit (96% of the sample) and were either licensed without any testing, or, based on their FAP, were required to pass BMV tests before a licensing determination could be made. The characteristics of drivers required to undergo BMV testing, their compliance with testing, and testing outcomes are described below.

BMV vision test requirement. Among the 481 referred drivers deemed medically fit were 23 initial license applicants who were required to take the BMV vision test as a part of the license process and 291 drivers required to vision test because of their age at renewal or because they were new residents with a valid out-of-State license applying for a Maine driver's license. These 314 drivers would have been required to take the vision test whether or not they were referred for medical review, so they were excluded from the numerator in analysis of drivers required to vision test as part of the medical review process. Of the remaining 167 referrals, 31 drivers were required to take the vision test (comprising 6.4% of the medically fit sample of 481 referrals). Of these 31 drivers, 26 took the test and passed (84%), two drivers failed and were

required to submit a vision specialist's statement, and complied (6.4%), and three drivers did not comply with the requirement to vision test (9.6%). The three drivers who did not comply with the vision test requirement were also required to take the knowledge and road tests. Two of the three drivers cancelled their licenses in lieu of testing (two females75 or older with dementia) and the license of the third was suspended for failure to comply with medical review requirements (a male in his 30's with a self-referred mental/emotional disorder).

BMV knowledge test requirement. Of the 458 drivers deemed medically fit and who were *not* initial applicants, 13 drivers (3%) were required to take the knowledge test based on the profile level assigned by the treating physician for the driver's medical condition, or the treating physician's recommendation. For example, drivers with dementia profiled at a level 3B (mild active impairment) were required to take a knowledge test and a road test. The average age of drivers required to knowledge test was 70.9 (range 25-87, *SD*=20.1, *Mdn*=77). The diagnoses associated with these 13 drivers were:

- dementia (10 drivers);
- Tourette's (1 driver);
- memory loss (1 driver); and
- unspecified mental/emotional condition (1 driver).

Three of the 13 passed the test, 7 failed, and three did not comply with the requirement to test. The three drivers who did not comply were the same three who did not take the vision test and either cancelled their licenses or had them suspended. Twelve of the 13 drivers (all but the driver with Tourette's) were also required to take the road test based on the profile level for their medical condition, but only those who passed the knowledge test were eligible to road test.

BMV road test requirement. Of the 458 drivers deemed medically fit and who were *not* initial applicants, 37 drivers (8%) were required to take the road test before a licensing determination could be made (including 12 of the drivers also required to knowledge test, as described above). The 37 drivers ranged from 18 to 87 (*M* = 67, *SD* = 17; *Mdn*= 72), and 23 of the 37 (62%) were 65 or older. The medical conditions for the 25 drivers required to take the road test independent of the knowledge test were:

- Parkinson's disease (6 drivers, including one who also had heart disease);
- dementia (2 drivers, both with co-existing conditions):
    - diabetes and COPD; and
    - diabetes and heart disease;
- memory impairment (2 drivers);
- strokes (5 drivers), including three with co-existing conditions:
    - limb amputation;
    - seizures; and
    - diabetes;
- head injury (1 driver with co-existing conditions including depression and potential onset of dementia);
- mental/emotional conditions (3 drivers):
    - bipolar disorder;
    - one with depression, diabetes, and COPD; and

    - anxiety and ADHD;
- musculoskeletal conditions (5 drivers):
    - arthritis (coexisting with diabetes);
    - radiation plexopathy;
    - spinal cord injury;
    - limb amputation; and
    - paralysis;
- sleep apnea (1 driver, coexisting with substance abuse and COPD).

Twenty-three of the 25 drivers passed the road test and two failed. Both drivers who failed were older females (72 and 79), one with severe memory impairment and the other with dementia (and co-existing conditions). One failed the road test twice and cancelled the third appointment, but did not submit paperwork to cancel her license and was therefore suspended. The other failed the first attempt, obtained a temporary permit restricted to driving with another licensed driver, and then cancelled her license.

Requirement for examination by driver rehabilitation specialist. The Maine BMV did not refer drivers to driver rehabilitation specialists for their assistance in making fitness to drive determinations.

Medical Advisory Board Involvement in Initial Licensing Decision

Only in 2 of the 500 cases (0.4%), was the consultant able to identify that the Medical Advisory Board had assisted with an initial licensing determination. Both cases involved drivers who self-reported having diabetes. The consultant's ability to characterize MAB involvement in case dispositions was limited to instances where a note was entered on the medical summary page that an MAB opinion was requested. However, MAB consultations were infrequent in 2012, as indicated in Volume 1 of this report (approximately 25 total for the year), so the proportion of such consults in the sample of 500 does not appear to be an underrepresentation.

Medical Review Outcomes

Figure B3 shows the referral sources and the licensing process and outcomes across the sample of 500 case study drivers referred for medical review. Table B5 presents the licensing outcomes for the total sample of 500 drivers, as well as by referral source. The medical review process resulted in a periodic review requirement only (i.e., no licensing restrictions) for the majority of referrals (360 of 500, or 72%). As an aside, a corrective lenses restriction was applied to 23 of these drivers as a result of a vision test requirement for new applicants, renewal drivers of a certain age, or drivers converting an out-of-State license. However, these 23 drivers would have received a corrective lenses restriction independent of their referral for medical review.

Fewer than 2% of the referrals (8 of 500 drivers) resulted in a new restriction plus a periodic review requirement, as a result of the medical review process. Only one driver received a licensing restriction without a periodic review requirement. The restriction types included:

- radius of home (2 drivers with dementia):
    - 25-mile radius of home; and
    - 50-mile radius of home;
- adaptive equipment (6 drivers), including combinations of the following:
    - automatic transmission (6 drivers);
    - power steering (3 drivers);
    - steering knob (3 drivers);
    - hand-operated dimmer switch (3 drivers);
    - hand-operated emergency brake (2 drivers);
    - full hand controls (2 drivers);
    - both outside mirrors (2 drivers);
    - left-foot accelerator (1 driver); and
    - modified directional signals (1 driver);
- corrective lenses (2 drivers).

The drivers issued an adaptive equipment restriction had experienced a stroke (3 drivers, one of whom had also experienced a limb amputation), limb amputation (1 driver), or had musculoskeletal weakness (2 drivers, one resulting from radiation plexopathy and the other an un-specified paralysis).

Thirty-two drivers (6.4% of the total sample) lost their licenses as a result of the medical review process. This included:

- 19 drivers who were suspended as medically not fit (based on the FAP level their physician provided for their medical condition and BMV's medical standards for licensing);
- 8 drivers who failed the BMV knowledge or road test and were suspended;
- 1 driver who failed to comply with the reexamination requirements and was therefore suspended;
- 3 drivers who chose to cancel their licenses in lieu of taking the BMV reexamination tests; and
- 1 driver who surrendered their license and moved out of State (this driver should have been excluded from the sample of 500 drivers selected for case study, but was overlooked).

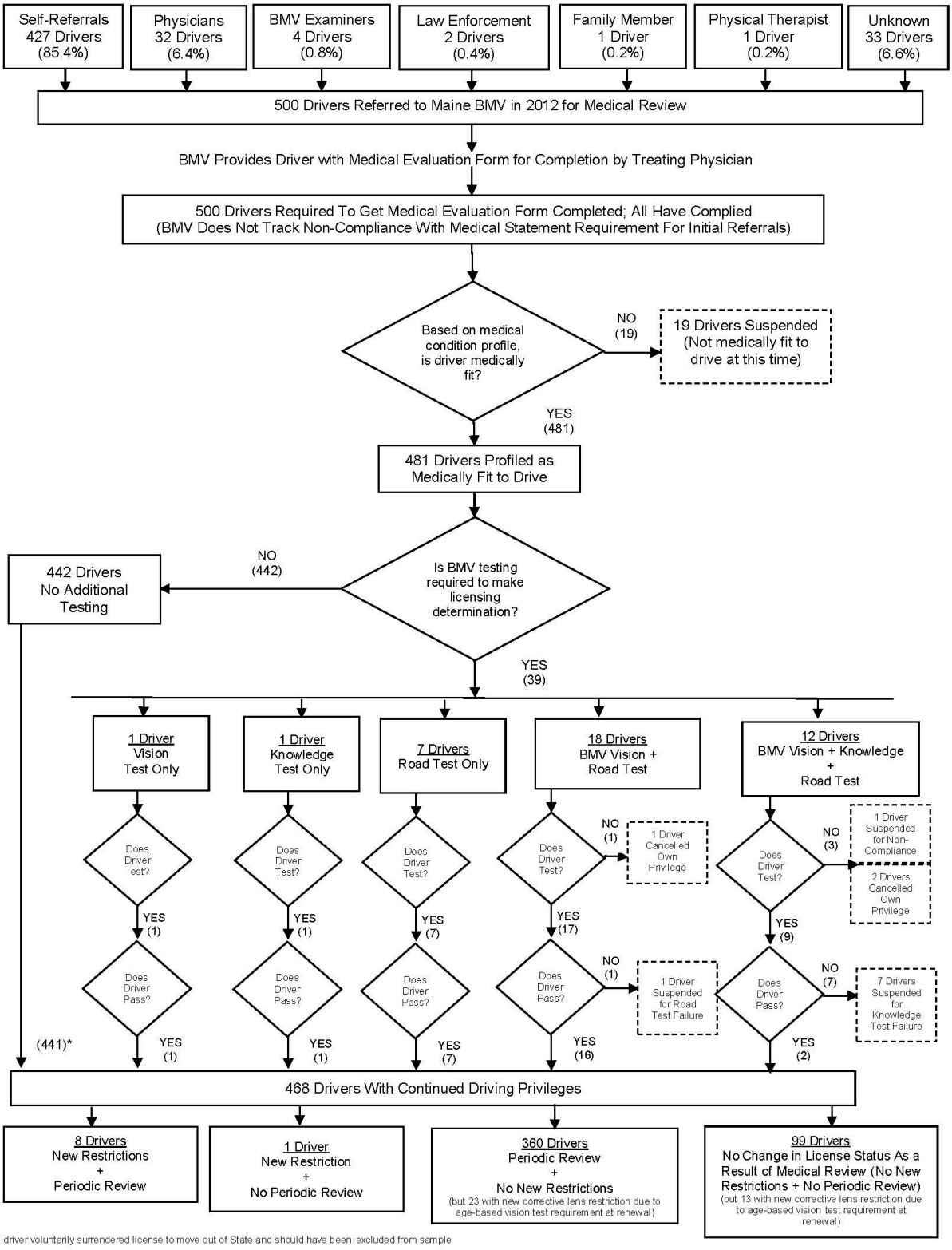


Figure B3. Medical review process and outcomes for 500 drivers referred to the Maine Bureau of Motor Vehicles.

Table B5. Medical Review Process Licensing Outcomes, by Referral Source

Referral Source	Number of Drivers	Change in License Status as a Result of Medical Review							
		New Restriction Only (Row %)	Periodic Review Only (Row %)	New Restriction + Periodic Review (Row %)	Suspension (Medically Unfit) (Row %)	Suspension (Test Failure) (Row %)	Suspension (Fail to Comply With Reexam Requirements) (Row %)	Driver Cancelled Own License[a] (Row %)	No Change (Row %)
Self	427	1 (0.2%)	323 (75.6%)	3 (0.7%)	2 (0.5%)	1 (0.2%)	1 (0.2%)		96 (22.5%)
Physicians	32		10 (31.3%)	4 (12.5%)	12 (37.5%)	3 (9.4%)		2 (6.3%)	1 (3.1%)
BMV Employee	4		4 (100%)						
Law Enforcement	2		1 (50%)		1 (50%)				
Physical Therapist	1							1 (100%)	
Family Member	1				1 (100%)				
Unknown	33		22 (66.7%)	1 (3.0%)	3 (9.1%)	4 (12.1%)		1 (3.0%)	2 (6.1%)
Total	500	1 (0.2%)	360 (72.0%)	8 (1.6%)	19 (3.8%)	8 (1.6%)	1 (0.2%)	4 (0.8%)	99 (19.8%)

[a] In lieu of complying with testing requirements, or following one or two test failures, the driver opted out of licensure, and completed paperwork to formally cancel their license, rather than complete the re-examination testing. In Maine, this was called "cancellation" and in other States, it was called "voluntary surrender." The term "voluntary surrender" in Maine was reserved for drivers who moved out of State, and gave up their Maine license to establish licensure in another State.

There was no change in license status for nearly 20% of the sample as a result of the medical review process (99 of 500 drivers). No BMV tests were required for this set of referrals, apart from tests given as a part of the licensing process for new applicants (vision, knowledge, and road tests), or vision tests due to age at renewal or as a result of converting an out-of-State license. The medical conditions associated with these referrals were:

- COPD (37 drivers);
- heart conditions (32 drivers);
- diabetes (9 drivers);
- stroke (7 drivers);
- mental/emotional conditions including ADHD, ADD, and depression with anxiety (3 drivers);
- asthma (2 drivers); and
- deep vein thrombosis, head injury/concussion, hypoglycemia, hypothyroidism, kidney failure, migraines, seizure, syncope, and vertebral artery dissection (1 driver each).

Within this set of 99 drivers were 13 who received a corrective lenses restriction as a result of vision screening upon initial licensure or at renewal due to their age; these drivers would have received this restriction independent of the medical review process.

A comparison of the outcomes reported in Table B5 for self-referrals and physician referrals indicates that physician referrals were much *more* likely to result in suspensions for being medically unfit and much *less* likely to result in no licensing action. Physician referrals were also *more* likely than self-referrals to result in suspension for inability to pass the licensing tests (knowledge and road) for drivers meeting the BMV medical standards but required to demonstrate their knowledge and ability to drive safely. Self-referrals were more likely than physician referrals to result in a periodic review only requirement. The self-referral sample was younger than the physician-referred sample, and included drivers applying for licenses for the first time who indicated having a medical condition. The simple presence of a medical condition may not indicate functional impairment. For example, diabetes controlled by diet alone may not result in a functional limitation that would impair driving; however, periodic monitoring could be appropriate to ensure that the condition remained under control. The severity of the medical conditions associated with the older drivers in the physician-referred sample is likely to have been higher than the severity of conditions in the self-referred sample. Their functional ability profile level indicated greater risk, resulting in smaller proportions of physician-referred drivers with no change in license status and larger proportions of physician-referred drivers suspended as medically unfit, compared to the drivers who indicated on their licensing application that they had a medical condition (self-referrals). In addition, the older, physician-referred sample was more likely than the younger self-referred sample to have had (and been prescribed medication for) multiple medical conditions, both likely to affect functional ability and safe driving performance.

Licensing outcomes can be grouped into three broad categories. The first category is a licensing action based on medical or functional guidelines or BMV test performance. This includes the outcomes of license suspension as medically unsafe to drive, suspension for failing BMV tests, restricted licensure, or a periodic review requirement (collapsing across the first 5

outcomes in Table B5). The second category is loss of licensure when drivers opt out of participating in the medical review process (either by canceling their licenses, or not complying with testing requirements, and having their licenses suspended). The third category is no license action as a result of the medical review process (the last column in Table B5). Drivers in this category retain the same licensing status they had before they were referred for medical review. Referrals where there is no change in license status following medical review may function as a warning flag for diminished driving safety, if that driver is subsequently referred for medical review.

Comparing these broad licensing outcomes for self- and physician-referrals (who together referred 92% of the sample), indicates that physician referrals were *more likely* than self-referrals to result in licensing action based on medical or functional guidelines or BMV test performance and *less likely* to result in no action. Table 6 presents the contingency table showing observed and expected frequencies (where the expected frequencies are calculated by multiplying the total frequencies common to the cell, and dividing by the total 459). A chi-square test using these three categories showed a significant difference in medical review outcomes for these two referral sources (X^2=22.4, d.f.=2, p<0.005). No statistical tests of significance were performed for cases referred by the remaining sources in Table B5, due to the small sample sizes.

Table B6. Chi-Square Contingency Table Showing Observed and Expected (in parentheses) Values for Medical Review Outcomes by Referral Source

Referral Source	Result of Medical Review on License Status			Total
	License Action: Periodic Review, Restriction, or Cancellation for Medically Unfit or Test Failure	Opt Out of Licensing: Suspension for Failure to Comply With Medical Review Requirements or Voluntary Cancellation	No Change in License Status	
Self	330 (334)	1 (3)	96 (90)	**427**
Physicians	29 (25)	2 (0.2)	1 (7)	**32**
Total	**359**	**3**	**97**	**459**

The outcomes of the "unknown" referrals were more similar to those of the physician referrals than self-referrals. It is likely that these 33 cases were physician referrals, based on their medical review outcomes, coupled with the absence of other documents in the driver's medical file that would indicate report of adverse driving, and the fact that it was not time for license renewal (although self-referrals may occur at other times).

Case Disposition Time

Case disposition time was calculated as the number of days elapsed from the date a case was opened to the date the BMV determined the licensing action (case disposition date). The time between the referral date and case opened date was not included in case disposition time analyses. This is because referral date was not available for the cases with referral source unknown. Referral date and case opened date were identical for 457 of the cases. Case disposition times are described below, for three sets of cases:

- drivers deemed not medically fit and therefore suspended;

- drivers deemed medically fit and licensed without further testing; and
- drivers deemed medically fit and required to undergo BMV tests.

Suspended as medically unfit. Case disposition time for the 19 drivers whose physicians submitted a CR-24 profiled at a level indicating they were medically unfit to drive ranged from 0 to 247 days, with an average of 18 days (*SD*=56 days; *Mdn*= 2 days). For 8 of the 19 drivers, the decision to suspend the license was made the day the physician's medical statement was received (the case opened date, resulting in a disposition time of 0 days). For 6 drivers, it was made within 1 to10 days of receipt of the CR-24, and for 4 drivers within 11 to 30 days of the CR-24. The driver with a case disposition time of 247 days was a driver who self-reported having diabetes upon renewal, but spent winters living out of State. This driver was given a CR-24 at license renewal in the fall of 2011 for completion by the treating physician, and a temporary license was issued. This driver's license expired in December of 2011. When the CR-24 was returned by the physician in the spring of 2012, the BMV suspended the license due to an adverse medical condition. Excluding this driver from the analyses resulted in a range of 0-27 days, with an average of 5 days (*SD* = 7 days).

Medically fit and no further testing required. The sample included 441 drivers deemed medically fit with no further testing requirements[5]. Case disposition time ranged from 0 days to 713 days (*M*=30 days, *SD*=52 days; *Mdn*= 13 days). Excluding the driver whose case exceeded 1 year (713 days), disposition time ranged from 0 days to 327 days (*M*=28 days, *SD*=41 days). Table B7 presents the distribution of case disposition times for drivers not required to undergo additional testing. Inspection of this table reveals that the majority of cases had disposition times of 30 days or less (69% of the sample), while 88% of the cases had case disposition times of 60 days or less. Case disposition time for drivers initially referred for medical review in Maine was largely a function of the time elapsed between the driver being given a CR-24 form and the physician returning the completed form to the Medical Review Department. Case disposition may also have been delayed when physicians returned incomplete CR-24 forms, or did not address the diagnosis or problem surrounding the reason for referral, resulting in multiple BMV Medical Department requests for additional information (4 cases). In 4 additional cases, drivers were issued temporary 60-day licenses while awaiting the return of their CR-24. In one of these cases, two 60-day temporary licenses were issued, and the case included MAB involvement with the driver's physician.

The majority of cases with very long case disposition times likely resulted from drivers who self-reported a medical condition at renewal, were given a CR-24 for completion by their physician, and whose licenses expired before the CR-24 was submitted to the BMV. Their medical review cases were not closed via suspension for failure to submit the medical information, but they could no longer legally drive between the time their licenses expired and their CR-24 forms were submitted and reviewed.

[5] This analysis excludes the driver who voluntarily surrendered their Maine license and moved out of State. This driver was required to take the road test based on his medical condition profile, but he moved out of State before taking the test.

Table B7. Case Disposition Time for Drivers Deemed Medically Fit and No BMV Tests Required for Medical Review/Reexamination

Case Disposition Time (Days)	Number of Cases	Percentage of Sample (n=441)
0	45	10%
1-15	195	44%
16-30	63	14%
31-45	49	11%
46-60	37	8%
61-75	16	4%
76-90	8	2%
91-105	4	1%
106-120	5	1%
121-135	4	1%
136-150	3	1%
151-165	2	0%
166-180	1	0%
181+	9	2%

Medically fit and required to road test. Case disposition time for the 37 drivers required to take a road test ranged from 12 to 412 days, and averaged 96 days (*SD*=71 days). Table B8 presents the distribution of case disposition times for drivers required to road test as a part of their medical review process. The case that required 412 days involved a new applicant who was required to road test as part of the licensing process, but also required road testing as a result of the diagnosis and the way the treating physician profiled it on the CR-24 form. Excluding this driver from this analysis (to avoid confounding permit holding time with medical review and testing time), the range of disposition times was 12 to 222 days, and averaged 87 days (*SD*=47.7 days; *Mdn*= 83 days).

As shown by Table B8, nearly one-third of the cases requiring a road test were resolved within 60 days of the case opening date, and just slightly over half within 90 days of the case opening date. Notes provided by the data entry consultant indicated that six drivers required multiple attempts to pass the road test with one driver finally passing on a fourth attempt. Drivers were normally limited to three attempts at a road test, but a fourth or fifth may have been granted if a driver showed improvement from test to test. One driver failed the first attempt, had therapy, and then passed on the second attempt two months later. Drivers who attempted a road test and failed may have had their licenses suspended or been issued a temporary license restricting them to driving with a licensed driver, until they could pass the test. This decision was at the discretion of the driver license examiner. Four cases were notated indicating that 60-day restricted licenses were issued. Specifically, two drivers were issued restricted temporary licenses to practice driving with prostheses or adaptive equipment, and one to practice with a driver rehabilitation specialist. Restricted temporary licenses were valid for 60 days each, and were renewable. Drivers may have requested a temporary license to practice driving before taking their test, or the Driver's License Examiner may have issue a restricted license allowing the person to drive with a licensed driver when they failed a test, to enable practice while awaiting retesting. When a 60-day temporary license expired, no other licensing action (i.e., suspension) was placed on the license, because the license had expired. Case disposition time may have been affected by multiple factors, including the time required for the treating physician to submit the CR-24,

delays caused by incomplete CR-24 forms, issues involved in scheduling road tests, and the number of test attempts. In addition, drivers may have requested a delay in testing, if they went out of State in the winter, didn't want to drive in the winter, needed time to practice with new adaptive equipment, or for other similar reasons.

Table B8. Case Disposition Time for Drivers Deemed Medically Fit, but Requiring a BMV Road Test for Medical Review/Reexamination

Case Disposition Time (Days)	Number of Cases	Percentage of Sample (n=37)
0	0	0%
1-15	1	3%
16-30	1	3%
31-45	7	19%
46-60	3	8%
61-75	3	8%
76-90	4	11%
91-105	6	16%
106-120	4	11%
121-135	2	5%
136-150	2	5%
151-165	1	3%
166-180	0	0%
181+	3	8%

Medically fit with vision-test-only or knowledge-test-only requirements. Two cases were unique, in that only a knowledge or vision test was required. The disposition time for the driver required to take only the knowledge test was 504 days. The case involved a driver converting an out-of-State license to a Maine license, with a medical condition profiled as requiring both knowledge and road testing. This driver took the knowledge test, but for some reason was not scheduled for the road test. He presented a second medical statement that profiled his medical condition as not requiring the road test, and was able to convert his out-of-State license to a Maine license. No notes were provided to explain the circumstances surrounding the driver who was required to vision test only. The case involved a driver with diabetes, and was resolved in 56 days of this driver's self-report.

Feedback to Reporting Source

The Maine BMV did not provide feedback to the reporting source, regarding the outcome of medical review, for any drivers referred for medical review. This was a confidentiality issue that fell under the Driver's Privacy Protection Act.

Case Cost

It was not possible for the BMV to estimate the cost to process each case. One difficulty with providing a per-case estimate was identifying the number of drivers examined the day the case driver was road tested at that station. Maine is very rural, and examiners were paid for their travel time to an exam station. Their travel time would need to be divided by the number of tests they conducted that day. This information was not tracked specifically for medical reviews.

Appeal of Licensing Action

One of the 500 case study drivers requested a hearing. This driver self-disclosed a medical condition when requesting a duplicate license. The driver should have received a CR-24 for his physician to complete, prior to being licensed; however, the license was issued in error. When the Medical Review Department received the driver's application with the self-disclosed medical condition a month later, they suspended the license until the medical statement was returned. The driver requested a hearing, the suspension was rescinded, his physician returned the medical statement, and he was licensed with no new restrictions and no periodic review requirement. He did not need to appeal his case to Superior Court.

The Maine MAB did not participate in hearings or appeals for drivers aggrieved by the licensing agency's decision.

Appendix C: Detailed Summary of 500-Driver Case Study in Ohio

Case Study Sample Selection

The Ohio Bureau of Motor Vehicles (BMV) supplied a de-identified data file to the PI containing a list of 5,971drivers initially referred for medical review in 2012 for whom the BMV opened a medical review case (drivers on periodic review had already been excluded). The dataset included drivers referred from all possible sources, both within and outside of the BMV.

The list included drivers meeting several case study exclusion criteria, as it was not possible for the BMV to design a query to exclude them. This included drivers with commercial driver license (CDL) endorsements who were operating a commercial motor vehicle when they were referred, motorcycle operators, drivers referred because of alcohol abuse, drivers adjudicated as mentally incompetent by the court, drivers who moved out of State, drivers who died prior to completing the medical review process, and drivers whose licenses were already suspended or cancelled (for non-medical reasons) or expired.

The list contained BMV case number, case opened date, driver's date of birth and sex, and was sorted by case opened date, and BMV case number within case opened date. The BMV did not track referral source, so it was not possible to develop a stratified sampling plan based on referral source. The PI reviewed referral counts to determine whether there were variations by month, age, or sex. The number of referrals by month ranged from 430 to 550, and averaged 498 (*SD*=43). The monthly proportion of referrals ranged from 7% to 9% of the total.

Proportions of medical referrals by month and by age group and sex were stable, so there was no need to adjust the sampling strategy to account for fluctuations in referral counts. The data collector selected a systematic random sample of 500 drivers using the list of 5,971 sorted by case opened date, and BMV case number within case opened date, and selecting every 11th driver on the list (driver 11, 22, 33, 44) until 500 cases were obtained. If one of the "every 11th" drivers selected for case study met the exclusion criteria, then the prior driver on the list was sampled (the 10th driver in that set of 11 drivers).

Data Entry

A Memorandum of Understanding was executed between the contractor and the Ohio BMV. The BMV assigned an employee in the medical unit to select cases, research case information, and enter data into the case study database. Using NHTSA project funds, the contractor reimbursed the BMV at the end of data collection for the hours their employee worked on this project.

Coding was straightforward for the majority of data fields; however, several fields require additional discussion for this report. In Ohio, all applicants for an original or renewal license, and drivers converting a license from another State were required to take the BMV vision test. Drivers required to undergo vision testing or who received a corrective lens restriction as part of the licensing process only (i.e., not as a result of their medical condition and resulting physician statement) were coded as *not* being required to test as a result of the medical review process and the PI excluded them from analyses of medical review restrictions.

The disposition date, as defined for the study, was the date the BMV made a licensing decision at the completion of the medical review process. If the BMV required a road test, the disposition date was coded as the date the driver passed and was licensed, or the date they failed their final test opportunity and received a license suspension. Four testing opportunities were permitted within a 6-month period (with at least 7 days between attempts). Although drivers who failed were suspended after the first opportunity and were required to be accompanied by a licensed driver for subsequent tests, case study drivers were coded as failed only after their final testing opportunity within the 6-month period. All drivers referred for medical review in Ohio were required to have a physician's statement completed and returned to the BMV within 30 days. If a driver failed to comply with the medical report or BMV testing and received a license suspension, the disposition date was entered as the compliance deadline date (and not the suspension effective date, which was approximately 15 days following). If the BMV required only a medical or vision statement, the disposition date was entered as the date that the statement was reviewed and the decision was made to either (1) allow continued licensure or, (2) to suspend licensure because the driver was deemed medically unfit by their physician or did not meet BMV vision standards. For new applicants, the date the medical form was received in the Medical Review Office allowing the Temporary Instruction Permit Identification Card (TIPIC) to be issued (and not the road test date) was entered as the disposition date, to preclude confounding TIPIC holding time (minimum of 6 months) with medical review/testing time.

The data collector provided detailed notes describing the reason for referral. This permitted post-coding by the PI describing how drivers came to the attention of law enforcement (crash or observed driving behavior) and what observations about the person's condition led the officer to refer the driver for medical review, and the diagnoses/medical conditions that prompted physician and self-referrals. She noted several other details which allowed for additional post-coding and analyses, such as whether a physician included findings by an occupational therapist when referring a patient for review, and when potentially driver-impairing medications were mentioned in the referral narrative or the physician's statement.

The data collector also noted if and when any case study driver died following their medical review (between 2012 and 2014, when the case study data were accessed). This was possible, because each month, the State Vital Records Office, Division of Public Health submitted a "deceased file" to the Oho BMV, allowing the BMV to update the customer record automatically with a deceased notation. This information was used to determine when a case should be excluded (deceased prior to submitting medical review information or undergoing required tests); the PI requested notation of death and the date when a case study driver died following medical review, to further characterize the medical/functional condition of medical referrals.

Finally, the data collector noted whether a license suspended as a result of a seizure was reinstated following submission of an acceptable medical statement from the driver's physician. Ohio did not have a mandatory seizure-free period. Ohio's Motor Vehicle Laws granted the Registrar of Motor Vehicles the authority to place a medical restriction on the driver license of people who had a condition that could cause them to suffer a loss of consciousness or otherwise impair their ability to drive safely. This restriction required the driver to submit periodic satisfactory medical statements to maintain licensure. The medical statements may have been required every 6 months, annually, or every 4 years at license renewal, based on the physician's

recommendation. The BMV's procedures and policies for placing and removing medical license restrictions were administrative. In accordance with BMV guidelines, the driver's treating physician determined whether a patient's condition was under sufficient medical control to allow safe driving. Based on the physician's recommendations, licenses were granted or suspended. In a discussion of medical review outcomes, license status depended on the window of time selected, because medical conditions could improve or deteriorate over time. If any of the case study drivers received a license suspension based on an unacceptable medical report due to a seizure/loss of consciousness or control, they were included in the set of drivers suspended as not medically fit in the database. To illustrate that license status for medical review cases may change over time, the PI conducted an additional analysis describing if and when licenses were reinstated following receipt of an acceptable medical report for the subset of drivers suspended due to a seizure.

Sample Demographics

Table C1 presents the age and sex distribution of the 500 drivers selected for the case study. Overall, males represented 58% of the sample, and larger percentages of males than females were present in nearly every age group. The average age of the case study sample was 54.8 (range 16 to 99, *SD*=25.5); the median age was 57.

Table C1. Ohio Case Study Sample Demographics (n=500)

Age Group	Case Study Total	Age Group Percentage of Sample	Number of Males	Number of Females	Percent Male	Percent Female
16-24	98	20%	52	46	53%	47%
25-34	50	10%	27	23	54%	46%
35-44	28	6%	10	18	36%	64%
45-54	58	12%	34	24	59%	41%
55-64	61	12%	43	18	70%	30%
65-74	53	11%	30	23	57%	43%
75-84	74	15%	44	30	59%	41%
85-94	76	15%	52	24	68%	32%
95-99	2	0%	0	2	0%	100%
Total	**500**	**100%**	**292**	**208**	**58%**	**42%**

Table C2 displays the demographics of the entire pool of drivers referred to the Ohio BMV for medical review in 2012, where both age and sex were known (n=5,941). The average age of the total sample of referrals was 52.7 (SD=25.3, *n*=5,971) and the median age 54.5, indicating that the case study sample was slightly older than the referral sample. Figure C1 compares the proportion of medical referrals by age group for the entire referral pool (green bars) and the case study sample (red bars) to their respective proportions within the licensed driver population in 2012 (blue bars). This figure shows that the youngest driver group and the two oldest driver groups were *overrepresented* among the medical referral population and the case study sample compared to their proportion in the population of licensed drivers, drivers 25

to 64 were *underrepresented* in the medical referral population and case study sample, and drivers 65 to 74 were about equally represented among the medical referral population and case study sample compared to their proportion in the population of licensed drivers.

Table C2 also shows that males accounted for 55% of the medical review referrals in 2012, and for the majority of referrals in most age groups. Thus, the male-to-female ratio in the case study sample was similar to that of the entire pool of referrals.

Across all age groups, males accounted for 48% of the licensed driver population in 2012, some 55% of the medical review referrals, and 58% of the case study sample indicating a slight overrepresentation of males who underwent medical review and were selected for the case study, contrasted with their percentage within the driving population.

Table C2. Demographics of All Referrals to Ohio BMV for Reexamination in 2012 (n=5941)*

Age Group	Total Referrals in 2012	Age Group Percent of Sample	Number of Males	Number of Females	Percent Male	Percent Female
16-24	1333	22%	711	622	53%	47%
25-34	479	8%	238	241	50%	50%
35-44	479	8%	236	243	49%	51%
45-54	686	12%	373	313	54%	46%
55-64	736	12%	432	304	59%	41%
65-74	608	10%	334	274	55%	45%
75-84	903	15%	520	383	58%	42%
85-94	671	11%	420	251	63%	37%
95+	46	1%	29	17	63%	37%
Total	**5,941**	**100%**	**3,293**	**2,648**	**55%**	**45%**

* Excluded 1 driver who was age 14 and 29 drivers whose sex was coded as unknown

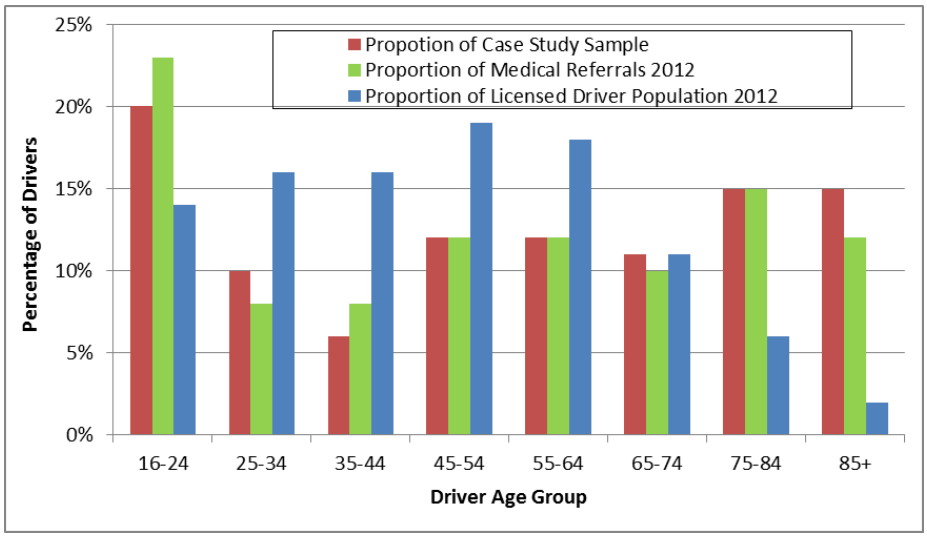


Figure C1. Comparison of case study population, medical referral population, and licensed driver population in Ohio in 2012, by driver age group.

Referral Source

Table C3 presents the proportion of referrals by referral source, and average age. Self-referrals comprised just over half of the sample and law enforcement just over one-fourth. Physician referrals accounted for nearly 10% of the sample.

The self-referral sample was much younger on average (41.1 years) than the law enforcement (72.3 years) and physician referrals (80.5 years). In fact, the majority of the self-referrals were *younger* than55 (68%), while the majority of the law enforcement and physician referrals were*55 or older* (83% and 90%, respectively).

The courts, licensing agency representatives, and family members accounted for less than 1% of the sample each.

Table C3. Proportion of Referrals by Referral Source in the Ohio Case Study Sample

Referral Source	Number in Sample (%)	Average Age (SD)	Median Age
Self (license application or renewal form)	294 (58.8%)	41.1 (SD =21.4)	40.5
Law Enforcement	146 (29.2%)	72.3 (SD=17.1)	79
Physicians	49 (9.8%)	80.5 (SD=12.5)	84
Courts	4 (0.8%)	80.5 (SD=18.4)	89
Licensing Agency Representative	3 (0.6%)	64.6 (SD=15.8)	61
Family Member	2 (0.4%)	88.5 (SD=0.7)	88.5
Unknown	2 (0.4%)	58.5 (SD=40.3)	58.5
Total	500 (100%)	54.8 (SD=25.5)	57

Reason for Referral

Self-referrals. Drivers with medical conditions or functional impairments that could affect their ability to drive safely were brought to the attention of the BMV in a number of ways.

First-time and renewal applicants were required to respond to the following three questions as they completed their license application:

- *Do you have a condition that results in episodic impairment of consciousness or loss of muscular control?*
- *Do you have a physical or mental condition that prevents you from exercising reasonable and ordinary control of a motor vehicle? If Yes,*
  _____ (nature and extent);
  _____ (name of treating physician).
- *Are you chemically dependent on alcohol or a drug of abuse and currently using alcohol or a drug of abuse?*

Applicants who responded in the affirmative were given a medical form to take to their physicians for completion and return to the BMV. The data collector entered the medical condition provided by the driver on the license application/renewal form.

Table C4 summarizes the medical conditions reported by initial and renewing drivers, and their proportions within the self-referral sample. There were 38 drivers with multiple conditions listed; Table C4 shows only the first condition listed. Over one-third of the drivers who self-reported a medical condition on their licensing application or renewal form indicated having diabetes and more than one-quarter reported epilepsy or a seizure disorder. Slightly fewer than 10% reported a psychiatric condition and nearly 8% a musculoskeletal condition.

Physician referrals. Table C4 shows the reasons provided by physicians who referred patients for medical review. Sixteen referrals included multiple medical conditions; only the first condition listed is presented in Table C4. Over half of the physician referrals were associated with either dementia or cognitive impairment. Epilepsy or seizure disorders were the next most frequent reason, followed by strokes and visual disorders.

Law enforcement referrals. The PI read the narrative provided by the data collector describing the reason for referral, and coded:

- when the narrative indicated that a crash occurred;
- the driving behavior that brought a driver to the attention of a law enforcement officer;
- the officer's observations about the driver's condition that prompted the referral for medical review; and
- whether potentially driver impairing medication was noted in the referral narrative.

Crash involvement was noted in just over half of the law enforcement referrals, which in and of itself would bring a driver to the attention of law enforcement. The driving behavior that either resulted in the crash or that caused the officer to make the traffic stop was provided in 91 of the 146 narratives, and is reported in Table C5. Running off the road and loss of control resulting from pressing the accelerator instead of the brake were two of the most frequent driving violations mentioned in the law-enforcement referrals. Other frequently mentioned driving errors were running stop signs, lane-keeping difficulty, driving the wrong way (into opposing traffic), and illegal or improper wide turns across multiple lanes of traffic.

Table C4. Medical Conditions or Functional Impairments Associated With Self-Referred and Physician-Referred Drivers in the Ohio Case Study Sample

Medical Condition or Functional Impairment[a]	Self-Referrals		Physician Referrals	
	Number of Cases (n= 294)	Percent of Self-Referral Cases	Number of Cases (n=49)	Percent of Physician Referral Cases
Diabetes	106	36.1%	--	--
Epilepsy or Seizure Disorder	81	27.6%	4	8.2%
Psychiatric Conditions (includes: depression, anxiety, bipolar, Asperger's, autism, ADD, ADHD, schizophrenia, Tourette)	28	9.5%	2	4.1%
Musculoskeletal (includes: cataplexy, cerebral palsy, amputations, fibromyalgia, knee replacement, left-sided weakness, paralysis in legs, muscular dystrophy, myasthenia gravis, multiple sclerosis, paraplegia, prosthetic leg, spina bifidia, arthritis)	23	7.8%	1	2%
Stroke	11	3.7%	3	6.1%
Heart Conditions (includes: atrial fibrillation, congestive heart failure, arteriosclerotic cardiovascular disease, and hypertension, postural orthostatic tachycardia syndrome)	10	3.4%	--	--
Pulmonary Conditions (includes: asthma, COPD, emphysema)	9	3.1%	1	2%
Parkinson's Disease and Essential Tremor	5	1.7%	--	--
Dementia	3	1%	17	34.7%
Peripheral Neuropathy	3	1%	1	2%
Sleep Disorders (includes: narcolepsy and Kleine-Levin syndrome)	2	0.7%	--	--
Syncope	2	0.7%	--	--
Traumatic Brain Injury	2	0.7%	--	--
Vertigo	1	0.3%	--	--
Right Foot Drop	1	0.3%	--	--
Vision (includes: Macular Degeneration, glaucoma, cataracts)	1	0.3%	3	6.1%
Cancer	1	0.3%	--	--
Encephalopathy	1	0.3%	--	--
Cognitive Impairment	--	--	11	22.4%
Unspecified Medical Condition	4	1.4%	6	12.2%

[a] There were 38 drivers with multiple conditions listed; Table C4 shows only the first condition listed.

Table C5. Driving Behavior That Brought Driver to the Attention of Law Enforcement in Ohio

Driving Behavior	Number of Cases (n=91)
Ran Off Road	10
Pedal Error (pressed accelerator instead of brake, or foot stuck on accelerator)	8
Ran Stop Sign	7
Wrong Way	6
Lane-Keeping Difficulty/Weaving	6
Illegal or Improper Wide Turn	6
Erratic or Reckless	5
Hit and Run	5
Driving Too Slow (plus weaving for a subset)	5
Struck Pedestrians or Bicyclists	4
Passed Out/Blacked Out/Fell Asleep	4
Ran Red Light	3
Stopped for No Reason	3
Fail to Yield	2
Speeding	2
Inattention or Looked and Didn't See	2
Near Crashes	2
Backed Into Someone's Yard	1
Driving on Flat Tires	1
Driving Disabled Vehicle	1
Multiple Past Crashes	1
Operating While Intoxicated	1
Driving in Median of Divided Highway	1
Repeatedly Struck Vehicle in Drive Through	1
Driver Rolled Backward and Struck Police Cruiser During Traffic Stop	1
Failure to Pull Over for Emergency Vehicle	1
Difficulty Handling Vehicle	1
Drove Through Barricade Into Spectator Area	1

Table C6 displays the driver condition that prompted the officer to refer the driver for medical review, either the officer's observation of a mental or physical impairment, or a driver's self-report (or passenger's report) of a medical condition or functional impairment. Such a condition was mentioned in 118 of the 146 narratives, and 10 cases indicated that the driver was taking potentially driver impairing medications. Confusion was noted most frequently, followed by the driver being lost. Other reasons for the referral included loss of consciousness while driving (diabetic reactions, falling asleep, blackouts, seizures), and observations of poor physical condition. Drivers often reported to the officer that they had medical conditions (e.g., dementia, Parkinson's disease, multiple sclerosis), prompting a referral for medical review. The 28 drivers whose referral narratives did not note driver condition ranged from 58 to 93; there were 22 who were 75 or older. The older age coupled with driving errors characteristic of drivers with medical or functional impairments (e.g., driving too slowly, pedal errors, weaving/failing to maintain lane, and failure to yield) may have prompted officers to refer these drivers for medical review.

Information about the medical conditions affecting the law enforcement referrals was available for 90 of the 146 drivers (either a physician's medical statement was returned or the driver self-reported the condition to the officer). The medical conditions associated within the subset of 90 law enforcement referrals were:

- heart conditions (21 drivers);
- musculoskeletal condition (13 drivers);
- dementia or cognitive decline (12 drivers);
- seizures or epilepsy (9 drivers);
- diabetes (8 drivers);
- psychiatric conditions (5 drivers);
- vision conditions (5 drivers);
- syncope (4 drivers);
- peripheral neuropathy (2 drivers);
- pulmonary conditions (2 drivers);
- stroke or transient ischemic attacks (2 drivers);
- renal disease (2 drivers); and
- cancer, essential tremor, Huntington's, Parkinson's disease, or narcolepsy (1 driver each).

Table C6. Description of Driver's Condition That Prompted Law Enforcement Officer's Referral for Medical Review in Ohio

Driver's Condition	Number of Cases (n=118)
Confused	21
Lost	12
Blacked Out or Lost Consciousness	11
Vision Problems (driver or family reported to officer)	11
Seizure	8
Disoriented	7
Driver Unaware of Crash	7
Diabetic Episode	6
Observed Mobility Limitations or Poor Motor Skills	6
Dementia (driver or family reported to officer)	5
Inattention or Looked and Didn't See (driver reported to officer)	5
Drowsy or Fell Asleep	2
Observed Uncontrolled Shaking	1
Pale and Lethargic	1
Most of Fingers Missing	1
Unstable Behavior	1
Driver Babbling	1
Delusional	1
Driver Thought Vehicle Was Stolen	1
Arthritis (self-reported to officer)	1
Back Spasm (self-reported to officer)	1
Bipolar (self-reported to officer)	1
Brain Tumor (self-reported to officer)	1
Dizzy (self-reported to officer)	1
Huntington's Disease (self-reported to officer)	1
Multiple Sclerosis (self-reported to officer)	1
Parkinson's Disease (self-reported to officer)	1
Psychiatric Disorders (self-reported to officer)	1
Physical Afflictions (self-reported to officer)	1

Court referrals. No reason was provided for three of the four court referrals. For the fourth referral, the court requested a medical evaluation because the driver crashed as the result of a loss of consciousness.

Licensing agency representative referrals. Two of the three referrals for medical review resulted from a renewing driver failing the vision screen. Both drivers were provided with a vision screening referral form to take to Ohio State University for further evaluation. Unless license applicants went to an eye care specialist affiliated with the Ohio State University School of Optometry (OSU), which provided an independent vision evaluation at the patient's cost, they were retested with the BMV's equipment. Drivers were not licensed unless they could attain acuity of at least 20/70, and a peripheral visual field of at least 70 degrees on one side and 45 degrees on the other. The BMV accepted readings provided by one of the OSU-contracted eye care specialists.

The third referral for medical review resulted from a deputy observing a customer who did not self-report any medical conditions but was using a wheelchair when applying for a Temporary Instruction Permit Identification Card.

Family member referrals. Family members of two drivers mailed letters to the BMV medical unit expressing concern about safe driving ability. Concern was due to dementia for one driver, and confusion and short-term memory loss for the other driver.

Referrals from unknown sources. Two drivers were referred from sources that could not be identified. One driver had been crash involved, so the referral could have come from law enforcement or a crash report. Notes indicated that this driver was taking medications that could have contributed to the crash. For the other referral, a medical form was received in the medical unit indicating a condition requiring road testing with hand controls.

Medical Review Requirements

When the BMV became aware of a driver with medical conditions or functional impairments, the Special Case Unit customer service assistants mailed the driver a "Request for Statement of Physician" form, and a letter advising that the driver was required to have the form completed and returned within 30 days. All drivers undergoing initial medical review were required to have this form completed and returned to the BMV. One question on the form asked the physician whether the patient's medical condition was sufficiently under effective medical control to operate a motor vehicle, and if "Yes," whether the driver should be required to take and pass a BMV vision, knowledge, and/or road test before the BMV made a licensing determination (see Figure C2). Another asked the physician whether the patient should be reevaluated in the future for continued licensure and, if so, what the re-evaluation interval should be (6 months, 1 year, or 4 years at the time of license renewal).

Special Case Unit customer service assistants evaluated the completed medical statements. Licensing decisions, including further BMV testing requirements, were based solely on the physician's professional opinion as recorded on the medical form. If testing was required (vision, road, and possibly knowledge testing), the BMV mailed a notice to the driver advising of the testing requirement, specifying that testing must begin within 30 days of the date of the notice to avoid license suspension. If a driver failed to comply with the testing requirement, a

suspension went into effect within 45 days of the date of the notice. Drivers were permitted to request up to two 30-day extensions (one at a time) to begin testing.

In your professional opinion, is this patient's condition(s), on this date, sufficiently under effective medical control to operate a motor vehicle?

PLEASE NOTE: IF YOU ANSWER "YES" TO PARTS B, C, or D BELOW, THE EXAM WILL BE CONDUCTED NOW. THE EXAM(S) WILL BE CONDUCTED AT A DRIVER LICENSE EXAM STATION.

A. ☐ Yes. This patient **should be permitted to** retain driving privileges.

B. ☐ Yes. This patient **should be permitted to** retain driving privileges **only if** they can pass a partial driver license exam which consists of a vision screening and a road test for driving and maneuverability.

C. ☐ Yes. This patient **should be permitted to** retain driving privileges **only if** they can pass a vision exam.

D. ☐ Yes. This patient **should be permitted to** retain driving privileges **only if** they can pass a complete driver license exam which consists of a vision screening, written test of Ohio's laws and signs, and a road test for driving and maneuverability.

E. ☐ No. This patient **should not be permitted to** retain driving privileges.

Figure C2. Question 6 from the Ohio BMV request for statement of physician regarding fitness to drive and testing requirements for licensing determination.

Requirement to submit a physician's or vision specialist's statement. As noted above, all drivers undergoing medical review were required to have their treating physician complete and return a medical form to the medical unit within 30 days. The medical unit suspended licensure if the form was not received within 30 days. In the case study sample, 496 drivers were required to submit a physician's statement and 4 drivers were required only to submit a statement from their vision specialists. Three of the four drivers were referred for medical review because they failed the vision screen at renewal and the fourth driver renewed his or her license when out of State, requiring a vision specialist's statement. All four drivers complied with the requirement to submit the vision statement; three were deemed visually fit to continue with the medical review process. The fourth did not meet the BMV vision standards due to diabetic retinopathy and glaucoma, resulting in license suspension.

Of the 496 drivers required to submit a physician's statement, 6 voluntarily surrendered their licenses and were issued a State identification card in lieu of submitting the medical information, and 79 drivers had their licenses suspended for failing to comply with the reporting requirement. Drivers who voluntarily surrendered ranged from 76 to 94 years and averaged 86.8 years (*SD* = 6.2 years; *Mdn*=87.5 years). Drivers who failed to have their physicians submit the medical form ranged from 29 to 95 years old, and averaged 74.4 years old (*SD*=15.2 years; *Mdn*= 80 years).

Of the 411 drivers who obtained a physician's statement, 33 were deemed not medically safe to drive and their licenses were suspended. This included 7 females and 26 males, ranging from 27 to 89 years old (*M*= 72.8 years, *SD*=18.1; *Mdn*= 81 years) with the following medical conditions:

- dementia (14 drivers);
- seizures/epilepsy (6 drivers);
- Parkinson's disease (4 drivers);
- psychiatric or emotional conditions (4 drivers);

- diabetes (2 drivers); and
- multiple sclerosis, cancer, and stroke (1 driver each).

Based on the information provided in the medical and vision statements returned by the 381 drivers who were deemed medically fit, 59 were required to undergo BMV testing and 322 drivers were not. The testing requirements for these 59 drivers are described below.

BMV vision test only. Four drivers were required to take and pass only the vision test. One driver had glaucoma, one was blind in one eye, and one had both macular degeneration and cataracts. No information about the vision condition for the fourth driver was provided. All four drivers complied with the vision test requirement, passed the test, and retained licensure.

BMV vision and road test. Thirty-three drivers were required to take both the BMV vision test and the road test. The medical conditions associated with these drivers included:

- peripheral neuropathy (7 drivers);
- musculoskeletal conditions (6 drivers);
- cognitive impairments or dementia (3 drivers);
- diabetes (2 drivers);
- seizures (2 drivers);
- visual conditions (2 drivers);
- stroke (2 drivers);
- essential tremor (1 driver);
- traumatic brain injury (1 driver);
- vertigo (1 driver); and
- unspecified (6 drivers).

Two drivers, an 87-year-old female and a 65-year-old male, did not comply with the testing requirement, resulting in license suspension. Of the 31 drivers who complied with the testing requirements, 26 passed both tests and retained licensure, and 5 drivers, males ranging in age from 86 to 92, failed the road test and received license suspensions.

BMV vision, knowledge, and road test. Twenty-two drivers were required to take all three BMV tests (vision, knowledge, and road). The medical conditions associated with these drivers included:

- cognitive impairment or dementia (5 drivers);
- musculoskeletal conditions (4 drivers);
- heart conditions (2 drivers);
- Parkinson's disease (1 driver);
- chronic obstructive pulmonary disease (1 driver);
- stroke (1 driver);
- chronic renal failure (1 driver); and
- unspecified medical conditions (7 drivers).

Nine drivers did not comply with these testing requirements and their licenses were suspended. These drivers ranged in age from 33 to 86 and averaged 71.2 (*SD* = 17.2; *Mdn*= 79).

Of the 13 drivers who tested, 8 failed and were suspended, and 5 passed and retained licensure. Drivers who failed included 7 who failed the knowledge test and one who passed the knowledge test but failed the road test. They included 4 males and 4 females ranging in age from 69 to 99 years old, and averaging 83.5 (*SD*=10.3; *Mdn*= 85).

Requirement for examination by driver rehabilitation specialist. The Ohio BMV did not refer drivers to driver rehabilitation specialists for their assistance in making fitness to drive determinations. In eight cases, it was noted that the driver's physician had referred them to an occupational therapy driving evaluation program before completing the physician medical statement.

Medical Review Outcomes

Figure C3 shows the referral sources and the licensing process and outcomes across the sample of 500 case study drivers referred for medical review. Table C7 presents the licensing outcomes for the total sample of 500 drivers, as well as by referral source.

Nearly half of the case study sample retained licensure, but either had restrictions and/or were required to submit periodic medical/vision reports as a result of medical review. Just over one-fourth of the case study sample lost licensure as a result of medical review, either because they were deemed not medically fit, they failed BVM tests, they voluntarily surrendered their licenses in lieu of submitting medical/vision reports or attempting BMV tests, or they failed to comply with medical review requirements. There was no change in the license status for nearly one-fourth of the case study sample.

Twenty-five drivers received license restrictions as a result of the medical review process. These included:

- adaptive equipment (16 drivers), including combinations of:
    - power steering (12 drivers);
    - spinner knob (12 drivers);
    - automatic transmission (10 drivers);
    - all hand controls (8 drivers);
    - modified accelerator (4 drivers); and
    - modified turn signals (2 drivers);
- dual outside mirrors (9 drivers);
- corrective lenses (7 drivers)[6]; and
- daytime only (2 drivers).

[6] An additional 52 drivers who self-referred during renewal or upon initial license application received corrective lenses, but their vision tests and resulting restrictions were the result of the licensing process and not the medical review process. These 52 drivers would have received the corrective lens restriction independent of their referral for medical review, and are not included in the analyses of drivers requiring a vison screen or receiving restrictions.

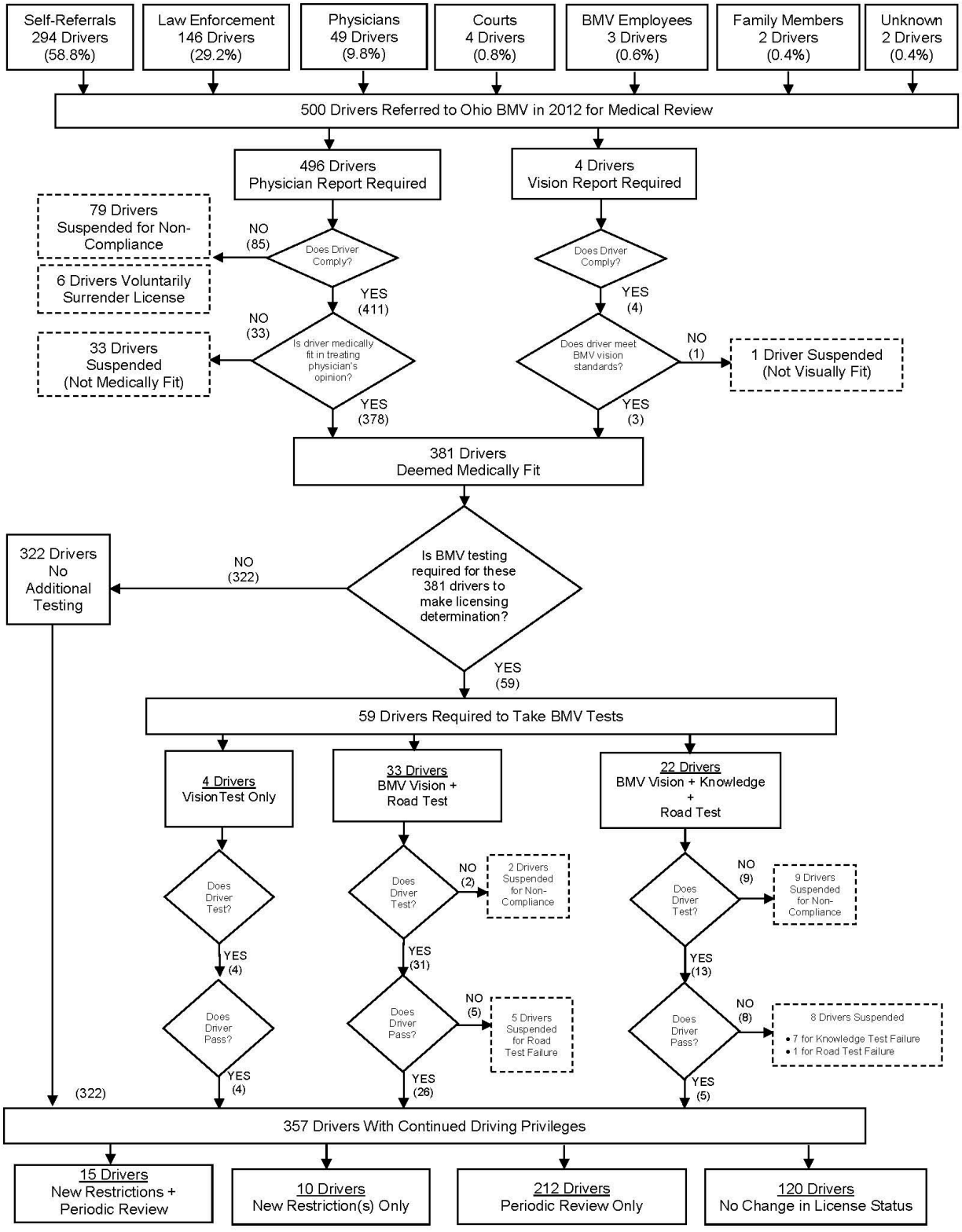


Figure C3. Medical review process and outcomes for 500 drivers referred to the Ohio Bureau of Motor Vehicles.

Table C7. Medical Review Process Licensing Outcomes, by Referral Source in Ohio Case Study Sample

Referral Source	Number of Drivers	Change in License Status as a Result of Medical Review							
		New Restriction Only (Row %)	Periodic Review Only (Row %)	New Restriction + Periodic Review (Row %)	Suspension (Medically Unfit) (Row %)	Suspension (Test Failure) (Row %)	Suspension (Fail to Comply With Reexam Requirements) (Row %)	Voluntary Surrendered Own License (Row %)	No Change (Row %)
Self	294	7 (2.4%)	168 (57.1%)	8 (2.7%)	8 (2.7%)	2 (0.7%)	15 (5.1%)	1 (0.3%)	85 (28.9%)
Law Enforcement	146		33 (22.6%)	3 (2.1%)	12 (8.2%)	6 (4.1%)	56 (38.4%)	3 (2.1%)	33 (22.6%)
Physicians	49	2 (4.1%)	8 (16.3%)	2 (4.1%)	11 (22.4%)	4 (8.2%)	19 (38.8%)	1 (2%)	2 (4.1%)
Courts	4		2 (50%)	1 (25%)		1 (25%)			
BMV Representative	3		1 (33.3%)	1 (33.3%)	1 (33.3%)				
Family Member	2				2 (100%)				
Unknown	2	1 (50%)						1 (50%)	
Total	500	10 (2%)	212 (42.4%)	15 (3%)	34 (6.8%)	13 (2.6%)	90 (18%)	6 (1.2%)	120 (24%)

Self-referrals were more likely than other referral sources to result in a periodic review requirement, and accounted for the largest proportion of drivers with no change in license status. This is logical, as this sample was younger than the law enforcement and physician-referred samples, and included drivers applying for a license for the first time who indicated having a medical condition. The mere presence of a medical condition does not mean that functional ability is impaired; for example, diabetes controlled by diet, without medication. Periodic monitoring to ensure that the condition remained under control was deemed appropriate, rather than suspending or restricting licensure. Physician referrals were more likely than other referral sources to result in a suspension for a medical condition not under sufficient control for safe driving.

Physician referrals were also slightly more likely than self- and law-enforcement referrals to result in a driving restriction. Physician referrals were the least likely source to result in no change in license status, where the sample size included more than four cases. This is also logical, as the physician referral sample age averaged 80.5 and included a large percentage of drivers with cognitive impairment or dementia (57%). The severity of the medical conditions associated with the older drivers in the physician-referred sample was likely higher than that of conditions in the self-referred sample, causing functional impairment and impacting safe driving ability. In addition, the older, physician-referred sample is more likely than the younger self-referred sample to have had multiple medical conditions and to be treated with multiple medications, both likely to affect functional ability and safe driving performance.

The outcomes of the law enforcement referrals fell between those for self-referrals and physician referrals. Law enforcement referrals were less likely than physician referrals but more likely than self-referrals to result in suspensions for insufficiently controlled medical conditions and for failing the BMV tests. Drivers referred by law enforcement and by physicians were equally likely to be suspended for failing to comply with medical review requirements and both more likely than self-referrals. These findings may also be associated with the proportion of older drivers in the law enforcement (71% were 65 or older) and physician-referred (88% 65 or older) samples whose medical conditions reached a level of severity that impacted functional ability. These older, medically impaired drivers may have been more accepting of opting out of licensure (or knew they could not pass the tests, and therefore did not comply with the BMV testing requirements) than their younger counterparts in the self-referral sample, where only 17% were 65 or older.

Licensing outcomes can be grouped into three broad categories. The first, a licensing action based on medical fitness to drive and BMV test performance, includes suspension as medically unsafe to drive, suspension for failing BMV tests, license restriction(s), or required periodic review (collapsing across the first 5 outcomes in Table C7). The second category is loss of licensure when drivers opt out of participating in the medical review process (either by voluntarily surrendering their licenses, or not complying with medical reporting or testing, and having their licenses suspended). The third category is no license action (the last column in Table C7). Drivers in this category retain the same license status they had before medical review referral. Such referrals may function as a warning flag for diminished driving safety, if that driver is subsequently referred for medical review.

Comparing these broad licensing outcomes for cases referred by law enforcement, physicians, and self-referrals, indicates that physician referrals were *less likely* to result in no change in licensing status, and that physician referrals and self-referrals were *more likely* than law enforcement referrals to result in a change in license status due to medical fitness to drive and performance on BMV knowledge and road tests. Referrals by law enforcement and physicians were equally likely (and both more likely than self-referrals) to result in drivers opting out of licensure.

Table C8 presents the contingency table showing observed and expected frequencies (where the expected frequencies were calculated by multiplying the total frequencies common to the cell, and dividing by the total 489). A smaller number of physician and law enforcement referrals than expected resulted in no change in license status, while a larger number of self-referrals resulted in this outcome than expected. A larger number of self-referrals than expected resulted in a licensing action based on medical/functional guidelines or DMV test performance, while a smaller number of law enforcement referrals resulted in this outcome than expected. Referrals generated by physicians performed as expected, based on their proportions in the sample, for this outcome. A chi-square test using these three categories showed a significant difference in medical review outcomes for these three referral sources (X^2=99.41, d.f.=4, p<0.005). No statistical tests of significance were performed for cases referred by the remaining sources in Table C7, due to the small sample sizes. However, all cases referred by family members, the courts, and BMV representatives resulted in a licensing action as a result of medical fitness to drive or BMV test performance.

Table C8. Chi-Square Contingency Table Showing Observed and Expected (in parentheses) Values for Medical Review Outcomes by Referral Source

Referral Source	Result of Medical Review on License Status			Total
	License Action: Periodic Review, Restriction, or Cancellation for Medically Unfit or Test Failure	Opt Out of Licensing: Suspension for Failure to Comply With Medical Review Requirements or Voluntary Surrender	No Change in License Status	
Self	193 (165)	16 (57)	85 (72)	**294**
Law Enforcement	54 (82)	59 (28)	33 (36)	**146**
Physicians	27 (27)	20 (10)	2 (12)	**49**
Total	**274**	**95**	**120**	**489**

Case Disposition Time

The time between the date the driver was referred and the date the BMV opened the case ranged from 0 to 273 days, and averaged 17.1 days (*SD*=20.1; *Mdn*= 12). The case opened date was the date the Special Case Unit received the completed medical form. Seventy percent of the cases were opened within 15 days of the date of the referral, 87% within 30 days of referral, 93% within 45 days of referral, and 94% within 60 days. The time between referral and case opening varied depending on the method the medical form was submitted to the Special Case Unit: returned by the driver in-person at an exam station versus mailed or faxed. Delays may have

occurred when the exam stations held medical forms for two weeks before mailing a bundle in one envelope to the main office. Delays may also have occurred when applicants for a Temporary Instruction Permit Identification Card (TIPIC) took the vision and knowledge exam, and did not tell the examiner that they had a potentially impairing medical condition. The medical issue may not have been disclosed until the applicants went to the Deputy Registrar to purchase the TIPIC and were given the same questionnaire. In such cases, the TIPIC was issued without a completed medical form, but drivers could not take the driving and maneuverability tests until they returned the completed medical form (and had awaited the mandatory TIPIC holding time of 6 months). For such drivers, the case opening date was delayed until the applicant returned to the exam station with the completed physician examination report and took the driving and maneuverability tests.

The outlier with 273 days between referral and case opening was an original applicant who disclosed a medical condition at the time of the initial TIPIC application, but the medical form was not returned before the TIPIC was issued. The applicant was not permitted to road test until the medical form was returned. The case was opened the date the medical form was received in the medical unit, which was at the time the driver road tested, following the mandatory TIPIC holding time. Eliminating this driver from the analyses of case opening times results in a range of 0 to 121 days (M=16.6, SD = 16.5).

Case disposition time is presented as the number of days that elapsed between the time the BMV opened the case (received the medical statement) and the date the BMV determined the license action (disposition date). Across the sample of 500 drivers, case disposition time ranged from 0 to 193 days, and averaged 35.6 days (SD = 36.3; Mdn= 32). Thirty-eight percent of the cases were completed within 15 days, 48.6% within 30 days, 61.2% within 45 days, and 82.2% within 60 days.

Case disposition times are described below, for four sets of cases:

- 34 drivers who were suspended as not medically fit following the BMV's review of a physician/vision specialist examination report;
- 85 drivers who failed to submit the requested physician's report or surrendered their licenses in lieu of submitting the report (and required no BMV tests);
- 322 drivers who were deemed medically fit following the BMV's review of a physician examination report, with no additional testing required; and
- 59 drivers deemed medically fit and required to take the BMVs tests.

Suspensions as medically or visually not fit. Based on information provided by the treating physician or vision specialist, 34 drivers were determined to be not medically safe to drive and were suspended. Case disposition time for these drivers averaged 36.9 days (range 0-85 days, SD = 20.9; Mdn= 38.5). Thirty-two percent of these cases were completed within 30 days and 91% within 60 days.

Suspensions for failure to submit physician's report. There were 85 drivers who were required to submit a physician's examination report and either failed to do so and were therefore suspended (79 drivers) or voluntarily surrendered their licenses in lieu of submitting the medical forms (6 drivers). Case disposition time for these drivers averaged 61 days (range 21 to 160 days,

SD = 21.7; *Mdn*= 57). Five percent of these cases were completed within 30 days (a subset of those who voluntarily surrendered their licenses) and 80% within 60 days.

Medically fit and no further testing required. The disposition time for the 322 drivers deemed medically fit, with no additional BMV testing required ranged from 0 to 190 days, and averaged 21.8 days (*SD*=30.1; *Mdn*= 0). Sixty-eight percent of these cases were completed within 30 days, and 89% within 60 days.

Medically fit and required to undergo BMV testing. The disposition time for the 59 drivers required to undergo BMV testing before a licensing determination could be made ranged from 6 days to 193 days, and averaged 73.6 days (*SD*=43.8; *Mdn*= 64s). Forty-four percent of these cases (26 of 59) had disposition times of 60 days or less, while 64% (38 of 59) had disposition times of 90 days or less. The longer disposition times resulted from multiple attempts at passing the knowledge and/or road test. As a reminder, four opportunities were permitted within a 6-month period, and although drivers who failed were suspended after the first opportunity and were required to be accompanied by a licensed driver for subsequent tests, case study drivers were coded as failed only after their final testing opportunity within the 6-month period, or failure to show for additional testing after one or more failed attempts.

Table C9 presents a summary of case disposition times for the 59 drivers required to take the BMV tests based on medical review requirements and licensing outcomes.

Table C9. Case Disposition Times for 59 Drivers Required to Take and Pass Ohio BMV Tests, by Licensing Outcome

Licensing Outcome	Number of Cases	Case Disposition Time (Days)			
		Range	Average	Standard Deviation	Median
Passed and Were Licensed	35	6-171	70.9	45	62
Suspension for Test Failure	13	12-138	58.8	31.6	53
Suspension for Non-Compliance With Testing Requirement	11	53-193	99.6	44.5	94

A brief summary of the longest case disposition time in each of the three categories is provided below. The driver with the 171-day disposition time was referred by a physician who requested license revocation due to dementia. The medical form was returned by a different physician, with a diagnosis of mild depression, requesting the vision, knowledge, and driving tests, which the driver passed. The driver with the 138-day disposition time was referred by a physician with concerns regarding mild cognitive impairment and Parkinson's disease, and requested a vision test and driving test. The driver was allowed an extension to prepare for the driving test. The driver passed the vision test, and then attempted and failed the driving test four times and was suspended for 6 months before attempting another driving test (which was never attempted). The driver with the 193-day disposition time was referred by a law enforcement officer, following a traffic violation and the officer's observation that the driver was confused. The treating physician requested vision, knowledge, and driving tests. The driver passed the vision test and then passed the knowledge test on the third attempt. The driver did not attempt the driving test, and was therefore suspended for failing to comply with the medical review testing requirements.

Feedback to Reporting Source

The Ohio BMV did not provide feedback to any reporting source regarding the outcome of medical review, for drivers referred for medical review.

Case Cost

Case cost could not be estimated on a case-by-case basis for this study.

Appeal of Licensing Action

None of the case study drivers appealed the licensing agency's determination.

Additional Analyses

Drivers deceased following medical review. Thirty-two of the case study drivers (6.4% of the sample) were reported to the BMV as deceased within the 2-year period following their case disposition dates. The range of days between license disposition and death was 5 to 633 days, and averaged 251 days (*SD* = 164.8; *Mdn*= 227). At the time of their referral, these drivers ranged from 34 to 93 years old, with an average of 78.7 (*SD* = 12.9; *Mdn*= 80.5). Twenty-two had been referred by law enforcement, 5 by a physician, and 5 were self-referrals. Eleven of the 32 had maintained licensure as a result of their medical reviews, 4 had been suspended as medically unsafe, 14 had been suspended for failing to comply with medical review requirements, 2 had been suspended for failing BMV tests, and 1 voluntarily surrendered their license.

License reinstatements following suspension for seizure. As described earlier, identifying the license status of any particular driver is often a function of when the researcher reviewed the driver's license file. Drivers who received a suspension due to a seizure were coded for the study as suspended/medically not fit. License reinstatement in Ohio required drivers to submit an acceptable report from their treating physician indicating that their patient's condition was "sufficiently under effective medical control to operate a motor vehicle." The consultant noted if and when these drivers submitted an acceptable medical statement and had their licenses reinstated. This illustrates that license status may change as health status improves or deteriorates.

All six drivers whose licenses were suspended following referrals indicating seizures submitted an acceptable physician's statement, but licenses were reinstated for only five drivers. One driver was not reinstated following submission of an acceptable medical report because the physician (not the referring physician) requested a vision and driving exam, which the driver did not take, and instead surrendered licensure. For the 5 drivers whose licenses were reinstated, the time period between the license suspension and the reinstatement ranged from 118 to 168 days, and averaged 145.6 days (*SD*=19.6 days). All five were required to submit periodic medical statements, with review cycles at 6 months (2 drivers), 1 year (1 driver), and at renewal (2 drivers). One of the five reinstated drivers experienced another seizure nine months following reinstatement. This driver was again suspended and then reinstated four months later, based on an acceptable medical statement.

Appendix D: Detailed Summary of 500-Driver Case Study in Oregon

Case Study Sample Selection

A total of 4,660 drivers were referred to the Oregon Driver and Motor Vehicle Services (DMV) for medical review in 2012. The list was reduced to 3,441 drivers after excluding duplicate referrals, drivers referred because of alcohol abuse, and drivers with a CDL endorsement who were operating a commercial vehicle when they were referred. To determine whether there were seasonal or demographic variations in referrals in developing a sampling plan, the PI requested a de-identified list of the 3,441 cases, including the case opened or referral date, and driver age and sex. Oregon did not track these data, and meeting this request would have required a manual review of each case. Therefore, the research team developed a plan to sample representatively within the two Oregon licensing databases (*at-risk* and *re-exam*) used to identify the set of 3,441 drivers, as follows.

The *at-risk* database contained drivers referred under the mandatory reporting program (referrals from physicians and health care providers of people with severe cognitive and/or functional impairments that cannot be corrected or controlled by surgery, medication, therapy, and/or a driving device or technique). Such drivers received immediate license suspensions. Thirty-one percent of the referrals (1,074 drivers) were from the "at-risk" database.

The *re-exam* database contained drivers referred through the non-mandatory reporting program, and included:

- self-reports of medical conditions on driver licensing and renewal applications;
- law enforcement reports;
- family reports;
- reports from medical professionals who were not required to report under the medical reporting program; and
- voluntary reports from medical professionals with concerns about their patients' driving safety, but whose conditions did not yet meet the mandatory reporting threshold of severe and uncontrollable.

Re-exam database drivers were required to have their medical provider complete a Driver Medical Report form, and/or undergo DMV testing (vision, knowledge, and drive tests). Sixty-nine percent of the referrals (2,367 drivers) were from the re-exam database.

The Oregon medical programs coordinator created two driver lists, one from each database, sorted by referral date. Within referral date, drivers were sorted by license number. This permitted the data collectors to sample from the lists proportionately, by selecting 31% of the 500 case study sample (155 drivers) from the "at-risk" list, and 69% of the 500 cases (345 drivers) from the "re-exam" list, spread out over the entire year. The data collectors selected the 6^{th} driver from each list (driver 6, 12, 18, etc.). Exclusion criteria included:

- drivers who were operating a motorcycle or moped at the time they were referred;
- drivers referred by a court as adjudicated mentally incompetent;

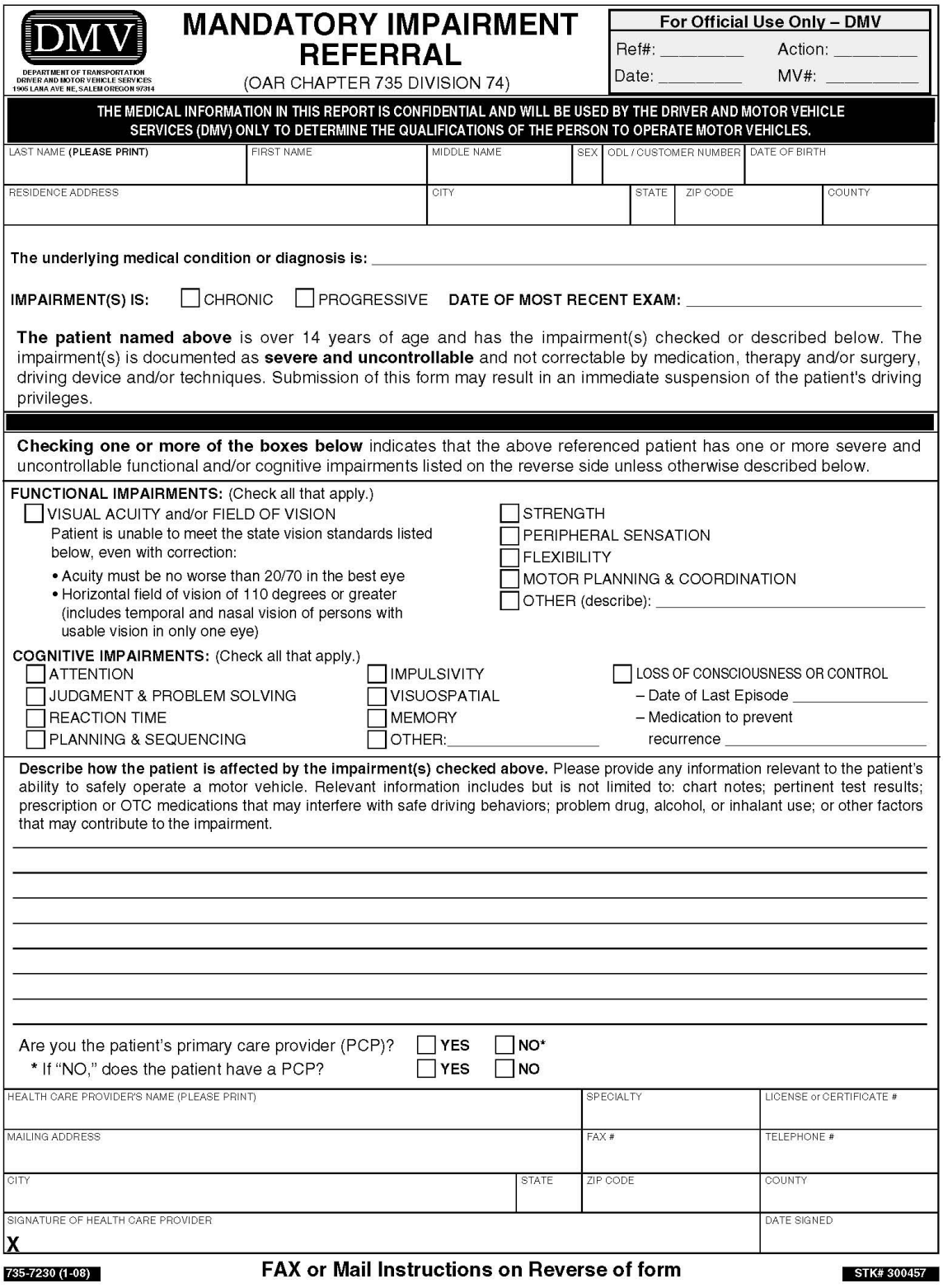
- drivers who died before completing the medical review process;
- drivers who moved out of State before completing the medical review process;
- drivers who were already suspended or cancelled when they were referred (for non-medical review related issues, such as traffic violations, failure to pay fines or provide insurance, and driving under the influence of alcohol or other intoxicants); and
- drivers with an expired license at the time they were referred.

If one of the "every 6th" drivers met the exclusion criteria, then the prior driver on the list was sampled (the 5th driver in that set of 6 drivers).

Data Entry

Two recently retired Oregon Driver and Motor Vehicle Services employees served as consultants, one a driver licensing operations/policy analyst, and the other from the Accident Reporting and Insurance Verification Department. The medical programs coordinator provided the consultants with both lists of drivers, described previously. The study sample drivers' licensing and medical files included scanned images of referral notices, medical statements, crash reports, medical determination officers' reports, and other documentation. The consultants provided detailed notes regarding the reason for referral, which allowed for post coding by the PI to describe how drivers came to the attention of law enforcement (crash or observed driving behavior), what observations about the person's condition led the officer to refer the driver for medical review, and what medical conditions, cognitive and/or functional impairments prompted referrals by physicians and health care providers.

The time window for coding license disposition was determined as follows. Oregon had a mandatory reporting law requiring physicians and health care providers to report people whose cognitive and/or functional impairments were likely to affect safe driving ability because they were *severe and uncontrollable*. *Severe and uncontrollable* meant the impairment(s) substantially limited a person's ability to perform activities of daily living, including driving, because it could not be controlled or compensated for by medication, therapy, surgery, or adaptive devices**.** When the DMV received a Mandatory Impairment Referral Form (see Figure D1) that met the criteria for a mandatory referral, the DMV immediately suspended the person's license, and mailed the driver a letter stating that their license would be immediately suspended (within 5 days of the date of the letter). People had several choices at that point: they could turn in their driver license and obtain a DMV-issued identification card; or they had the right to request a hearing under Oregon's Administrative Procedures Act. The DMV thus deemed the driver "not medically fit to drive" based on the mandatory referral, without requesting additional medical information from the treating medical provider (via a DMV medical examination report). Similarly, a non-mandatory report that indicated a driver's medical condition presented an immediate threat to safety (usually from a physician or law enforcement) resulted in immediate suspension, without requiring a medical report from the treating physician. If a suspended individual subsequently submitted an acceptable medical report (i.e., approved by the medical determination officers as medically fit to drive), licensure was reinstated (sometimes with the requirement to pass the vision, knowledge, and drive tests).



DMV

DEPARTMENT OF TRANSPORTATION
DRIVER AND MOTOR VEHICLE SERVICES
1905 LANA AVE NE, SALEM OREGON 97314

MANDATORY IMPAIRMENT REFERRAL

(OAR CHAPTER 735 DIVISION 74)

For Official Use Only – DMV

Ref#: _____ Action: _____

Date: _____ MV#: _____

THE MEDICAL INFORMATION IN THIS REPORT IS CONFIDENTIAL AND WILL BE USED BY THE DRIVER AND MOTOR VEHICLE SERVICES (DMV) ONLY TO DETERMINE THE QUALIFICATIONS OF THE PERSON TO OPERATE MOTOR VEHICLES.

LAST NAME (PLEASE PRINT)	FIRST NAME	MIDDLE NAME	SEX	ODL / CUSTOMER NUMBER	DATE OF BIRTH

RESIDENCE ADDRESS	CITY	STATE	ZIP CODE	COUNTY

The underlying medical condition or diagnosis is: _____

IMPAIRMENT(S) IS: ☐ CHRONIC ☐ PROGRESSIVE **DATE OF MOST RECENT EXAM:** _____

The patient named above is over 14 years of age and has the impairment(s) checked or described below. The impairment(s) is documented as **severe and uncontrollable** and not correctable by medication, therapy and/or surgery, driving device and/or techniques. Submission of this form may result in an immediate suspension of the patient's driving privileges.

Checking one or more of the boxes below indicates that the above referenced patient has one or more severe and uncontrollable functional and/or cognitive impairments listed on the reverse side unless otherwise described below.

FUNCTIONAL IMPAIRMENTS: (Check all that apply.)

☐ VISUAL ACUITY and/or FIELD OF VISION
Patient is unable to meet the state vision standards listed below, even with correction:
- Acuity must be no worse than 20/70 in the best eye
- Horizontal field of vision of 110 degrees or greater (includes temporal and nasal vision of persons with usable vision in only one eye)

☐ STRENGTH
☐ PERIPHERAL SENSATION
☐ FLEXIBILITY
☐ MOTOR PLANNING & COORDINATION
☐ OTHER (describe): _____

COGNITIVE IMPAIRMENTS: (Check all that apply.)

☐ ATTENTION
☐ JUDGMENT & PROBLEM SOLVING
☐ REACTION TIME
☐ PLANNING & SEQUENCING
☐ IMPULSIVITY
☐ VISUOSPATIAL
☐ MEMORY
☐ OTHER:_____
☐ LOSS OF CONSCIOUSNESS OR CONTROL
– Date of Last Episode _____
– Medication to prevent recurrence _____

Describe how the patient is affected by the impairment(s) checked above. Please provide any information relevant to the patient's ability to safely operate a motor vehicle. Relevant information includes but is not limited to: chart notes; pertinent test results; prescription or OTC medications that may interfere with safe driving behaviors; problem drug, alcohol, or inhalant use; or other factors that may contribute to the impairment.

_____

_____

_____

_____

_____

_____

_____

_____

Are you the patient's primary care provider (PCP)? ☐ **YES** ☐ **NO***

* If "NO," does the patient have a PCP? ☐ **YES** ☐ **NO**

HEALTH CARE PROVIDER'S NAME (PLEASE PRINT)		SPECIALTY	LICENSE or CERTIFICATE #
MAILING ADDRESS		FAX #	TELEPHONE #
CITY	STATE	ZIP CODE	COUNTY
SIGNATURE OF HEALTH CARE PROVIDER			DATE SIGNED
X			

735-7230 (1-08)

FAX or Mail Instructions on Reverse of form

STK# 300457

Figure D1. Mandatory Impairment Referral Form for mandatory physician reports to the Oregon DMV (Form 735-7230, page 1 of 2).

INSTRUCTIONS TO HEALTH CARE PROVIDER

1. Please complete the first page with your findings and recommendations. Attach any additional information, including test results and chart notes, that will assist DMV in determining a patient's ability to safely operate a motor vehicle.

2. **FAX** *or mail* medical information and completed forms on the patient to:

DMV - DRIVER SAFETY UNIT	Phone:	(503) 945-5083
1905 LANA AVE NE	TTY:	(503) 945-5001
SALEM, OR 97314-4120	**FAX:**	**(503) 945-5329**

Submission of this Mandatory Impairment Referral form is in compliance with HIPAA regulations for the release of medical information.

IMPAIRMENT DEFINITIONS

The definitions listed below are to be used by physicians and health care providers as an aid to correctly identify the impairment listed on the front of this form. The definitions apply to those impairments that are documented as severe and uncontrollable, **and** not correctable by medication, therapy and/or surgery, **and** not correctable by driving device and/or technique.

PERIPHERAL SENSATION OF EXTREMITIES (Including but not limited to):
- Tingling and numbness and loss of position sense in extremities affecting the ability to feel, grasp, manipulate or release objects or use foot controls effectively.

STRENGTH (Including but not limited to):
- The inability to consistently maintain a firm grip on objects.
- The inability to apply consistent pressure to objects with legs and feet.
- Weakness or paralysis of muscles affecting the ability to maintain sitting balance.
- Weakness or paralysis in extremities affecting the ability to feel, grasp, manipulate or release objects or use foot controls effectively.

FLEXIBILITY (Including but not limited to):
- Rigidity and/or limited range of mobility in neck, torso, arms, legs or joints.

MOTOR PLANNING AND COORDINATION (Including but not limited to):
- Difficulty and slowness in initiating movement.
- Vertigo, dizziness, loss of balance or other motor planning conditions.
- Involuntary muscle movements.
- Loss of muscle control.

ATTENTION (Including but not limited to):
- Decreased awareness.
- Reduction in ability to efficiently switch attention between multiple objects.
- Reduced processing speed.

JUDGMENT AND PROBLEM SOLVING (Including but not limited to):
- Reduced processing speed.
- An inability to understand a cause and effect relationship.
- A deficit in decision-making ability.

REACTION TIME (Including but not limited to):
- A delayed reaction time.

PLANNING AND SEQUENCING (Including but not limited to):
- A deficit in the ability to anticipate and/or react to changes in the environment.
- Problems with sequencing activities.

IMPULSIVITY (including but not limited to):
- Lack of emotional control.
- Lack of decision–making skills.

VISUOSPATIAL (Including but not limited to):
- Problems determining spatial relationships.

MEMORY (Including but not limited to):
- Problems with confusion and/or memory loss.
- A decreased working memory capacity.

LOSS OF CONSCIOUSNESS OR CONTROL

Figure D1. Mandatory Impairment Referral Form for mandatory physician and health care provider reports to the Oregon DMV (Form 735-7230, page 2 of 2).

Because the study focus was the medical review outcome, if an immediately suspended case study driver submitted an acceptable medical report from their treating medical provider within 60 days of their suspension, the consultants coded the driver as medically fit, and continued to code the case including subsequent medical review testing requirements and their outcomes. This matched the 60-day window the DMV allowed referred drivers who were not immediately suspended to comply with medical review requirements such as submitting medical reports, vision reports, and passing DMV tests before a suspension was imposed (see discussion below for non-mandatory reporting referrals).

For a non-mandatory (voluntary) report, the driver may have been required to submit a medical and/or vision report, and/or to take the DMV tests. Drivers who were required to submit a physician's report were mailed a letter describing this requirement, noting that failure to submit the requested medical information within 30 days would result in a notice of license suspension, effective 30 days from that notice (i.e., suspension effective date was 60 days from the original notice of the requirement). For those who did *not* comply with the requirement to submit a medical report, the consultants coded case disposition as the date the notice of suspension was mailed (as opposed to the suspension effective date). If a driver who was suspended for failure to submit a medical report complied within the second 30-day period (i.e., within 60 days of the request for medical information), the consultants coded that driver as compliant with the medical report requirement, and continued to code the remaining medical review requirements and outcomes.

Similarly, drivers required to take the DMV tests had to do so within 30 days of the notice; failure to comply resulted in a suspension. If both a medical report and DMV testing were required, drivers were given 60 days to comply before a suspension notice was mailed, with an effective suspension date 30 days following notice of suspension, plus an additional 5 days for mailing the letter (95 days from the notice of testing requirements to the suspension effective date). The consultants coded case disposition as the date the notice of suspension was mailed. Drivers who were not immediately suspended maintained legal licensure for the 30 to 60 days permitted for submitting medical reports and to comply with testing requirements.

People were limited to 5 drive test attempts for a Class C driver's license within a 12-month period. There was a mandatory waiting period between test attempts: 7 days between the first and second attempts; 14 days between the second and third attempts; 28 days between the third and fourth attempts; and another 28 days between the fourth and fifth attempts. No further tests were permitted for one year from the date of a failed fifth test. There was no limit to the number of times a knowledge test could be attempted. Four knowledge tests were permitted on successive days, but a fifth knowledge test could be conducted no sooner than 28 calendar days following the fourth attempt. Any subsequent knowledge test must have been conducted no sooner than 28 days from the prior knowledge test. Since the study focus was the medical review outcome, if a driver's license was suspended for failing to pass the DMV drive test within the 60-day period, but the driver continued to test, the consultants coded the licensing outcome for the final (5^{th}) test attempt, even though the license was suspended during the subsequent attempts. If drivers failed multiple knowledge tests, were suspended, and then continued to fail subsequent knowledge tests, the consultant coded the case disposition date as the date the driver was notified of the suspension.

For a subset of the case study drivers who took the tests early in the year and received license suspensions, data were missing in the files to allow a determination of whether the suspension was due to attempting but failing to pass the tests, or for failing to comply with the requirement to test. The medical review outcome for this group of case study drivers is shown as a license suspension in the medical review process and outcomes flow chart at the testing stage (see Figure D2), separate from those whose licenses were suspended for failing to test, or for failing the tests.

Sample Demographics

Table D1 presents the age and sex distribution of the 500 drivers selected for the case study. Overall, males represented 56% of the sample, and larger percentages of males than females were present in most age groups. The average age of the case study sample was 73.2 years (range 16 to 98 years, *SD*=16.7). The median age was 78 years.

Researchers were unable to compare the demographics of the sample to the entire pool of drivers referred for medical review in 2012, as extracting the sex and birthdate of all 3,441 drivers would have required a time consuming manual undertaking for DMV staff.

Drivers65 and older accounted for 78% of the case study sample, but only 19% of the licensed population of drivers in the same year. Males and females were equally represented among the population of licensed drivers (49.7% and 50.3%, respectively).[7] If the sample of 500 drivers was representative of the entire pool of drivers referred for medical review in 2012, this indicates that males and older drivers were overrepresented among the population of drivers referred for medical review, compared to their proportion of the licensed driver population in the State.

Table D1. Oregon Case Study Sample Demographics (n=500)

Age Group	Case Study Total	Age Group Percent of Sample	Number of Males	Number of Females	Percent Male	Percent Female
16-24	6	1%	5	1	83%	17%
25-34	21	4%	13	8	62%	38%
35-44	15	3%	9	6	60%	40%
45-54	33	7%	20	13	61%	39%
55-64	33	7%	22	11	67%	33%
65-74	81	16%	43	38	53%	47%
75-84	173	35%	89	84	51%	49%
85-94	133	27%	79	54	59%	41%
95+	5	1%	2	3	40%	60%
Total	**500**	**100%**	**282**	**218**	**56%**	**44%**

[7] Federal Highway Administration (FHWA). (2013). *Highway Statistics, 2012*. Table DL-22 Licensed Drivers by State, Sex, and Age Group. Office of Highway Policy Information. Washington, D.C.

Referral Source

Table D2 presents the proportion of referrals by referral source and average age in the case study sample. Physicians referred nearly three-fourths of the sample and law enforcement referred 15%. The average age of physician- and law enforcement-referred drivers was 73 years. Drivers referred by family members and concerned citizens were generally older (averaging 80 years). The two referral sources included as "others" were a health care provider and adult protective services.

Interestingly, the case study sample included no self-referrals. The PI followed up with the Oregon DMV medical programs coordinator to inquire whether the sampling strategy unintentionally excluded self-referrals or whether there were indeed very few self-referrals within the medical referral population. The DMV medical programs coordinator was not surprised by this finding, and advised that the DMV receives few to none of these, as customers generally do not self-report medical conditions on the license application or renewal form.

Table D2. Proportion of Referrals by Referral Source in the Oregon Case Study Sample

Referral Source	Number in Sample (%)	Average Age (SD)	Median Age
Physicians	368 (73.6%)	72.8 (16.4)	78
Law Enforcement	77 (15.4%)	73.1 (18.1)	79
Family Members	23 (4.6%)	79.9 (11.5)	78
Licensing Agency Representatives	17 (3.4%)	77.3 (16.9)	86
Concerned Citizens	8 (1.6%)	80.1 (9.2)	82.5
Crash Reports	5 (1.0%)	52.2 (30.1)	66
Other	2 (0.4%)	75 (7.1)	75

Oregon's mandatory reporting law for health care providers likely accounted for the large proportion of referrals for medical review by physicians. Oregon Revised Statute 807.710 dictated that designated health care providers were required to report people whose cognitive and/or functional impairment(s) affected that person's ability to safely operate a motor vehicle. Physicians who submitted a mandatory report to DMV in good faith were immune from civil liability, as were physicians who chose not to submit a mandatory report. As a result of the passage of HB 2195, beginning January 1, 2014, physicians and health care providers were also immune from civil liability for submitting non-mandatory (*voluntary)* reports in good faith to DMV. All mandatory and non-mandatory reports submitted by physicians and health care providers, including the name of the person submitting the report, were kept confidential and could not be admitted as evidence in any civil or criminal action. A report could, however, be used in an administrative hearing or an appeal from an administrative hearing in which the person's qualification to operate a motor vehicle was at issue. Oregon Administrative Rule 735-074-0080 defined a Mandatory Reporter as:

- a physician or health care provider acting in the capacity of a person's primary care provider;
- a physician or health care provider rendering specialized or emergency health care services to a person who does not have a primary care provider; or
- an ophthalmologist or optometrist providing health care services to a person who does not meet DMV vision standards (OAR 735-062-0050).

Reason for Referral

Physician and health care provider referrals. The PI read the narratives describing the reason for referral, and broadly categorized the medical conditions, and cognitive and/or functional impairments prompting the physicians and health care providers to refer the 368 drivers in the sample (see Table D3). Multiple impairing conditions were described for 73 of the 368 referrals. In categorizing medical conditions, cognitive, and/or functional impairments for Table D3, the PI selected conditions such as loss of consciousness and control and cognitive impairments/diagnoses such as dementia and memory loss over physical conditions and diagnoses such as diabetes, heart disease, and COPD. Therefore, the presence of these secondary conditions among the physician- and health care provider-referred drivers is under-represented in Table D3. For example, co-existing conditions for 17 of the 53 drivers categorized as cognitive impairment included: poor balance, difficulty walking, arthritis, minimal physical strength, COPD, sleep apnea, macular degeneration, visual field defect, frozen shoulder, etc. The PI categorized phrases such as "poor problem solving, judgment, memory, planning and sequencing" and "the driver scored poorly on cognitive tests" as cognitive impairment.

Dementia was associated with the plurality of physician and health care provider referrals. Together, dementia, cognitive impairment, and memory loss comprised the reason for referral for over half of the physician and health care provider referrals while seizures, loss of consciousness, and epilepsy accounted for another 15%.

In addition to impairing conditions listed in the referral narratives, health care providers mentioned that their patients had experienced recent crashes (11 of the 368 referred drivers), and that 12 referrals were associated with use of driver-impairing medications.

Law enforcement referrals. The PI read the narratives describing the reason for the 77 law enforcement referrals, and coded:

- when the narrative indicated a crash occurrence;
- the driving behavior that drew the attention of a law enforcement officer;
- the officer's observations about the driver's condition that prompted the referral for medical review; and
- whether the referral narrative noted potentially driver-impairing medication.

Almost half of the law enforcement referrals noted crash involvement, which in and of itself would bring a driver to the attention of law enforcement. The driving behavior that caused the officer to make the traffic stop was provided in 35 of the 39 remaining narratives (see Table D4). Driving the wrong way (on a one-way street or head-on into opposing traffic on the wrong side of the road), lane-keeping difficulty, and driving too slowly were the most frequent driver errors resulting in the traffic stops.

Table D3. Medical Conditions or Functional Impairments Associated With Physician- and Health Care Provider-Referred Drivers in Oregon Case Study Sample

Medical Condition or Functional Impairment[a]	Number of Drivers (n=368)	Percentage of Physician Referrals
Dementia	148	40.2%
Cognitive impairment	53	14.4%
Seizure	33	8.9%
Vision (includes macular degeneration, diabetic retinopathy, glaucoma, cataracts, double vision, acuity below standard, field of vision below standard)	25	6.8%
Loss of consciousness	20	5.4%
Physical impairments (includes arthritis, balance & coordination, loss of strength, peripheral neuropathy, gait instability, tremors, slow reaction time, ALS, multiple sclerosis, spinal cord injury)	17	4.6%
Stroke	14	3.8%
Memory loss	14	3.8%
Parkinson's disease	7	2%
Psychiatric/emotional (includes delusional disorder, paranoid psychosis, schizophrenia, bipolar)	6	1.6%
Alcohol or drug dependence or abuse (prescription and illicit)	5	1.4%
Hepatic encephalopathy	4	1.0%
Traumatic brain injury	3	0.8%
Diabetes	3	0.8%
Transient ischemic attacks	2	0.5%
Sleep disorders (includes narcolepsy and sleep apnea)	2	0.5%
Respiratory (includes respiratory failure and COPD)	2	0.5%
Getting lost in familiar places	2	0.5%
Epilepsy	2	0.5%
Multiple crashes or unsafe driving performance	2	0.5%
Vertigo	2	0.5%
End stage renal disease	1	0.3%
Ventricular fibrillation arrest	1	0.3%

[a] Multiple impairing conditions were described for 73 of the 368 referrals. The most likely condition to be driver impairing was selected for categorization in this table.

Table D4. Driving Behavior That Brought Driver to the Attention of Law Enforcement, in Oregon

Driving Behavior	Number of Cases With Descriptions (n=35)
Lane-keeping difficulty	3
Too slow	4
Lane-keeping difficulty + too slow	6
Wrong way	6
Stopping for no reason	2
Reckless or speeding	2
Near crashes	3
Ran stop sign or red light	2
Dangerous left turn	1
Unsafe passing	1
Driving on shoulder	1
Attempting to hit pedestrians	1
DUII Arrest	1
Welfare check on driver parked with keys in door	1
Swerving, hitting curb resulting in flat tire, and continued driving on flat tire	1

Table D5 displays the driver condition that prompted the officer to refer the driver for medical review, either the officer's observation of a mental or physical impairment, or a driver's self-report (or other passenger's report) of a medical condition or functional impairment. Such a condition was mentioned in 67 of the 77 narratives, and 7 cases included comments about use of potentially driver-impairing medications. Observations of cognitive impairment (e.g., confusion, disorientation, lost, unaware, and dementia) were the most frequent reasons for referral. There was no mention of driver condition in 10 narratives; 8 of these 10 referrals involved drivers70 or older, and 6 involved a crash. The older age coupled with crashes or driving errors characteristic of drivers with medical or functional impairments listed in Table D4 (e.g., lane-keeping difficulties, driving too slowly, and stopping for no reason) may have prompted officers to refer these drivers for medical review).

Family member referrals. Table D6 summarizes the reasons provided for the 23 family-member referrals, and shows that concerns about cognitive impairments were the most prevalent. Three drivers were noted as having had a recent crash.

Table D5. Description of Driver's Condition That Prompted Law Enforcement Officer's Referral for Medical Review in Oregon

Driver's Condition	Number of Cases With Descriptions (n=67)
Confused	9
Vision (includes macular degeneration, recent eye surgery, difficulty with night vision, "didn't see," and wearing 2 sets of glasses)	8
Disoriented	7
Unaware	3
Lost	3
Dementia	3
Seizure	3
Stroke	3
Blacked out/loss of consciousness	2
Heart problems	2
Parkinson's disease	2
Cognitive impairment + balance issues	1
Combative/defensive	1
Denial of poor driving behavior	1
Diabetes and vertigo	1
Dialysis resulting in lethargy	1
Dizzy + recent hospitalization	1
Fell asleep	1
Hearing impairment	1
Hypoglycemia	1
Memory problems	1
Mental health issues	1
Missing/endangered subject	1
Multiple sclerosis	1
Neuromuscular disease	1
Neuropathy in feet	1
No longer familiar with vehicle	1
Poor judgment	1
Problems with knee range of motion and ability to take foot off gas pedal	1
Rambling	1
Severe medical conditions (unspecified)	1
Slow reaction time	1
Using a walker, on oxygen, appears blind in one eye	1

Table D6. Description of Driver's Condition That Prompted Family Member Referrals for Medical Review in Oregon

Driver's Condition	Number of Drivers (n=23)
Dementia	6
Cognitive impairments	3
Confusion	2
Memory loss	1
Physical impairments (arthritis, slow RT, no head/neck ROM, mobility impairment)	3
Stroke	2
Parkinson's disease	1
Psychiatric/emotional (Bipolar/schizophrenia)	1
Vision impairment	1
Loss of consciousness	1
Heart condition	1
Multiple crashes	1

Licensing agency representative referrals. Initial and renewal license applicants were required to answer the following three questions on the application form:

- Do you have a vision condition or impairment that has not been corrected by glasses, contacts or surgery that affects your ability to drive safely?
- Do you have any physical or mental conditions or impairments that affect your ability to drive safely? If Yes:
    - What is the condition or impairment?
    - Describe how this affects your ability to drive safely.
- Do you use alcohol, inhalants, or controlled substances to a degree that affects your ability to drive safely? If Yes:
    - Describe how your use affects your ability to drive safely.

The applicant was required to report only ongoing medical conditions, impairments, and use of alcohol, inhalants or controlled substances that made them unable to drive safely. The applicant was not required to report a temporary medical issue such as a broken arm, a condition that occurred only once and no longer affected their driving, or a medical issue that improved their ability to drive safely such as a new pair of glasses. DMV reviewed all "Yes" answers with the applicant; the applicant was permitted to change a "Yes" answer to "No" at any point in the process, however, the license application included a perjury statement that any false statement would result in cancellation or suspension of the license, and if convicted, a fine and/or jail sentencing. A DMV vision screening was required if, after DMV review and clarification, the answer remained "Yes" to the vision question. Applicants who failed the vision screening were referred to a licensed vision specialist for a professional examination.

If, after DMV review and clarification, the answer regarding the applicant's medical conditions/impairments or use of alcohol, inhalants, or controlled substances remained "Yes," the licensing agency employee denied the driver licensure and made a medical referral to the DMV Driver Safety Unit.

Drivers' vision was screened upon initial licensure and again at each 8-year renewal upon reaching age 50. The DMV screened for acuity and field of vision, and issued a driver permit or license only to people whose eyesight, with best possible correction, met the following standards:

- **Acuity:** The person must have a visual acuity level of 20/70 or better when looking through both eyes (or one eye if the person has usable vision in only one eye). Persons with usable vision in both eyes met the standard if the visual acuity level in one eye was worse than 20/70 so long as the visual acuity level in the other eye was 20/70 or better.

- **Field of vision:** The person must have a field of vision of 110 degrees.

Except in the case of bioptic-telescopic lenses, drivers could meet the eyesight check standards with the use of corrective lenses. Drivers who required corrective lenses to meet the vision standards were restricted to driving only when wearing corrective lenses. The DMV issued a driver permit or driver license to people who wore bioptic-telescopic lenses only if the

person could meet the vision standards when looking through the carrier lens (not the telescopic device).

When the corrected visual acuity of the person's best eye was worse than 20/40 and no worse than 20/70, DMV restricted the person to daylight driving only, unless, in the written opinion of a licensed vision specialist (ophthalmologist, or optometrist), the person's driving should not be restricted to daylight driving only. If a person's eyesight did not meet the vision standard, the DMV issued a Temporary Driver's Permit which was valid for 60 days. In order to renew their license, the individual was required to submit a vision examination form (Certificate of Vision, Form 24) signed by a licensed vision specialist (ophthalmologist or optometrist) indicating their vision is satisfactory for driving; the applicant then had to comply with all other driver license renewal requirements.

Twelve of the 17 case study referrals by DMV representatives resulted from vision limitations. In nine of these cases, the driver failed the DMV vision screening (acuity and or field of vision below the standard), in two the driver indicated having macular degeneration, and in one a driver reported a progressive vision impairment.

Two drivers were referred by DMV employees because of physical impairments: one because of muscle weakness resulting from congenital myasthenic syndrome, and the other due to missing both legs and no drive test indicated in the past 40 years. Two drivers were referred for observed cognitive impairments: one was confused about how to complete the renewal application, had difficulty finding her license, and thought her license photograph was being taken when the vision screening was administered; and the other driver exhibited disorientation. One driver was referred due to failure on a voluntary drive test.

Referrals from concerned citizens. The eight referrals from citizens other than family members referenced concerns about drivers' cognitive functioning; two specifically mentioned concerns due to dementia. One referral that mentioned dementia included concerns about the driver's peripheral neuropathy and inability to feel the pedals, total deafness, and using a walker. One referral that mentioned cognitive impairment included concerns about the effects of transient ischemic attacks, specifically weakness and lack of coordination.

Of the remaining three referrals, one referenced vision limitations, one mobility issues accompanied by unsafe driving practices, and one careless driving coupled with use of alcohol and multiple medications.

Crash reports. Of the five crash reports that triggered medical review, three were Oregon Insurance and Accident Reports and two were law enforcement crash reports. DMV staff reviewed Oregon Traffic Accident and Insurance Reports for indications that a medical impairment may have contributed to the crash. Oregon law required completion of these reports by crash-involved drivers within 72 hours that met the following criteria: damage to the driver's vehicle over $1,500; an injury (regardless of how minor); death; damage to any one person's property over $1,500; or any vehicle with damage over $1,500 and any vehicle towed from the crash scene as a result of damages. Drivers identified as potentially medically impaired following DMV review of Form 735-32 were required to have their treating physician or health care

provider complete and submit a Driver Medical Report. In one of these reports, the driver indicated becoming seriously ill and striking another car while turning, another indicated having a seizure and didn't recall what happened, and the third indicated losing consciousness due to a drop in blood sugar, losing control of the vehicle, and hitting a building.

One law enforcement crash report involved a fatal crash resulting from a driver with diabetes who lacked awareness and had slow reaction time. A fatal crash automatically triggered a medical review. The other law enforcement report described the driver as having had a seizure which caused the crash.

Other referral sources. Both referrals by other sources noted concerns about dementia, including drivers getting lost in familiar areas and incapable of following the rules of the road. One referral was submitted by adult protective services and the other by a health care provider on behalf of the patient's family member.

Medical Review Requirements

The medical review requirements could include submission of detailed medical information from a driver's medical provider, vision specialist or both; passing the DMV vision, knowledge, and drive tests; or no other requirements (i.e., immediate suspension).

Oregon DMV did not have an MAB, but their four medical determination officers (MDOs) performed case review functions similar to those of physicians on MABs in other States by determining medical fitness to drive, and assisting in developing DMV medical guidelines. The four MDOs shared one full-time permanent position within the DMV reviewing case files as needed (collectively, approximately 20 hours and 280 cases per month). Two of the MDO physicians were internists, one was a physiatrist, and one was an osteopath. All four had an informal specialty in disability determinations, and one was the lead medical consultant for Oregon DHS Disability Determination Services. DMV could require MDO review for a determination of medical eligibility in situations where DMV had determined that testing (e.g., vision, knowledge, or drive) could not be used to establish eligibility. A voluntary report of loss of consciousness or control that DMV was unable to clear as "low risk" required clearance by the MDO. Loss of consciousness or control could occur from a variety of conditions including but not limited to seizure disorders, diabetes mellitus, hypoglycemia, hyperventilation, migraine, vertigo, narcolepsy, sleep apnea, cardiac arrhythmia, cardiac syncope, supraventricular arrhythmia, ventricular tachycardia, ventricular fibrillation, and substance abuse. MDO review of the person's medical eligibility for testing was also required on all mandatory reports of severe and uncontrollable cognitive impairments. A report of vision that did not meet State standards required certification by a vision specialist (i.e. ophthalmologist, optometrist) showing that vision did meet State standards as well as medical clearance from the MDO.

The MDOs were involved in case review for 69 of the 500 drivers in the sample (13.8%) as of the case disposition date coded for this study. MDOs may have reviewed medical information submitted subsequent to the study-defined case disposition date to determine medical eligibility for people whose medical conditions may have improved or who have met criteria indicated by the MDOs such as seizure-free timeframe. Such reviews and any resulting licensing actions are not reflected in these data.

No medical reporting or testing requirements. DMV could immediately suspend a driver's license based on the information provided in a medical provider-submitted Mandatory Impairment Referral Form or in a referral from another source (usually law enforcement-submitted Driver Evaluation Request with attached crash report), without additional information from the medical provider or DMV testing, if the information in the referral indicated the driver presented an immediate danger to safety ("high risk"). The DMV did not seek the opinion of their medical determination officers when applying an immediate suspension. Of the 500 case study drivers, 323 (64.6%) were immediately suspended. Referral sources for the immediately suspended drivers included:

- physicians and other treating medical providers (288 drivers);
- law enforcement (31 drivers);
- Oregon Traffic Accident and Insurance Reports (2 drivers);
- family member (1 driver); and
- Adult Protective Services (1 driver).

Immediately suspended drivers ranged from 16 to 98 years, and averaged 71.8 years (*SD*=17.1). The median age was 77 years. Table D7 presents the medical conditions or functional impairments associated with referrals resulting in immediate suspension.

Within 60 days of immediate suspension, 20 of the 323 drivers submitted medical or vision statements from their physicians to obtain medical recertification. Three drivers were medically cleared following review of the physician statements by DMV staff, without the need for medical determination officer (MDO) opinion. The MDOs reviewed the remaining 17 physician statements, and medically cleared 16 of the 17 drivers. Of the 19 drivers medically cleared, 14 were required to pass vision, knowledge and drive tests before their suspension could be lifted. The medical conditions or functional impairments associated with the 19 drivers who were medically cleared were:

- dementia (4 drivers);
- cognitive impairment (4 drivers);
- loss of consciousness or seizure (4 drivers);
- visual impairments (2 drivers);
- Multiple Sclerosis (1 driver);
- impaired balance and coordination (1 driver);
- narcolepsy (1 driver);
- unaware of medication side effects and drives while taking driver impairing medications (1 driver); and
- heart attack (1 driver, inaccurately self-diagnosed).

Table D7. Medical Conditions/Impairments and Number of Cases in Oregon Sample Immediately Suspended

Medical Condition or Functional Impairment	Number of Drivers (n=323)
Dementia	129
Cognitive impairment	39
Seizure	30
Loss of consciousness	19
Vision (includes macular degeneration, diabetic retinopathy, glaucoma, cataracts, double vision, acuity below standard, field of vision below standard)	18
Physical impairments (includes arthritis, balance & coordination, loss of strength, peripheral neuropathy, gait instability, tremors, slow reaction time, ALS, multiple sclerosis, spinal cord injury)	15
Memory loss or getting lost in familiar places	15
Stroke or TIA	12
Confused or disoriented	8
Psychiatric/emotional (includes delusional disorder, paranoid psychosis, schizophrenia, bipolar)	7
Parkinson's disease	5
Alcohol or drug dependence or abuse (prescription and illicit)	5
Hepatic encephalopathy	4
Sleep disorders (includes narcolepsy and sleep apnea) or fell asleep	3
Vertigo or dizzy	3
Heart conditions	3
Traumatic brain injury	2
Respiratory (includes respiratory failure and COPD)	2
Epilepsy	2
Diabetes	1
End stage renal disease	1

Subtracting the 19 drivers who were immediately suspended but subsequently medically cleared from the 323 drivers immediately suspended, leaves 304 drivers who remained suspended as a result of the information provided in the referral (60.8% of the case study sample), and 196 drivers who continued through the medical review process.

Requirement to submit a treating medical provider's or vision specialist's statement. Of the 196 drivers eligible to continue with the medical review process (the 177 drivers not immediately suspended and the 19 drivers who received medical clearance subsequent to their immediate suspension), 109 drivers were required to submit more detailed information about their medical or vision condition (21.9% of the total sample of 500). Both a treating medical provider and a vision statement were required for 10 drivers, only a treating medical provider statement was required for 71 drivers, and only a vision statement for 28 drivers.

Twenty-nine drivers (5.8% of the total sample of 500 drivers) did not submit the required information and consequently lost licensure. MDO reviewed one of the 29 drivers, even though no medical information was returned. The consultants did not provide notes to explain the MDO review. It is assumed that DMV requested MDO review of the referral information to determine whether the driver should be immediately suspended or should be required to submit medical

information (i.e., an assessment of risk level). The referral involved family member report of Alzheimer's disease, multiple unreported crashes, and observed driving incidents. The family member also indicated that the driver's neurologist requested the patient complete driving tests.

No additional medical information was required for 68 of the 196 drivers, and 19 drivers had already submitted treating medical provider statements to obtain medical clearance.

Medical fitness to drive. Based on the information submitted in the medical and vision statements for the 80 drivers who complied with the reporting requirement, 48 were deemed medically eligible and 32 drivers' licenses were suspended as medically not safe to drive. The medical conditions or functional impairments associated with the 32 suspended drivers are shown in Table D8.

The medical determination officers determined medical ineligibility for 28 of the 32 drivers receiving suspensions. In two of the four suspended cases not requiring MDO opinion, a vision specialist returned the vision certificate indicating vision did not meet the standard. In the other two cases, medical providers completed the requested medical information and concurrently submitted a Mandatory Impairment Referral Form recommending suspension.

Combining the 32 drivers suspended as medically ineligible following review of their medical reports with the 304 drivers remaining suspended as a result of the information presented in the initial referral, results in a total of 336 drivers (67.2% of the total sample of 500) receiving license suspensions because they were deemed not medically safe to drive.

The MDOs provided an opinion for 23 of the 48 cases in which drivers were deemed medically fit, and included cases with:

- dementia and cognitive impairment;
- confusion and disorientation;
- Parkinson's disease;
- seizures and other losses of consciousness;
- heart condition; and
- psychiatric condition.

MDO opinion was <u>not</u> sought for 25 of the 48 cases deemed medically fit. These included 23 vision-related cases, one case involving muscular weakness resulting from congenital myasthenic syndrome, and one case in which the physician indicated the reported condition did not affect the patient's safety to drive.

Table D8. Medical Conditions/Impairments and Number of Cases in Oregon Sample Suspended as Medically Not Fit Following Review of Medical and/or Vision Statements

Medical Condition or Functional Impairment	Number of Drivers (n=32)
Dementia	10
Seizure	7
Diabetes	4
Vision (includes macular degeneration, diabetic retinopathy, glaucoma, cataracts, double vision, acuity below standard, field of vision below standard)	2
Stroke or TIA	2
Heart conditions	2
Physical impairments (neuromuscular disease similar to multiple sclerosis)	1
Psychiatric/emotional (bipolar/schizophrenia)	1
Parkinson's disease	1
Alcohol or drug dependence or abuse (prescription and illicit)	1
Respiratory (COPD)	1

Subtracting the 336 drivers suspended as not medically fit and the 29 drivers suspended for failing to submit medical and/or vision statements from the total sample of 500 results in 135 drivers deemed medically fit. Of these 135 drivers, 23 were licensed without any further DMV testing, and 112 were required to take and pass the DMV tests before a licensing determination could be made. Included in the set of 112 drivers required to take the DMV tests were 67 of the 68 drivers not required to submit a treating medical provider or vision specialist's statement. The driver who was neither required to submit medical/vision information or take any DMV tests was referred on a Vision Statement form, where the vision specialist recommended restricting to daylight driving only with corrective lenses.

Also included among the 112 drivers required to demonstrate their driving skills were 14 of the 19 drivers immediately suspended but medically cleared. The 5 drivers in the set of 19 who were not required to test included 4 drivers with losses of consciousness for various reasons (hypoglycemic event, narcolepsy, seizure, and anxiety-related) who were medically cleared with a 1-year recertification requirement, and one whose vision specialist indicated vision met DMV standards, but recommended restriction to daytime only driving, and recertification in 6 months.

DMV test requirements. Of the 112 drivers required to take the DMV tests, 90 were required to take vision, knowledge, and drive tests, 9 the drive test only, 8 both the knowledge and drive test, and 5 the vision test only.

Eight drivers voluntarily surrendered their licenses in lieu of testing (or completing testing). These included 6 females and two males ranging from 71 to 94, with an average age of 82 (*SD*=8.6). The median age was 81.5. Four who voluntarily surrendered did not attempt any of the tests, three after failing the knowledge test, and one after passing the knowledge test but failing the drive test.

An additional 49 drivers had their licenses suspended for failing to comply with the testing requirements. This included 22 males and 27 females ranging in age from 62 to 97, with an average age of 80.4 (*SD*=7.7; *Mdn*= 81).

Seven additional drivers were suspended, but the DMV files did not contain adequate documentation to determine whether they were suspended for failing to comply with the testing requirements or for attempting and failing the tests. This included four males and three females ranging in age from 82 to 95, with an average age of 87.1 (*SD*=4.7; *Mdn*= 86).

Test outcomes of the 48 remaining drivers who attempted the tests were as follows: All 5 drivers required to take the vision test complied, passed the test, and retained licensure. Of the 43 drivers who attempted the knowledge and drive tests, 21 passed and retained licensure, and 22 failed and lost their licenses. Of the 22 drivers suspended for test failure, 13 failed the knowledge test and 9 the drive test. Drivers who failed the tests included 14 males and 8 females ranging in age from 36 to 96, and averaging 80.1 (SD=12.5; *Mdn*= 82). The 21 drivers who passed the knowledge and drive tests included 17 males and four females ranging in age from 50 to 90, and averaging 72.6 (*SD*=11.9).

Combining the 21 drivers who passed the knowledge and drive tests, the 5 who passed the vision test, and the 23 deemed medically fit and requiring no additional testing, results in 49 drivers out of the total sample of 500 (9.8%) with continued licensure following medical review.

Medical Review Outcomes

Figure D2 shows the referral sources and the licensing process and outcomes across the sample of 500 case study drivers referred for medical review. Table D9 presents the licensing outcomes for the total sample of 500 drivers, as well as by referral source.

There was no change in the license status for 2 of the 500 case study drivers. They retained licensure with no new restrictions or periodic medical and/or vision report requirements. Just fewer than 10% of the study sample retained licensure with new restrictions and/or were required to submit periodic medical/vision reports. The overwhelming majority (90.2%) lost their licenses as a result of medical review because they were deemed not medically fit, failed DMV tests, voluntarily surrendered their licenses in lieu of submitting medical/vision reports or attempting DMV tests, or failed to comply with medical review requirements.

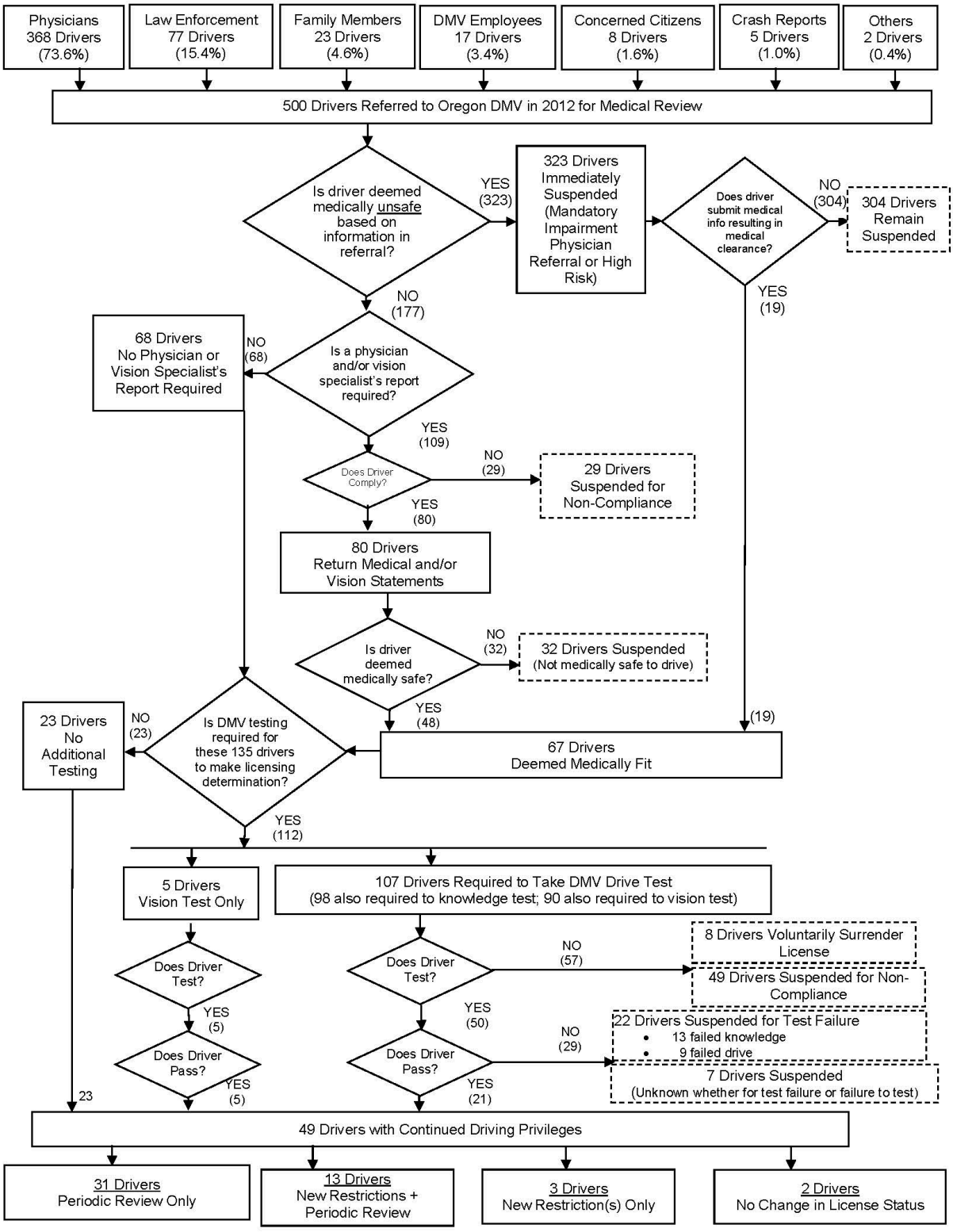


Figure D2. Medical review process and outcomes for 500 drivers referred to the Oregon Driver and Motor Vehicle Services Division.

Table D9. Medical Review Process Licensing Outcomes, by Referral Source, in the Oregon Case Study

Referral Source	Number of Drivers	Change in License Status as a Result of Medical Review							
		New Restriction Only (Row %)	Periodic Review Only (Row %)	New Restriction + Periodic Review (Row %)	Suspension (Medically Unfit) (Row %)	Suspension (Test Failure) (Row %)	Suspension (Fail to Comply With Reexam Requirements[a]) (Row %)	Voluntary Surrendered Own License[b] (Row %)	No Change (Row %)
Physicians	368	2 (0.5%)	15 (4.1%)	3 (0.8%)	289 (78.5%)	11 (3.0%)	45 (12.2%)	3 (0.8%)	
Law Enforcement	77		3 (3.9%)	1 (1.3%)	36 (46.8%)	9 (11.7%)	25 (32.5%)	3 (3.9%)	
Family Member	23		3 (13.0%)		6 (26.1%)	2 (8.7%)	9 (39.1%)	1 (4.3%)	2 (8.7%)
DMV Employee	17	1 (5.9%)	5 (29.4%)	8 (47.1%)			3 (17.6%)		
Concerned Citizen	8		3 (37.5%)	1 (12.5%)	2 (25.0%)		1 (12.5%)	1 (12.5%)	
Crash Reports	5		2 (40.0%)		2 (40.0%)		1 (20.0%)		
"Other" (Adult Protective Services; Health Care Provider)	2				1 (50.0%)		1 (50.0%)		
Total	500	3 (0.6%)	31 (6.2%)	13 (2.6%)	336 (67.2%)	22 (4.4%)	85 (17.0%)	8 (1.6%)	2 (0.4%)

[a] Includes 7 drivers suspended for unknown cause (either for failure to test or for test failure).

[b] In lieu of complying with testing requirements, or following one or two test failures, the driver chose to give up their licenses, and completed paperwork to formally surrender their license, rather than complete the re-examination testing.

Licensing outcomes can be grouped into three broad categories. The first is a licensing action based on medical or functional guidelines or DMV test performance. This includes the outcomes of suspension for medically unsafe to drive, suspension for failing DMV tests, restricted licenses, or a periodic review requirement (collapsing across the first 5 outcomes in Table D9). The second category includes loss of licensure when drivers opt out of participating in the medical review process (either by voluntarily surrendering their licenses, or not complying with medical reporting or testing, and having their licenses suspended). The third category is no license action as a result of the medical review process (the last column in Table D9). Drivers in this category retained the same licensing status they had before they were referred for medical review. Referrals resulting in no change in license status following medical review may function as a warning flag for diminished driving safety, if that driver is subsequently referred for medical review. This project focused on initial referrals for medical review, so the data could not be used to validate this potential benefit.

Only 2 of the 500 cases, both referrals from family members, resulted in no change in license status. One was a 90-year-old driver who had three at-fault crashes in the prior 4-month period. No medical or vision information was required for case review, and the driver passed the vision, knowledge, and drive tests. The other case involved a 64-year-old referred due to concerns about a possible cardiac condition affecting safe driving performance. The driver submitted the requested physician report and was found medically eligible by the MDOs with no DMV testing required.

The most common outcome across all reporting sources was licensing action based on medical or functional guidelines or DMV test performance (81% of the case study sample), and this was observed for all reporting sources shown in Table D9 with five or more referrals. Eighty percent or more of the cases referred by physicians, DMV employees, and crash reports, and well over half of the referrals by law enforcement and concerned citizens resulted in a licensing action based on medical or functional guidelines or DMV test performance. Referrals by family members were only slightly more likely to result in such a licensing action than in drivers opting out of licensing.

A chi-square test using these three broad licensing outcomes showed a significant difference in medical review outcomes for the seven referral sources (X^2=77.43, d.f.=12, p<0.005). Table D10 presents the contingency table showing observed and expected frequencies (where the expected frequencies were calculated by multiplying the total frequencies common to the cell, and dividing by 500). A larger number of physician referrals than expected resulted in a licensing action based on medical/functional guidelines or DMV test performance, while a smaller number of law enforcement and family member referrals resulted in this outcome than expected. Referrals generated by DMV employees, concerned citizens, and review of crash reports performed as expected, based on their proportions in the sample.

Table D10. Chi-Square Contingency Table Showing Observed and Expected (in parentheses) Values for Medical Review Outcomes by Referral Source

Referral Source	Result of Medical Review on License Status			Total
	License Action: Periodic Review, Restriction, or Cancellation for Medically Unfit or Test Failure	Opt Out of Licensing: Suspension for Failure to Comply With Medical Review Requirements or Voluntary Surrender	No Change in License Status	
Physicians	320 (298)	48 (68)	0 (1)	**368**
Law Enforcement	49 (62)	28 (14)	0 (0)	**77**
Family Members	11 (19)	10 (4)	2 (0)	**23**
DMV Employees	14 (14)	3 (3)	0 (0)	**17**
Concerned Citizens	6 (6)	2 (1)	0 (1)	**8**
Crash Reports	4 (4)	1 (1)	0 (0)	**5**
Other	1 (2)	1 (0)	0 (0)	**2**
Total	**405**	**93**	**2**	**500**

Because several assumptions/restrictions were violated for this chi square analysis (i.e., more than 20% of the expected counts were less than 5, and not all expected counts were greater than 1), a second chi-square analysis was performed using only the first two medical review outcomes (licensing action and opting out of licensure) and the first four referral sources (physicians, law enforcement, family members, and DMV employees). In this second analysis, the chi-square test also showed a significant difference in medical review outcomes for the four included referral sources (X^2=35.49, d.f.=3, p<0.005). There were no expected counts less than 1, but 25% of the expected counts were less than 5.

The types of new restrictions applied to the licenses of 16 drivers were associated with vision-related limitations, and included combinations of the following:

- daytime only (11 drivers);
- corrective lenses (9 drivers); and
- bioptic telescopic lenses (1 driver).

Case Disposition Time

The time between the date the driver was referred and the date the DMV opened the case ranged from 0 to 226 days, and averaged 5.5 days (*SD*=11.4 days). The median was 3 days. Four percent of the cases were opened the day they were referred, 69% were opened within 5 days, 94% within 15 days, and 98% within 30 days. It is likely that the referral date for a case that was opened 226 days following the referral was incorrectly entered into the database, as the case opened and case disposition dates were only 19 days apart (a physician referral resulting in suspension as medically not safe). Alternatively, the referral form or letter may have remained in

the physician's office for 226 days before being submitted to the DMV. Excluding this case, the time between the date the driver was referred and the date the DMV opened the case ranged from 0 to 45 days, and averaged 5.1 days (*SD*=5.7 days).

Case disposition time is presented as the number of days that elapsed between the date the DMV opened the case to the date defined as the case disposition date (the date a driver was notified of suspension as medically unfit to drive, or was notified of suspension for failing to comply with medical review requirements, or passed or failed DMV tests). Across the sample of 500 drivers, case disposition time ranged from 0 to 290 days, and averaged 23 days (*SD* = 38.3). The median was 1 day. Thirty-eight percent of the cases were resolved the same day they were opened, 62% were completed within 5 days, 65% within 15 days, 68% within 30 days, 77% within 45 days, 80% within 60 days, and 95% within 90 days.

Case disposition times are described below for four sets of cases:

- 304 drivers immediately suspended remained suspended as a result of the referral (requiring no additional medical information or testing);
- 61 drivers who either were cancelled as not medically fit following the DMVs review of a physician examination report or who were suspended for failing to submit the requested physician's report (and required no DMV tests);
- 23 drivers who were deemed medically fit following the DMV's review of a physician examination report, with no additional testing required; and
- 112 drivers deemed medically fit and required to take the DMV tests.

Immediate cancellations. The 304 immediate license cancellations required no physician or vision specialist examination and no MDO review for the Medical Review Department to determine a licensing action. Case disposition time ranged from 0 to 36 days, and averaged 1.1 days (SD=2.9; *Mdn*= 0). Fifty-nine percent of these cases were determined the same day the case was opened. The case with a disposition time of 36 days began as a referral from law enforcement requiring vision, knowledge, and drive testing, but 15 days following the letter to the driver advising him of the testing requirement, his physician submitted a Mandatory Impairment Referral Form indicating the driver had dementia and was not medically fit. The driver's license was therefore immediately suspended. Excluding this case, disposition time for immediate suspensions ranged from 0 to 19 days.

Cancellations based on a physician examination report. Based on information provided by the treating physician or vision specialist (when a physician or vision examination report was required for a medical review determination), 32 drivers were determined to be not medically safe to drive and their driving licenses were cancelled. Case disposition time for these drivers averaged 33 days (Range 6-83, *SD* = 17.2; *Mdn*=32). Forty-seven percent of these cases were completed within 30 days and 91% within 60 days.

Another 29 drivers were required to submit a physician and/or a vision examination report and failed to do so, resulting in license suspension. Case disposition time for these 29 drivers averaged 37.5 days (Range 30-77, *SD* = 9.3 *Mdn*=35). Sixty-two percent of these cases were completed within 35 days, 86% within 45 days, and 97% within 60 days. In the case that

took 77 days for a license disposition (suspend for failure to comply with requirement to submit a medical report), the driver was actually suspended within 35 days of the date the case was opened. However, the driver appealed the suspension and it was rescinded 19 days later, allowing the driver to legally drive pending findings of the hearing. The hearing was conducted 23 days following release of the suspension, and the judge found in favor of the DMV. The suspension for failure to submit medical information was reinstated.

Medically fit and no further testing required. The disposition time for the 23 drivers deemed medically fit, with no additional DMV testing required ranged from 0 to 88 days, and averaged 20.5 days (*SD*=26.7). The median was 3 days. Seventy percent of these cases were completed within 30 days, 74% within 45 days, and 96% within 60 days. The case that took 80 days for a licensing decision is likely an example of how the data collector coded disposition dates to reflect the outcome resulting from the referral for medical review if a driver complied shortly after the DMV-permitted window for submitting a medical statement. A suspension order may have been submitted after no medical statement was received within 60 days of the case opening date, but there were no notes in the database to substantiate this assumption.

Medically fit and required to undergo DMV testing. The disposition time for the 112 drivers required to undergo DMV testing before a licensing determination could be made ranged from 0 to 290 days, and averaged 76.9 days (*SD*=44.7; *Mdn*=66). The cases with the shortest disposition times (e.g., less than 15 days) were drivers referred because they failed the DMV vision screen and were required to submit a Certificate of Vision form and then pass the DMV vision screen (usually with a new corrective lens prescription). The case opened dates for these drivers were the dates the completed Certificate of Vision form was mailed or brought back to the field office. Two drivers brought completed Certificate of Vision forms to the field office and passed the vision screening on the same day, resulting in a case disposition time of 0 days.

Six percent of the cases requiring DMV testing (7 of 112) had disposition times of 30 days or less, 15% were completed within 60 days, and 77% within 90 days. Delay in cases longer than 60 days generally involved either a suspension for failing to submit a medical report, which was then submitted in the near term, or a suspension for not passing the drive test within 60 days of the notice of the test requirement. Drivers whose licenses were suspended for failing to submit a medical report and who subsequently submitted the report and passed the DMV tests did not have valid licenses between their suspension date and the date they passed the test. Similarly, drivers who did not pass the drive test within the DMV-specified 60-day timeframe, but subsequently passed were not licensed until they passed the drive test. The research team chose to extend the observation of the medical review period beyond the point where these drivers were temporarily suspended for failing to submit a medical report or failing to pass the drive test within 60 days (and were subsequently reinstated within a short period of time), to provide a more accurate indication of licensing outcomes following medical review. Similarly, because drivers were permitted 5 drive test attempts within a 12-month period, but were suspended if they did not pass within 60 days of the notice requiring testing, researchers coded the disposition date for drivers who failed the drive test as the final drive test attempt, which for some drivers was beyond the date their licenses were suspended.

As an illustration, a timeline follows for a driver whose medical review outcome was coded for this study as “suspended for DMV test failure” with a case disposition date of 281

days. The case was opened, and both a Certificate of Vision and a Driver Medical Report were required. The case was sent for suspension 40 days later for failure to submit the completed Certificate of Vision form and Driver Medical Report. The driver submitted a completed Certificate of Vision form 75 days after the case opened date, but the suspension took effect 78 days after case opening, due to the driver's failure to provide a completed Driver Medical Report form. The driver submitted a completed Driver Medical Report form 92 days after the case opened date, and the driver was determined medically eligible, but was required to pass the knowledge and drive test. The driver passed the knowledge test 103 days after the case was opened, but failed the drive test five times over the next 5 months, so the case was closed following the fifth test failure 281 days after the case opening date. The driver remained suspended from the 78th to the 281st day, and did not regain licensure.

Table D11 presents a summary of case disposition times for the 112 drivers required to take the DMV tests based on medical review requirements.

Table D11. Case Disposition Times for 112 Drivers Required to Take and Pass DMV tests, by Licensing Outcome

Licensing Outcome	Number of Cases	Case Disposition Time (Days)			
		Range	Average	Standard Deviation	Median
Passed vision test only and were licensed	5	0-35	9.8	14.9	2
Passed drive test (and other tests as required) and were licensed	21	31-290	89.1	57.5	76
Cancellation for test failure	22	4-281	98.9	66.7	68
Suspension for non-compliance with testing requirement	49	21-124	67.2	17.6	64
Suspension reason unknown (either test failure or failure to test)	7	61-102	78.7	17.7	66
Voluntary surrender	8	48-113	84.3	22.5	87

Feedback to Reporting Source

The DMV provided feedback regarding the medical review *outcome* only to physicians (and *only* when their patient received a suspension or when a suspension was lifted). However, the DMV mailed a general letter acknowledging the referral to all referral sources.

Feedback regarding the medical review outcome was mailed to 147 of the 368 physicians who referred their patients (representing 40% of all physician referrals, and 29.4% of the case study sample). In one of these cases, DMV received a Driver Evaluation Request from a law enforcement officer and a second Driver Evaluation Request a day later from the driver's physician. The DMV mailed both the physician and the law enforcement officer a report acknowledgment letter; the letter to the physician advised that the driver's license was immediately suspended as a result of the referral, while the letter mailed to the law enforcement officer indicated only that the DMV would evaluate the person's qualifications for licensure. The coding for feedback may underrepresent the actual frequency that feedback was provided, because the consultants only coded that feedback was provided to the referral source if a copy of the letter was included in the driver's file.

Feedback to 145 of the 147 physicians advised that the individual's license would be immediately suspended, based on the information in the referral. In one of two cases in which the driver was not immediately suspended, the physician referral included a request to evaluate the patient's driving skills. The DMV mailed this physician a letter advising that the patient had passed the DMV tests. In the other case, the DMV advised a referring physician that the patient would be notified of actions required to prove safe driving ability.

Oregon employed a variety of letters to communicate with and help educate physicians about the mandatory referral requirement. When a physician reported a driver under the mandatory reporting law using the MIRF (shown in Figure D1), and the report met *all* the criteria for a mandatory report (i.e., the condition was severe and uncontrollable, the report was complete, the person was a designated reporter, etc.) the driver was immediately suspended. In such cases, the DMV did not mail the physician a report acknowledgment letter. This may explain why a subset of the physician referrals did not receive feedback indicating their patent's license was suspended. In other cases, either *a physician education letter* or a *report acknowledgment letter* was mailed to the physician, depending on the type of referral, the driver's assessed risk level, and the DMV actions taken as a result of the report. There were several variations of physician education and report acknowledgment letters. The PI did not ask the consultants to specify which letter was provided for feedback, but several examples are described below.

- The physician education letter shown in Figure D3 was mailed to physicians who used an obsolete reporting form to report a loss of consciousness disorder when the DMV assessed the condition as high risk and suspended the driver's license.
- The report acknowledgment letter shown in Figure D4 was mailed to physicians who voluntarily reported patients the DMV assessed as high risk and immediately suspended.
- The physician education letter shown in Figure D5 was mailed to physicians who voluntarily reported patients using a Driver Evaluation Request Form who the DMV immediately suspended as high risk.
- The report acknowledgment letter shown in Figure D6 was mailed to physicians who voluntarily reported patients who the DMV assessed as moderate risk.
- The report acknowledgement letter shown in Figure D7 was mailed to physicians who voluntarily reported patients the DMV assessed as low risk.
- The letter shown in Figure D7 was also sent to all non-physician referral sources (such as law enforcement, family members, concerned citizens, and health care providers not designated as mandatory reporters) regardless of how the DMV assessed risk level.

RE:_____ DOB: _____ REF #: ____ P10

DMV received your *Report of Disorders Affecting Consciousness* for the above patient. However, this report and reporting process is obsolete. Please refer to the enclosed information on Oregon's At-Risk Driver Program mandatory reporting requirements.

DMV ACTION REGARDING PATIENT: Even though the report form and reporting process is obsolete, the information provides DMV with sufficient reason to take action under the non-mandatory reporting program. DMV will immediately suspend the patient's driving privileges. To regain driving privileges, the patient will be required to prove that their medical condition does not impair safe driving. DMV will notify the patient of the proof required. This proof may include passing DMV vision, knowledge and drive tests and/or submitting additional medical information.

If you believe this patient's condition/impairment meets the definition of severe and uncontrollable and you are the required reporter, please submit a *Mandatory Impairment Referral Form* (enclosed) with medical information to support your belief. Please be sure to complete the entire form. In order to process the form, we must have the underlying diagnosis, date of last exam and a description of how the patient is affected by the impairments.

Oregon law requires the reporting of "severe and uncontrollable" impairments. It does not require the reporting of a loss of consciousness or control or disorders characterized by momentary or prolonged lapses of consciousness. Please discard all unused copies of the *Report of Disorders Affecting Consciousness.*

For future reference, if a patient's level of impairment does not reach the threshold of severe and uncontrollable and/or you are not the required reporter, but you believe the person may no longer be safe to drive, you may voluntarily report your concerns to DMV using the *Driver Evaluation Request Form* (enclosed). We will evaluate the information as a non-mandatory report under the provisions of our At-Risk Driver Program.

Figure D3. Physician education letter for a Disorders Affecting Consciousness report, for a driver assessed as high risk, and suspended.

DATE

REPORTER INFO

RE: CUSTOMER NAME L154 S

Thank you for the information you recently submitted concerning the above named person. The information provides DMV with sufficient reason to believe the person is not able to safely operate a motor vehicle. We will immediately suspend the person's driving privileges and notify him or her of the suspension and the actions needed to regain driving privileges. These actions may include passing DMV vision, knowledge and driving tests and/or submitting medical information.

No further information is needed from you concerning this report. However, if you have questions, please contact us.

Driver Safety Unit
Processing Services Group
(503) 945-5083
TTY (503) 945-5001

Figure D4. Physician report acknowledgement letter for voluntary report of driver assessed as high risk and immediately suspended.

RE:_____ DOB: _____ REF #: ____ P13

DMV received your *Driver Evaluation Request Form* for the above patient. The information was evaluated as a non-mandatory report under the provisions of our At-Risk Driver Program.

DMV ACTION REGARDING PATIENT: The report provided DMV with sufficient reason to immediately suspend the patient's driving privileges. To regain driving privileges, the patient will be required to prove that their medical condition does not impair safe driving. DMV will notify the patient of the proof required. This proof may include passing DMV vision, knowledge and drive tests and/or submitting additional medical information.

For future reference, please refer to the enclosed information on Oregon's At-Risk Driver Program mandatory reporting requirements. If you believe a patient's condition/impairment meets the definition of severe and uncontrollable and you are the required reporter, please submit a *Mandatory Impairment Referral Form* (enclosed) with sufficient medical information to support your belief. Please be sure to complete the entire form. In order to process the form, we must have the underlying diagnosis, date of last exam and a description of how the patient is affected by the impairments.

Oregon law requires the reporting of "severe and uncontrollable" impairments. It does not require the reporting of a loss of consciousness or control or disorders characterized by momentary or prolonged lapses of consciousness.

Figure D5. Physician education letter acknowledging Driver Evaluation Request form and advising of immediate suspension for driver assessed as high-risk.

DATE

REPORTER INFO

RE: CUSTOMER NAME L154 C

Thank you for the information you recently submitted concerning the above named person. The information provides DMV with sufficient reason to question the person's ability to safely operate a motor vehicle. We will notify the person of the actions needed to prove that he or she is able to drive safely. These actions may include passing DMV vision, knowledge and driving tests and/or submitting medical information.

No further information is needed from you concerning this report. However, if you have questions, please contact us.

Driver Safety Unit
Processing Services Group
(503) 945-5083
TTY (503) 945-5001

Figure D6. Physician report acknowledgement letter for voluntary report of driver assessed as moderate risk, and requiring re-examination.

DATE

REPORTER INFO

RE: CUSTOMER NAME L154

Thank you for the information you recently submitted concerning the above named person. DMV will evaluate the person's qualifications for driving privileges.

No further information is needed from you concerning this report. However, if you have questions, please contact us.

Driver Safety Unit
Processing Services Group
(503) 945-5083
TTY (503) 945-5001

Figure D7. Non-physician report acknowledgement letter for referred drivers assessed as high, medium, and low risk.

Appeal of Licensing Actions

MDOs were not involved in appeals, except to review any new information provided by the driver's physician to make a determination of medical eligibility. Drivers who received notice of an immediate suspension or cancellation (those referred under the mandatory health care reporting law and others reported who were deemed high risk) and wanted to appeal the licensing action were required to request a hearing within 90 days from the date on the notice. The suspension or cancellation remained in effect pending the outcome of the hearing. A person otherwise issued a notice of suspension or cancellation was required to request a hearing within 20 days from the date on the notice, if they wanted to appeal the licensing action. The suspension or cancellation did not go into effect until the hearing outcome confirmed the suspension or cancellation.

Upon receipt of the request, the DMV Hearings processed the request and forwarded it to the Office of Administrative Hearings, where the case was heard by an Administrative Law Judge (ALJ). The ALJ rendered a decision of "affirmed" or "disaffirmed."

Eleven of the 500 case study drivers appealed the license agency's decision to suspend licensure. The suspensions were sustained for 8 of the 11 drivers, for the following reasons:

- driver failed to appear for their hearing (4 drivers):
- Driver withdrew the hearing request (1 driver); and
- Administrative Law Judge affirmed the Division's decision to suspend (3 drivers).

Three of the 11 drivers regained licensure, as follows. One driver's suspension for failing to submit a physician's statement was withdrawn following the hearing, and he subsequently submitted a completed physician statement. Another driver cleared the requirements set by the suspension prior to the hearing, resulting in the suspension being lifted (and no hearing necessary). The third driver was immediately suspended based on a Driver Evaluation Request submitted by a physician. The driver requested a hearing, and the suspension remained in effect pending the outcome of the hearing. The driver provided medical information to the Department, which was reviewed by the medical determination officers who found him medically eligible, but required him to pass the vision, knowledge, and drive tests, which he subsequently did. His license was reinstated, with the driver required to recertify in 6 months (periodic review).

Case Cost

Case cost could not be estimated on a case-by-case basis for this study. The Medical Review Department provided a general estimate of costs in an earlier project activity, summarized below.

Table D12 presents the personnel time and costs associated with each At-Risk case when no DMV testing was required, along with the additional time requirements and costs associated when a drive test and knowledge and vision testing were required. Costs are presented with and without the costs of supplies (mailing labels, stamps, envelopes, letters, and the costs of processing mailings, or knowledge test forms) or overhead costs.

Table D12. Time and Costs for Each At-Risk Medical Review Case

Measure	No Testing	Additional Costs of DMV Testing		Total
		Drive Test	Knowledge and Vision Testing	
Time	2.69 hours	1.35 hours	0.75 hours	4.79 hours
Cost (without supplies and overhead)	$77.88	$40.66	$22.80	$141.34
Cost (including supplies and overhead)	$99.20	$52.09	$29.25	$180.54

The estimated cost to the DMV for an appeal was $80. If a driver defaulted (did not appear for the hearing), it cost an additional $33 for the Administrative Law Judge and staff time to process the default, for a total of $113.

Appendix E: Detailed Summary of 500-Driver Case Study in Texas

Case Study Sample Selection

Texas Department of Public Safety (DPS) supplied a de-identified file to the PI containing a list of all 8,296 drivers who underwent medical review or reexamination in 2012. The list included the following:

- drivers who were not referred to the MAB but were required administratively to take a comprehensive examination (1,067 drivers), to provide general information about a medical condition during a medical field investigation (1,859 drivers), or both (87 drivers);
- drivers required to undergo MAB review (with or without the administrative required comprehensive examination or medical field investigation—this was not always discriminated) (3,912 drivers); and
- drivers who were referred by the courts as mentally incompetent and immediately denied licensure (1,378 drivers).

The DPS licensing file did not include a coded field for referral source, nor was DPS able to provide the date of referral or the date the case was opened without a manual review of each case. This effectively precluded case study sampling stratification by referral source, or developing different sampling strategies to account for seasonal variation in referrals.

Researchers excluded drivers revoked as mentally incompetent from the pool of cases sampled for this study. While the courts were a valid source of referrals, nothing can be learned about the medical review process by including them in the sample; such people were not required to obtain medical reports from their physicians or undergo DPS testing, nor did they receive license restrictions. They were immediately denied licensure until proof by court order that they were no longer adjudicated mentally incompetent. Court-referred mentally incompetent drivers accounted for 16.6% of the referrals to the Texas DPS for medical review in 2012.

After excluding the 1,378 drivers referred by the courts as mentally incompetent, cases requiring administrative review accounted for 44% of the referred cases, and cases referred for MAB review accounted for 56%.

The Research team provided the DPS with the following exclusion criteria:

- alcohol- or drug-abuse related referrals;
- resubmitted referrals (only the first referral for a person referred multiple times was used);
- drivers already on periodic review;
- drivers who also had a CDL or motorcycle endorsement who were operating a commercial motor vehicle, a school bus, a motorcycle, or a passenger transport van at the time they were referred;
- drivers who died or moved out of State before they could complete their medial review process;

- drivers who were referred with out-of-State licenses who would not be medically reviewed by TX DPS;
- drivers whose licenses were already suspended/cancelled/revoked or expired at the time they were referred for medical review.

The IT Department programmatically removed cases from the list of referrals in 2012, based on the exclusion criteria (where possible), prior to providing study data entry staff with the list for case study sampling. The resulting list used for case sampling included 3,392 drivers. To obtain a systematic random sample, the IT Department sorted the list by driver license number (because referral date was not a coded field in the licensing database), and the data collectors selected every 6th case until 500 cases were selected.

Data Entry

Texas DPS and the contractor executed a Memorandum of Understanding providing for four DPS senior analysts within the Enforcement and Compliance Service (ECS) Department to perform case review and data entry. The analysts performed data entry for the study on weekends using the Microsoft Access database and data entry form developed for this study and installed on their DPS computers. The analysts were paid by the DPS; the contractor reimbursed the DPS using NHTSA funds designated for the data entry task. DPS divided the list of 3,393 drivers into four lists of 848 drivers each. The analysts selected every 6th driver from their respective lists (i.e., #6, 12, 18, 24, etc.) and entered 125 drivers, for a total of 500 drivers.

The sample drivers' licensing and medical files included scanned images of referral notices, medical statements, crash reports, MAB reports, and other documentation. The analysts provided detailed notes regarding the reason for referral, which allowed The PI to further code how drivers came to the attention of law enforcement (crash or observed driving behavior), what observations about the person's condition led the officer to refer the driver for medical review, and what medical conditions or functional impairments prompted referrals by physicians, family members, concerned citizens, and others.

Figure E1 shows the three paths that a referral for medical review could take, which included:

- a field investigation resulting from a written report by an anonymous or potentially unreliable source stating that a driver has (or may have) a medical/physical/mental condition;
- a comprehensive examination (vision, knowledge, and road tests) resulting from observation by a DPS employee or written reliable documentation that a driver has a condition that could interfere with the safe operation of a motor vehicle; or
- referral to the Medical Advisory Board, resulting from written reliable documentation that a driver has a medical/physical/mental condition or the condition has worsened.

Texas Administrative Code defined a *reliable report* as any report that could be verified or substantiated. The field investigation path and the coding for this study are described in more detail, as it is unique among the study States participating in the project.

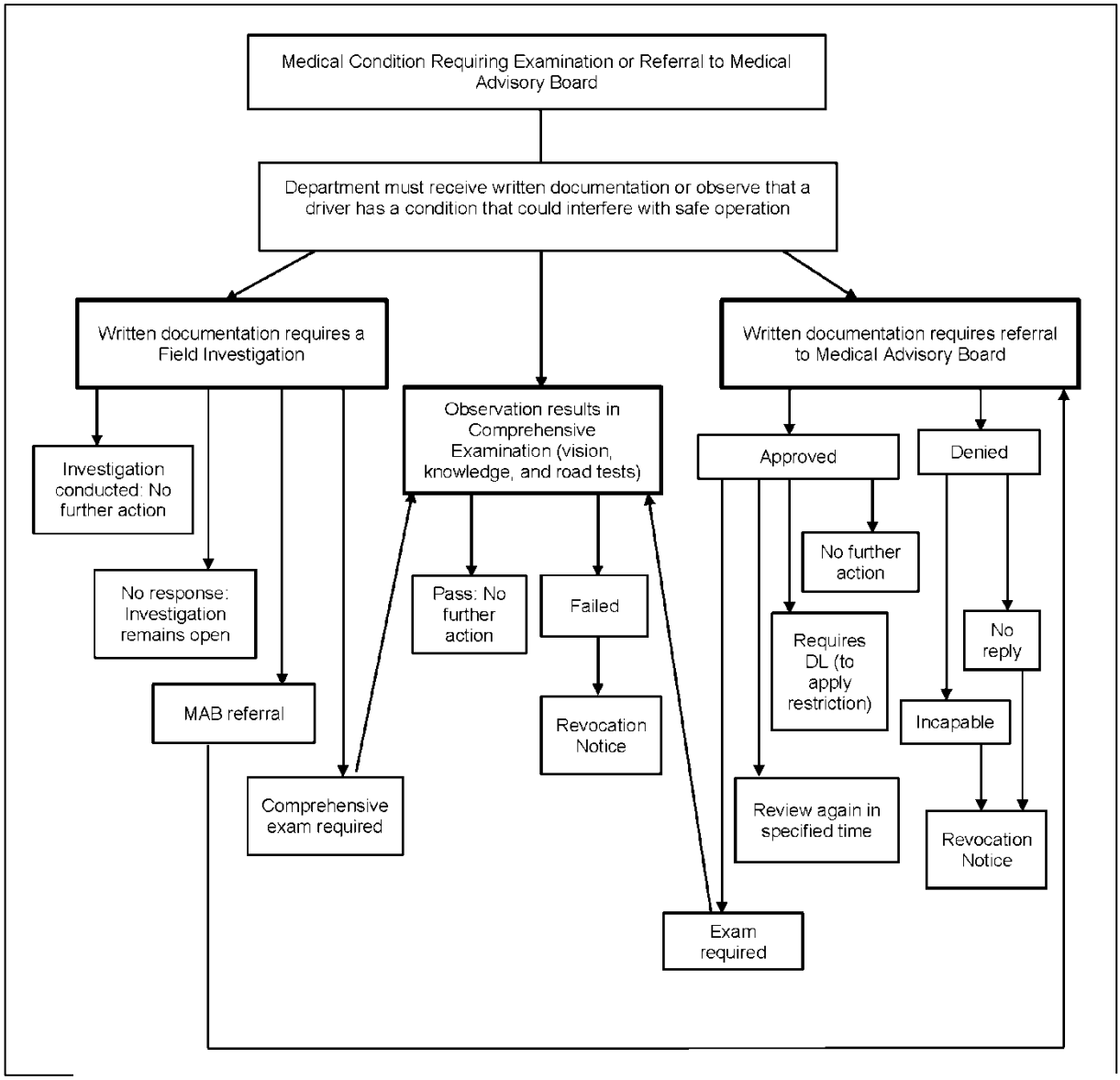


Figure E1. Three medical review paths resulting from referral to Texas DPS.

A field investigation was initiated when the Department received information concerning a possible medical/physical condition and either the source of the information was not reliable (i.e. anonymous, concerned citizen, family member) or there was uncertainty about the medical/physical condition itself (e.g., the referral indicated the driver "may have/possibly has a medical condition"). In these cases, the Department determined that it was more appropriate to conduct a preliminary investigation than to automatically refer such drivers to the Medical Advisory Board. To initiate an investigation, DPS mailed a notice to the driver to schedule an appointment at a local driver license office to discuss the information or possibly demonstrate driving ability (see Figure E2).

TEXAS DEPARTMENT OF PUBLIC SAFETY

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DEPUTY DIRECTORS

06/13/2013

[redacted]

Case Number [redacted]

The Department has received information indicating that you may have a medical condition which could affect your ability to safely operate a motor vehicle.

In order to verify the validity of this report, we request that you appear at a local driver license office. The information we received will be discussed and there is a possibility that you may be asked to demonstrate your driving ability and/or provide statements from your physician. Not all driver license office personnel will be able to assist you, therefore please schedule an appointment prior to appearing at the driver license office. For local driver license office information you may visit the DPS website at www.dps.texas.gov or contact customer service at 512-424-2600.

Failure to comply with the above instructions may result in administrative actions being taken against your driver license.

We appreciate your understanding of our responsibility to you, as well as the motoring public, in ensuring that our state has the safest drivers possible.

Manager,
Driver Improvement and Compliance Bureau

Figure E2. Letter to drivers describing requirement to appear for Texas DPS field investigation interview.

The driver had no deadline by which to comply with the medical investigation interview and any further requirements that arose out of the investigation. If the driver did not comply with the investigation requirement, the license was "alarmed for non-renewal." Such drivers could drive legally until their licenses expired, but they were not permitted to renew or obtain a duplicate license until they complied with the investigation. Since the Department was not able to gather the necessary information, no immediate licensing action was taken; therefore, these cases remained open.

Cases also remained open for drivers who partially complied with the requirements resulting from an investigation. For example, if a driver participated in the investigation and as a result, was required to submit medical information and take the comprehensive examination but only tested or submitted medical information, the license was alarmed for non-renewal and the driver could continue driving until the license expired.

For each case in the sample, the analysts noted whether a field investigation was required, and whether the driver complied. Since there was no immediate licensing action for drivers who did not comply with or complete an investigation (e.g., the license was not suspended or revoked for non-compliance), there was no case disposition date (as defined for this study). A driver's record was flagged for non-renewal the day that the investigation was ordered (and the flag removed when the driver complied). Analysts entered the case disposition date as the date the case was opened, resulting in a case disposition time of zero days for drivers who did not comply with the investigation. The PI did not include these cases in the analysis of case disposition times. The analysts noted the renewal date to enable calculation of the time period that drivers whose licenses were alarmed for non-renewal were legally permitted to continue driving until license expiration. The license renewal cycle was 6 years for drivers up to84, and 2 years for drivers 85 and older. The license could be renewed up to 1 year prior to the expiration date, with the new expiration date 6 years after the expiration date on the current license.

Analysts also provided notes describing if and when drivers obtained an ID card. In Texas, drivers could possess both an ID card and a driver license. This removed the interpretation that obtaining an ID was synonymous with voluntarily surrendering licensure. Therefore, analysts did not code ID card date as the disposition date for any of the license alarmed cases, as these cases remained open. Drivers wishing to voluntarily surrender their licenses were required to complete a voluntary surrender form, provide their reason for giving up driving, and sign the form.

The DPS deadlines used in determining the license disposition date for the remaining study sample are described next. When the Department received information resulting in a testing requirement, DPS mailed the driver a notice stating he or she had 30 days to complete the tests. However, licenses were revoked for non-compliance or test failure after 60 days had passed. When drivers were required to test, their cases were put into a pending file. When the 60 days elapsed, DPS reviewed the file for test results. If a driver did not test, or tested but failed, the DPS initiated revocation action.

Drivers were permitted three attempts to pass the comprehensive examination. After the third failed attempt, the DPS mailed the driver a notice of license revocation. The waiting period between test attempts was at the discretion of the driver license office. A license could be revoked after the first failed test if a driver was determined to be a great danger.

The analysts coded the final test attempt if two or three attempts were made. If a license was revoked after driver failure to pass within 60 days, but the driver tested within a month or two following the revocation, passed, and retained licensure, the analyst coded the driver as having passed the test as the medical review/reexamination outcome.

When a driver was required to have his or her physician submit medical information to the MAB, the due date was within 60 days of the date the medical packet was mailed to the driver. If a license was revoked for failing to submit medical information to the MAB within 60 days, but the information was submitted within a month or two following the revocation, the analyst coded the case as having complied with this medical review requirement.

Drivers who wished to reinstate a license that had been medically revoked, or revoked for failure to submit medical information to the MAB, were required to pay a $100 reinstatement fee, submit current medical information to the MAB, and be medically approved by the MAB. Drivers wishing to reinstate a license revoked for failure to pass a required comprehensive examination were required to pay the $100 reinstatement fee and pass the comprehensive tests at a driver license office.

Sample Demographics

Table E1 presents the age and sex distribution of the 500 drivers selected for the case study. Overall, males represented 56% of the sample, and larger percentages of males than females were present in most age groups. The male-to-female ratio was nearly equal in three age groups (25-34, 65-74, and 75-84). The median age of the case study sample was 71 (range =19 to 98, *M*= 66.2, *SD*=20.6). Drivers age 55 and older accounted for nearly three-fourths of the sample.

Table E2 displays the age distribution of the pool of drivers referred to the Texas DPS for medical review in 2012, excluding those adjudicated as mentally incompetent. DPS could not provide driver sex for the pool of referrals. The median age of the total population of referrals was 57 (*M*=56.8, *SD*=23.2). This indicates that the case study sample was slightly skewed towards older driver groups compared to the total population of referrals. This may be explained by virtue of the fact that the full sample contained sets of drivers excluded from the selection sample who may have been in the younger age groups: e.g., drivers already on period review, drivers with CDL and motorcycle endorsements who were operating these vehicles at the time they were referred, drivers referred due to alcohol and drug abuse, and drivers whose licenses were already cancelled/revoked/expired/suspended at the time of their referral for medical review.

Table E1. Texas Case Study Sample Demographics (n=500)

Age Group	Case Study Total	Age Group Percent of Sample	Number of Males	Number of Females	Percent Male	Percent Female
16-24	20	4%	12	8	60%	40%
25-34	37	7%	18	19	49%	51%
35-44	28	6%	9	19	32%	68%
45-54	50	10%	26	24	52%	48%
55-64	68	14%	50	18	74%	26%
65-74	75	15%	38	37	51%	49%
75-84	119	24%	61	58	51%	49%
85-94	98	20%	59	39	60%	40%
95+	5	1%	5	0	100%	0%
Total	500	100%	278	222	56%	44%

Table E2. Age Distribution of All Texas Drivers Referred for Reexamination and Medical Review in 2012 (n=6,918)

Age Group	Referral Total	Age Group Percent of Sample
16-24	499	7%
25-34	1,261	18%
35-44	782	11%
45-54	762	11%
55-64	753	11%
65-74	692	10%
75-84	1,079	16%
85-94	1,012	15%
95+	78	1%
Total	6,918	100%

Figure E3 compares the proportion of medical referrals by age group for the entire referral population (green bars) and the case study sample (red bars) to their respective proportions within the licensed driver population in 2012 (blue bars). This figure shows that the three oldest driver groups (i.e., drivers65+) were *overrepresented* among both the medical referral population and the case study sample compared to their proportion in the population of licensed drivers, and that drivers in all age groups from 16 to 64 were generally *underrepresented* in the medical referral population and case study sample compared to their proportion in the population of licensed drivers. The exception was age group 25 to 34, where the medical referral and licensed driver populations were equal.

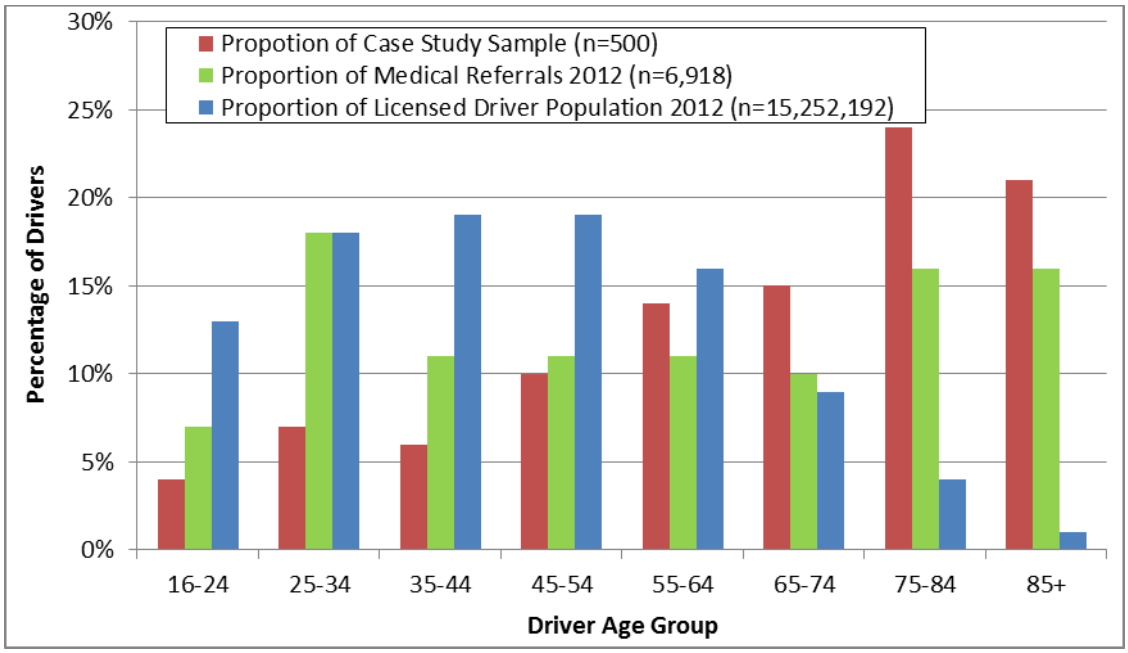

Figure E3. Comparison of case study population, medical referral population, and licensed driver population in Texas in 2012, by driver age group.

Referral Source

Table E3 presents the proportion of case study drivers referred by each source and the average and median age of the drivers within each referral group. Drivers identified for medical review via information coded in crash reports comprised the plurality of the case study sample, followed closely by referrals from law enforcement officers. Together, crash reports (Form CR-3) and referrals from law enforcement following a crash or traffic stop (Form DL-76) accounted for over half of the case study referrals. However, drivers identified for medical review via crash reports were younger on average compared to drivers referred by law enforcement officers (55.2 vs. 70.6).

Physician referrals accounted for 19.2% of the sample. These drivers' average age was 70.5, similar to the sample referred by law enforcement. Self-referrals constituted 9.2% of the sample, with an average age of 57.6, similar to the average age of drivers identified via crash reports. Family members referred 6.6% of the drivers selected for case study. This set was among the oldest of the case study drivers, with an average age of 83.1.

Licensing agency representatives and concerned citizens referred fewer than 5% of the sample each. The drivers referred by these two sources were similar in age (averaging 73.4 and 74.2, respectively).

There were nine drivers referred by "other sources," which included adult protective services (6 drivers), a nurse practitioner (1 driver), an employee in a health services laboratory (1 driver), and a driving evaluation company (1 driver). These drivers were among the oldest, averaging 77.9. The ages of the three drivers referred by unknown sources were 77, 86, and 89.

Table E3. Proportion of Referrals by Referral Source in the Texas Case Study Sample, and Average Driver Age Within each Referral Group

Referral Source	Number in Sample (%)	Average Age (SD)	Median Age
Crash Reports	143 (28.6%)	55.2 (SD =19.1)	57
Law Enforcement	139 (27.8%)	70.6 (SD=18.0)	75
Physicians	96 (19.2%)	70.5 (SD=20.9)	78.5
Self	46 (9.2%)	57.6 (SD=21.1)	59
Family Members	33 (6.6%)	83.1 (SD=11.3)	85
DPS Representative	20 (4.0%)	73.4 (SD=18.0)	80
Concerned Citizens	11 (2.2%)	74.2 (SD=19.8)	79
Other (includes Adult Protective Services, healthcare practitioners, driving evaluation company)	9 (1.8%)	77.9 (SD=10.0)	79
Unknown	3 (0.6%)	84.0 (SD=6.2)	86
Total	500 (100%)	66.2 (SD=20.6)	71

Reason for Referral

Crash reports. Law enforcement officers who investigated a crash that resulted in injury or death, or property damage of $1,000 or more were required to submit a crash report to the Texas Department of Transportation within 10 days. Sections of the report contained codes for factors the officer believed *contributed* and *may have contributed* to the crash. Included among these were drivers' physical and mental conditions, such as fatigued or asleep, physical handicap, physical or mental illness, and taking prescription or over the counter medication. If the driver's physical or mental condition caused an officer to question the person's ability to drive safely (e.g., the officer suspected the driver of being asleep, ill, blacking out, had missing limbs, etc.), the officer coded the condition in the *contributing* or *may have contributed* factors fields, and also described the factor in the narrative field of the report. The DPS ECS unit reviewed crash reports with such coded conditions, and determined whether to refer drivers for MAB review (requiring a physician's statement), require comprehensive testing, or request a field investigation to gather more information about the medical condition prior to determining whether to open a medical review case and what path it should take.

The 143 case study drivers identified via crash reports included 68 females and 75 males ranging from 19 to 93, with a median age of 57 (M=55.2, SD=19.1). This subset had the lowest average age of all referral sources. Fifty-five percent of the drivers identified for medical review via crash reports were 55 or older, 36% were 65 or older, and 17% were 75 or older.

The PI read the short narratives the data collectors provided describing the physical or mental conditions listed in the crash narrative as contributing or possibly contributing crash factors, and post-coded the driver's condition underlying each referral. The PI also coded whether the narrative field describing the reason for referral noted medication. Medication use was noted in 14 of the 143 cases (9.8%), either alone or in addition to other medical or functional issues. One case summary provided by the data collectors had no notation of medical condition or medication use; it is unknown whether this information was missing from the actual crash report narrative. Table E4 presents the medical conditions or functional impairments summarized

from the crash report narratives for the remaining 142 cases, and the number of cases with each condition.

Just over three-quarters of the crash reports mentioned a loss of consciousness or control while driving, such as a seizure, blackout, diabetic reaction, stroke, or the driver fell asleep (108 of 142 reports, or 76%).

Table E4. Medical Conditions or Functional Impairments Listed as Contributing or Possibly Contributing Factors in Crash Reports, Triggering Medical Review in Texas

Medical Condition/Functional Impairment	Number of Cases (n=142)
Blackout or loss of consciousness	43
Diabetic reaction	42
Seizure	19
Medications	11
Medical condition (unspecified)	5
Illness (unspecified)	4
Stroke (while driving)	3
Unaware of crash or unable to recall crash circumstances	2
Asthma attack	1
Bipolar + high blood pressure	1
Dementia + diabetes	1
Fell asleep	1
Headaches	1
Lightheaded	1
Lost	1
Parkinson's disease	1
Reaction to vaccine received earlier in the day	1
Right arm weakness/paralysis	1
Schizophrenic and not compliant with medications	1
Stomach pain	1
Vision	1

Law enforcement referrals. The 139 case study drivers referred by law enforcement officers included 58 females and 81 males ranging from 22 to 98, with a median age of 75 (M=70.6, SD=18). Eighty-three percent of the case study drivers referred for medical review by law enforcement were 55 or older, 67% were 65 or older, and 54% were 75 or older.

The PI read the narrative provided by the data collectors describing the reason for referral, and coded:

- when the narrative indicated that a crash occurred;
- the driving behavior that may have brought a driver to the attention of a law enforcement officer;
- the officer's observations about the driver's condition that prompted the referral for medical review; and
- whether potentially driver impairing medication was noted in the referral narrative.

Medication was mentioned in 7 of the 139 referrals (5%). Crash involvement was noted in 67 of the 139 law enforcement referral summaries (48.2%), which in and of itself would bring a driver to the attention of law enforcement. The driving behavior that caused the officer to make the traffic stop was provided in 60 of the remaining 72 narratives (those where no crash was noted) and is reported in Table E5. Driving the wrong way (into opposing traffic) was the most frequently noted reason drivers came to the attention of the law enforcement officer, followed by silver alerts issued on a missing older person with cognitive impairment. Other frequently noted driving behaviors associated with the traffic stops included lane-keeping difficulty, driving too slowly, and stopping for no reason.

Table E5. Driving Behavior That Brought Driver to the Attention of Law Enforcement, in Texas

Driving Behavior	Number of Cases (n=60)
Wrong way	11
Silver alert	8
Lane-keeping difficulty	7
Too slow	4
Ran off road	3
Stopping for no reason	3
Erratic	2
Failure to yield right of way	2
Near crash	2
Non-driving assist: driver lost car	2
Fail to stop for flagger	2
Speeding	2
Driver cut off officer in traffic/unaware officer intention to pull driver over	1
Drove a vehicle for hours before realizing it wasn't own vehicle	1
Lost control	1
Parked car in travel lane, got out of vehicle, walked around confused	1
Poor vehicle control	1
Ran another vehicle off road	1
Ran red light	1
Unsafe intersection negotiation	1
Unsafe lane change	1
Unsafe turn	1
Reckless	1
Numerous (unspecified) traffic offenses	1

Table E6 displays the driver condition that prompted the officer to refer the driver for medical review, either the officer's own observation of a mental or physical impairment, or a driver's self-report (or other passenger's report) of a medical condition or functional impairment. Such a condition was mentioned in 127 of the 139 narratives. All 12 cases without a description of driver condition prompting the referral involved drivers 65 or older; 9 of the 12 cases involved drivers 80 or older. It may be that older age accompanied by a crash or a violation characteristic of drivers with functional impairments (e.g., wrong way, stopping for no reason, failure to maintain lane, and driving too slow) prompted officers to refer these drivers for medical review, without noting any other cause for concern. In the case where age was noted as the reason for concern for an 88-year-old driver, the officer wrote that the driver was driving the wrong way on a one-way street, and the officer felt that due to her age she should not be driving.

Approximately 31% of the causes for concern were associated with a loss of consciousness or control (e.g., seizures, diabetic reactions, blackouts, falling asleep). Another 19% were associated with age-related cognitive decline (dementia, cognitive impairment, disorientation, confusion, and memory loss). Physical conditions alone were described for 13%, including slow reaction time, pedal errors, Parkinson's disease, stroke, lower limb mobility/unsteady on feet, multiple sclerosis, palsy, and shakiness. Lower limb mobility was described in combination with other conditions, and is underrepresented in Table E6. For example, unsteady gate or difficulty walking were included with disorientation, pedal error, and unawareness of crash involvement.

Table E6. Description of Driver's Condition That Prompted Law Enforcement Officer's Referral for Medical Review in Texas

Driver's Condition	Number of Cases (n=127)
Seizure	14
Blackout or loss of consciousness	11
Diabetic reaction	11
Vision (includes poor night vision, macular degeneration, blind in one eye, color blind, acuity, depth perception)	11
Dementia	9
Lost	8
Confused	7
Silver alert	7
Disoriented	6
Mental/emotional	6
Unaware (of crash involvement, of sirens, of surroundings)	6
Slow reaction time	4
Pedal error (confused accelerator for brake)	3
Parkinson's disease	3
Dizzy	2
Drowsy, fell asleep, or sleep apnea	3
Stroke	2
Unspecified medical issues	2
Lower limb mobility, unsteady on feet	2
Age	1
Cognitive impairment	1
Difficulty hearing	1
Hallucinations	1
Memory loss	1
Multiple sclerosis (with loss of feeling in legs)	1
Palsy	1
State of mind	1
Questionable safe driving ability	1
Shakiness	1

Physician referrals. The 96 case study physician-referred drivers included 44 females and 52 males ranging from 20 to 94, with a median of 78.5 (M=70.5, SD=20.9). Eighty percent of the case study drivers referred for medical review by physicians were 55 or older, 73% were 65 or older, and 59% were 75 or older.

Table E7 presents the reasons for the 96 physician-referred drivers. Fifteen cases included multiple medical conditions; only the first condition listed is presented in Table E7. Dementia, cognitive impairment, and memory loss were associated with just over half of the physician referrals (54%). Seizure disorders were the next most frequent reason for the referral (18% of the physician referrals). Potentially driver impairing medications were noted in 5 of the 96 narratives (5%).

Table E7. Medical Conditions or Functional Impairments Associated With Physician-Referred Drivers in the Texas Case Study Sample

Medical Condition or Functional Impairment	Number of Cases (n=96)
Dementia	45
Seizure	17
Unspecified medical condition, chronic, progressive or declined to the point of making it unsafe to drive	9
Loss of consciousness or blackout	5
Cognitive impairment	4
Memory loss	3
Psychiatric (includes PTSD, anger episodes, and attempted suicide)	3
Vision (includes blind in 1 eye, and peripheral visual field loss)	2
Heart conditions (hypertension, afib, CAD, high risk for syncope)	2
Diabetes/hypoglycemia	1
Parkinson's disease	1
Drug abuse (opiates)	1
Alcohol abuse	1
Neurological (unspecified)	1
Stroke	1

Self-referrals. First-time and renewal applicants were required to answer questions about their medical conditions when they completed the license application form. The medical questions asked on the initial and renewal application were as follows:

- *Do you currently have or have you ever been diagnosed with or treated for any medical condition that may affect your ability to safely operate a motor vehicle? Examples, including but not limited to: diagnosis or treatment for heart trouble, stroke, hemorrhage or clots, high blood pressure, emphysema (within past two years); progressive eye disorder or injury (i.e., glaucoma, macular degeneration, etc.); loss of normal use of hand, arm, foot, or leg; blackouts, seizures, loss of consciousness or body control (within the past two years); difficulty turning head from side to side; loss of muscular control; stiff joints or neck; inadequate hand/eye coordination; medical condition that affects your judgment; dizziness or balance problems; missing limbs.*
  - *Initial application: Please explain and identify medical condition: _____*
  - *Renewal application: If you answered Yes above, has your condition ( ) Improved or ( ) deteriorated since your last application for an original/renewal of your driver license?*
- *Within the past two years, have you been diagnosed with, been hospitalized for, or are you now receiving treatment for a psychiatric disorder?*
- *Have you ever had an epileptic seizure, convulsion, loss of consciousness, or other seizure?*

- *Do you have diabetes requiring treatment by insulin?*
- *Do you have any alcohol or drug dependencies that may affect your ability to safely operate a motor vehicle or have you had any episodes of alcohol or drug abuse within the past two years?*
- *Within the past two years, have you been treated for any other serious medical conditions? Explain _____.*
- *Have you EVER been referred to the Texas Medical Advisory Board for Driver Licensing?*

For each question answered "Yes" or corrected to "Yes" by examining personnel, the applicant was questioned carefully to determine whether he or she met criteria for referral to the MAB. Some applicants had medical conditions that could be evaluated by their answers to the application questions and/or road testing (i.e., amputation, back pain, Cerebral Palsy, congenital birth defects, fibromyalgia, hemiplegia, multiple sclerosis, osteoporosis, poliomyelitis musculoskeletal disorder, scoliosis, spina bifida, paraplegia, quadriplegia, spinal meningitis, Tourette's Syndrome, and traumatic brain injuries). Such applicants were initially road tested without referral to the MAB.

New applicants and renewal applicants not renewing by mail or online were also required to pass a vision test. Applicants without corrective lenses who scored worse than 20/40 with either eye or both together were referred to a specialist. Applicants whose vision was worse than 20/70 with the best eye or both together, with or without corrective lenses, and without further improvement possible were not licensed, except in meritorious circumstances.

The 46 case study self-referred drivers included 20 females and 26 males ranging from 20 to 95, with a median of 59 (M=57.6, SD=21.1). Fifty-four percent of the case study self-referrals were 55 or older, 41% were 65 or older, and 22% were 75 or older.

Table E8 summarizes the medical conditions reported by initial and renewing drivers, and their proportions within the self-referral sample. Only the first condition listed is shown in Table E8; two of the drivers who self-reported strokes reported other co-existing conditions (schizophrenia for one driver and seizures and heart failure for the other driver). Loss of consciousness or control from conditions such as seizures, diabetic reactions, brain injury, and orthostatic hypotension accounted for 41% of the self-referrals.

Family member referrals. The 33 family-referred drivers included 15 females and 18 males ranging from 40 to 97, with a median of 85 (M=83.1, SD=11.3). Ninety-seven percent of the case study family member referrals were 55 or older, 94% were 65 or older, and 85% were 75 or older. Table E9 summarizes the concerns reported by family members for these 33 drivers. Multiple conditions were listed for eight drivers. The most common reason for referrals by family members was dementia (19 of the 33 drivers).

Table E8. Medical Conditions or Functional Impairments Associated With Self-Referrals in the Texas Case Study Sample

Medical Condition or Functional Impairment[a]	Number of Cases (n=46)
Seizure	11
Mental/emotional (includes schizophrenia, bipolar, psychiatric hospitalization)	7
Loss of consciousness	4
Stroke	4
Heart attack	3
Diabetic reaction	2
Visual impairments	2
Back surgery (and wheelchair bound)	2
Brain injury with seizures	1
Cerebral palsy with hemiplegia (left-sided weakness), uses wheelchair	1
COPD	1
Currently under medical treatment and receiving physical therapy	1
Dementia	1
Huntington's disease	1
Multiple sclerosis	1
Orthostatic hypotension	1
Parkinson's disease	1
Peripheral neuropathy	1
Renal failure	1

[a] Reflects only the first condition listed, when multiple conditions were cited for a driver.

Table E9. Medical Conditions or Functional Impairments Associated With Family Member Referrals in the Texas Case Study Sample

Medical Condition or Functional Impairment	Number of Cases (n=33)
Dementia	16
Multiple medical conditions: Dementia + dizzy Dementia + left-sided weakness + unable to stand unassisted Dementia + decline in physical capabilities Glaucoma + heart condition + memory loss Difficulty walking + memory loss + dizzy spells/blackouts Seizures + memory loss + on dialysis + poor vision Poor balance + cognitive impairment Loss of consciousness + confused	8
Cognitive impairment/gets lost while driving	1
Left-sided weakness (fractured hip)	1
Schizophrenia	1
Neurologist advises no driving	1
Neuropathy (needs assistance walking)	1
Refusal to wear glasses and hearing aid resulting in several crashes	1
Progressive degeneration of central nervous system	1
TIA with physical disabilities	1
Unspecified age-related diminished capabilities	1

Licensing agency representative referrals. The 20 case study drivers referred by DPS employees included four females and 16 males ranging from 26 to 94, with a median of 80 (*M*=73.4, *SD*=18). Eighty-five percent of the case study referrals by DPS employees were 55 or older, and 65% were 65 or older (as well as 75 or older). Table E10 summarizes the concerns reported by DPS employees for these 20 drivers. The most frequent reason was dementia or cognitive impairment.

Table E10. Medical Conditions or Functional Impairments Associated With DPS Referrals in the Texas Case Study Sample

Medical Condition or Functional Impairment	Number of Cases (n=20)
Dementia	4
Cognitive impairment	3
Stroke	3
Blackout	2
Difficulty walking or standing without assistance	3
Vision (acuity and glaucoma)	2
Mental/emotional: hospitalized for psychiatric disorder	1
Unspecified (1 failed initial road test and 1 taking multiple medications)	2

Concerned citizen referrals. The 11 drivers referred by concerned citizens included 6 females and 5 males ranging from 33 to 95, with a median of 79 (*M*=74.2, *SD*=19.8). Seventy-three percent of the case study concerned citizen referrals were 55 or older (as well as 65 or older), and 64% were 75 or older. Table E11 summarizes the concerns reported by concerned citizens for these 11 drivers. The most frequent reason was dementia or cognitive impairment.

Table E11. Medical Conditions or Functional Impairments Associated With Referrals by Concerned Citizens in the Texas Case Study Sample

Medical Condition or Functional Impairment	Number of Cases (n=11)
Dementia	3
Vision (includes nearly blind and macular degeneration)	3
Cognitive impairment (includes confusion, disorientation, getting lost)	2
Seizures	2
Partial left leg	1

Referrals from other sources. The 9 case study drivers referred by others included 5 females and four males ranging from 65 to 91, with a median of 79 (*M*=77.9, *SD*=10). Fifty-six percent of these referrals were 75 or older. Table E12 summarizes the concerns reported by other sources for these 9 drivers. The most frequent reason was dementia or cognitive impairment.

Table E12. Medical Conditions or Functional Impairments Associated With Referrals by Others in the Texas Case Study Sample

Medical Condition or Functional Impairment	Number of Cases (n=9)
Dementia	4
Cognitive impairment	2
General concern about driving ability	2
Medication use for depression, anxiety, and memory loss	1

A referral source could not be determined for three case study drivers. This included two female drivers and one male driver (all over age 75). One driver was referred due to concerns about dementia and diabetes as well as having a pacemaker. Another was referred because she struck a bicyclist whom she indicated she did not see. The third was referred due to concerns about extreme drowsiness due to medication taken daily, plus spinal cord nerve damage resulting in leg jerks and right arm and hand weakness.

Medical Review Requirements

Medical review requirements could include participation in a field investigation, submission of more detailed medical information from drivers' treating physicians or vision specialists or both (MAB review); and/or passing the DPS vision, knowledge, and road tests (a comprehensive examination).

Field investigation. The licensing agency requested a field investigation to gather more information about the driver's condition for 180 of the 500 case study drivers (36%). All referral sources were represented among the 180 cases requiring investigation. These included:

- all 3 referrals from unknown sources;
- 10 of the 11 referrals from concerned citizens (91%);
- 29 of the 33 family referrals (88%);
- 5 of the 9 referrals from "other" sources (56%);
- 10 of the 20 referrals from DPS representatives (50%);
- 66 of the 139 referrals from law enforcement (47%);
- 50 of the 143 cases identified through crash reports (35%);
- 4 of the 46 self-referrals (9%); and
- 3 of the 96 physician referrals (3%).

Of the 180 drivers required to participate in a field investigation, 139 drivers did not comply, including 13 drivers who surrendered their licenses in lieu of participating and 126 drivers who did not respond to the request in any manner. The 13 drivers who surrendered their licenses included 5 females and 8 males ranging from 61 to 97, with a median of 84 (M=80.7, SD=10.2). The referral sources for these 13 drivers were:

- law enforcement (6 drivers);
- crash reports (3 drivers);

- family (2 drivers); and
- other concerned citizens (2 drivers).

The reasons for concern prompting referral for the 13 drivers who surrendered at this point in the process were:

- unawareness of crash involvement (3 drivers);
- lost and disoriented (3 drivers);
- dementia (3 drivers); and
- general medical; left-sided weakness; Parkinson's disease with confusion and non-compliance with medications; and near blindness (1 driver each).

The licenses of the 126 drivers who did not participate in the interview (and did not surrender licenses) were alarmed for non-renewal. They maintained licensure, but would not be permitted to renew their licenses or receive a duplicate license until they underwent the field investigation. The 126 drivers included 64 females and 62 males ranging from 24 to 98, with a median of 71.5 (M=67.5, SD=18.4). Nearly three-quarters of those whose licenses were alarmed for renewal were 55 or older (74%), 62% were 65 or older, 47% were 75 or older, and 20% were 85 or older. The driver conditions prompting these 126 referrals are listed in Table E13. The referral sources for these 126 drivers were:

- law enforcement (47 drivers);
- crash reports (40 drivers);
- family members (16 drivers);
- concerned citizens (7 drivers);
- adult protective services (4 drivers);
- self (3 drivers);
- DPS employees (3 drivers);
- unknown (3 drivers);
- physicians (2 drivers); and
- a lab testing service provider (1 driver).

Forty-one of the 180 drivers required to undergo field investigation complied (23%). Two of the 41 drivers surrendered their licenses at the time of the field investigation in lieu of continuing with the medical review process. Both were referred by family members with concerns about dementia; one was a 93-year-old male and the other a 74-year-old female.

Subtracting the 126 drivers who did not comply with the investigation process and the 15 who voluntarily surrendered their licenses instead of participating in the investigation or just after participating in the investigation from the sample of 500 drivers, leaves 359 drivers who were either referred to the MAB and required to submit a physician's statement and/or were required to take the comprehensive examination (vision, knowledge, and road tests).

Table E13. Driver Condition Prompting Referrals for Drivers Whose Licenses Were Alarmed for Non-Renewal (did not undergo medical review)

Medical Condition or Functional Impairment	Number of Cases (n=126)
Cognitive impairment (includes confused, disoriented, lost, unaware, memory loss, slow decision-making time)	24
Dementia	22
Blackouts/loss of consciousness	10
Medication effects	10
Diabetic reaction	8
Seizure	8
Mental/emotional (includes bipolar, psychiatric hospital admissions, schizophrenia, anger management)	6
Vision (includes poor night vision, failed to see struck road user, glaucoma)	5
Stroke or TIA	5
Dizzy	2
Fell asleep	2
Pedal error	2
Back surgery/wheelchair bound	1
Currently under medical treatment and physical therapy	1
Headaches	1
Neuropathy and needs assistance walking	1
Progressive degeneration of the central nervous system	1
Reaction to vaccine earlier in the day	1
Right arm weakness/paralysis	1
State of mind	1
Stomach pain	1
Unspecified medical condition	13

MAB referral/requirement to submit a physician's report. The MAB, housed within the Department of State Health Services (DSHS), had nine physicians representing the following medical specialties: ophthalmology, family practice, internal medicine, neurology, endocrinology, physiatry, general practice, and dermatology. Board physicians were paid consultants to the Texas DSHS, and were employed in private practice. The Texas MAB reviewed all cases in which a physician report was required, which comprised a large proportion of the licensing agency's medical review cases. Table E14 presents the conditions for referral of passenger vehicle drivers (Class C) for MAB review. When DPS referred a case to the MAB, the MAB physicians reviewing the case mailed the driver a letter explaining the requirement to undergo a physician examination, and enclosed a medical report for the driver's physician to complete and return to the MAB. MAB physicians reviewed the completed documents and determined whether the driver was capable of driving safely. The MAB's opinions were forwarded electronically to DPS on a bi-weekly basis. DPS mailed the driver a letter in 7 to 14 business days following MAB review, advising of the outcome of MAB review and any licensing action or further requirements. MAB opinions fell under one of the following categories:

- Approved - the driver has met qualifications to operate a motor vehicle:
  - Approved with no further requirements;
  - Approved with the requirement to take the comprehensive examination;
  - Approved with a requirement to review medical condition again in a specified timeframe; or
  - Approved to downgrade driver license to Class C only.
- Not approved – the driver did not meet the qualifications to operate a motor vehicle. An opinion for denial can be indefinite or for a specified time period. The customer has the option to request a hearing.

When a driver did not return completed medical forms or comply with an MAB request for additional information, the MAB could not review the case. Such cases were returned electronically to DPS after 60 days, and the DPS revoked the license as an MAB No Reply.

Of the 359 drivers continuing with the medical review process, DPS referred 269 for MAB review. These 269 drivers were required to have their physicians complete a medical form and return it to the MAB. The 90 drivers who were not referred to the MAB were required to take the DPS comprehensive exam (vision, knowledge, and road test).

Of the 269 drivers referred to the MAB:

- 138 drivers returned medical reports (age range 20 to 93, *Mdn*=65, *M*=61.7, *SD*=20.2);
- 4 drivers voluntarily surrendered their licenses in lieu of complying with this requirement (age range 67 to 91, *Mdn*=81.5, *M*=80.2, *SD*=2.1); and
- 127 drivers did not comply with the requirement to have medical forms completed and returned, resulting in license revocation (age range 19 to 95, *Mdn*=63, *M*=60.4, *SD*=23.2).

Table E14. Criteria for Medical Advisory Board Referrals, for Passenger Vehicle Drivers

"Under care of a physician" is defined as having been referred for treatment or having received treatment from a physician for the medical conditions indicated in the past 12 months without a release from further treatment. It does not apply to a condition diagnosed over 12 months ago and with treatment consisting only of periodic visits to a physician for checkup and maintenance.

Eye Diseases: applicants who are under the care of a physician, excluding the fitting of lenses when no eye disease is present. Applicants using telescopic lenses to pass the vision test must complete a comprehensive road test before licensure and are referred only the first time they present using telescopic lenses.
Cardiovascular Diseases: All applicants under the care of a physician for angina pectoris, arrhythmia, arterial aneurysms, coronary bypass surgery, dyspnea, myocardial infarction. Applicants who have had a heart attack during the past year. Applicants with hypertension who have had a loss of or any alteration in consciousness within the past year. Applicants with blood vessel disorders under the care of a physician and a qualifying road test has confirmed considerable interference with braking, accelerating, steering, or manipulation of controls or acceleration. All applicants with syncope with any loss of consciousness or any alteration of consciousness due to cardiovascular problems within the past year.
Metabolic Disorders: Applicants with Diabetes Mellitus under the care of a physician or with hyperglycemia or hypoglycemia severe enough to cause neurological dysfunction (confusion, motor dysfunction or loss of consciousness) or result in any type or degree of vehicle accident within the past two years.
Respiratory Conditions: applicants who are under the care of a physician and a qualifying road test has confirmed that shortness of breath or audible wheezing considerably affects driving ability.
Neurological disorders: all applicants under the care of a physician with transient cerebral ischemic attack, stroke, narcolepsy, excess daytime sleeping or sleep apnea. Applicants who have had a cerebral vascular accident (stroke), with any degree of persistent neurological deficit (applicant must take and pass a qualifying road test prior to referral) or if applicant has lost consciousness, "blacked out" or fainted within the past year. Applicants who have had seizures or epileptic or convulsive attacks within the past year. Applicants with movement disorders (conditions including but not limited to Parkinsonism, Torticollis, myoclonus and choreoathetosis), if disorder is active and progressive (the applicant must also take and pass a qualifying road test prior to referral).
Mental, nervous or emotional patients (all applicants as follows): Involuntary psychiatric patient committed for indefinite hospitalization (applicant must pass all required tests prior to referral and must present a court restoration to competency or a certificate of discharge). Involuntary psychiatric patient with a guardian appointed (applicant must pass all required tests prior to referral and must present a court restoration to competency. A certificate of discharge is not acceptable). All other psychiatric patients if under the care of a physician or if any significant behavioral problems or adverse drug therapy reactions exist (applicant must pass all required tests prior to referral).
Alcohol-induced problems (all applicants as follows): Three or more convictions for offenses involving drinking, the last offense occurring within past two years. Involvement in two or more accidents while drinking, the last incident occurring within past two years. A reliable report that applicant has had an active drinking problem within the past two years. Admits to an active drinking problem within the past two years. Under the care of a physician (exception: if there is no documented history of any episodes of alcohol abuse and applicant voluntarily enrolled in and successfully completed a recognized rehabilitation program, the applicant will not be referred).
Drug-induced problems (all applicants as follows): Addiction to any drug affecting safe driving ability. A reliable report that applicant has had an active drug problem in the past two years. Admits to an active drug problem in the past two years. Under the care of a physician.
Other conditions or disorders: All applicants, if under the care of a physician, and a qualifying road test has confirmed that safe driving ability is considerably affected by the condition. Examples of conditions that will be evaluated by testing rather than by referral include but are not limited to: amputation, back pain, cerebral palsy, congenital birth defects, fibromyalgia, hemiplegia, multiple sclerosis, osteoporosis, post-polio disabilities, scoliosis, spina bifida, spinal cord injuries, spinal meningitis, Tourette's syndrome and/or traumatic brain injuries.

Medical fitness to drive. Of the 138 drivers whose treating physicians completed and returned a medical statement, 132 were denied by the MAB (medically ineligible to drive), and their licenses were revoked. This included 53 females and 79 males ranging from 20 to 93 years old with a median of 64 (*M*=61, *SD*=20). Table E15 presents the medical conditions/functional impairment associated with these 132 revoked drivers.

The remaining six drivers were approved by the MAB (deemed medically eligible), with five of the six required to take the DPS comprehensive tests before a licensing determination could be made.

Table E15. Medical Conditions or Functional Impairments Associated With License Revocation Due to MAB Denial (Medically Ineligible) in the Texas Case Study Sample

Medical Condition or Functional Impairment	Number of Cases (n=132)
Diabetic reaction	38
Blackout or loss of consciousness (medical reason not specified in narrative)	31
Seizure	27
Dementia	25
Mental/emotional conditions	3
COPD	1
Heart attack	1
Parkinson's disease	1
Stroke	1
Vision	1
Substance abuse	1
Unspecified	2

DPS comprehensive exam requirements. In addition to the 5 drivers approved by the MAB pending their comprehensive test outcomes, there were 90 drivers who did not undergo MAB review who were required to take the DPS comprehensive tests. The comprehensive test consisted of a vision test, a knowledge test, and a road test.

Six drivers voluntarily surrendered their licenses in lieu of testing. These included two females and four males ranging from 81 to 97 years old, with a median age of 84.5 (*M*=87, *SD*=6.5). Another 50 drivers had their licenses revoked for failing to comply with the testing requirements. These included 19 females and 31 males ranging in age from 26 to 94, with a median age of 77.5 (*M*=73, *SD*=17.5).

While 39 drivers attempted the comprehensive exam, only 2 passed and retained licensure (both males, one 26 and the other 93). The remaining 37 drivers had their licenses revoked for failing the comprehensive exam (2 drivers following vision test failure, 15 after failing the knowledge test, and 20 after failing the road test). These included 19 females and 18 males ranging from 49 to 94 with a median age of 85 (*M*=80.4, *SD*=11.5).

Combining the two drivers who passed the comprehensive exam, the one driver deemed medically fit without the requirement to test, and the 126 drivers with their licenses alarmed for non-renewal resulted in 129 drivers out of the total sample of 500 (25.8%) with continuing licensure.

Requirement for examination by driver rehabilitation specialist. The Texas DPS did not refer drivers to driver rehabilitation specialists for their assistance in making fitness to drive determinations.

Medical Review Outcomes

Figure E4 shows the referral sources and the licensing process and outcomes across the sample of 500 case study drivers referred for medical review. Table E16 presents the licensing outcomes for the total sample of 500 drivers, as well as by referral source.

Table E16 includes the 126 cases that neither underwent MAB review nor comprehensive testing. This set of drivers did not comply with the DPS request to participate in a preliminary DPS field investigation/interview. Field investigations were requested to obtain more information from a driver about a reported medical condition to determine the authenticity of the referral and the path that medical review should take. Investigations were requested when the DPS received reports from anonymous sources, and for reports considered unreliable (i.e., from family members and other concerned citizens, and when the report indicated there *may* be a medical condition that affects driving performance or that contributed to a crash). Licenses were not suspended or revoked for failure to comply with the field investigation; the only consequence to the license was that it was alarmed for non-renewal. Drivers could legally drive until their licenses expired. These 126 cases represented 25% of the case study sample.

The time period that these drivers were legally permitted to drive before their licenses expired, when they would either be required to participate in the field investigation and any further medical review or testing requirements, or be prohibited from renewing varied considerably. Three drivers' licenses expired between referral and the day their cases were opened. The remaining cases expired between 4 and 2,383 days (6.5 years) from the case opening date. Excluding four drivers who were reported as deceased prior to their license renewal date (with valid licenses for 2 to 3 years between case opening and death), and six drivers with either missing license renewal dates or whose licenses expired between referral and case opening, the average interval before license renewal for the license alarmed cases was 2.9 years (*SD*=1.9 years; *Mdn*= 2.8 years). The licenses of 7% of the license alarmed drivers expired within 90 days of case opening date, 11% within 180 days (6 months), 15% within 9 months, 22% within 1 year, 39% within 2 years, 53% within 3 years, 66% within 4 years, and 82% within 5 years. Twenty-eight of the 126 drivers (22%) obtained an ID card, but because drivers in Texas could possess both an ID card and a driver's license, this was not an indication that they surrendered their licenses instead of participating in the field investigation.

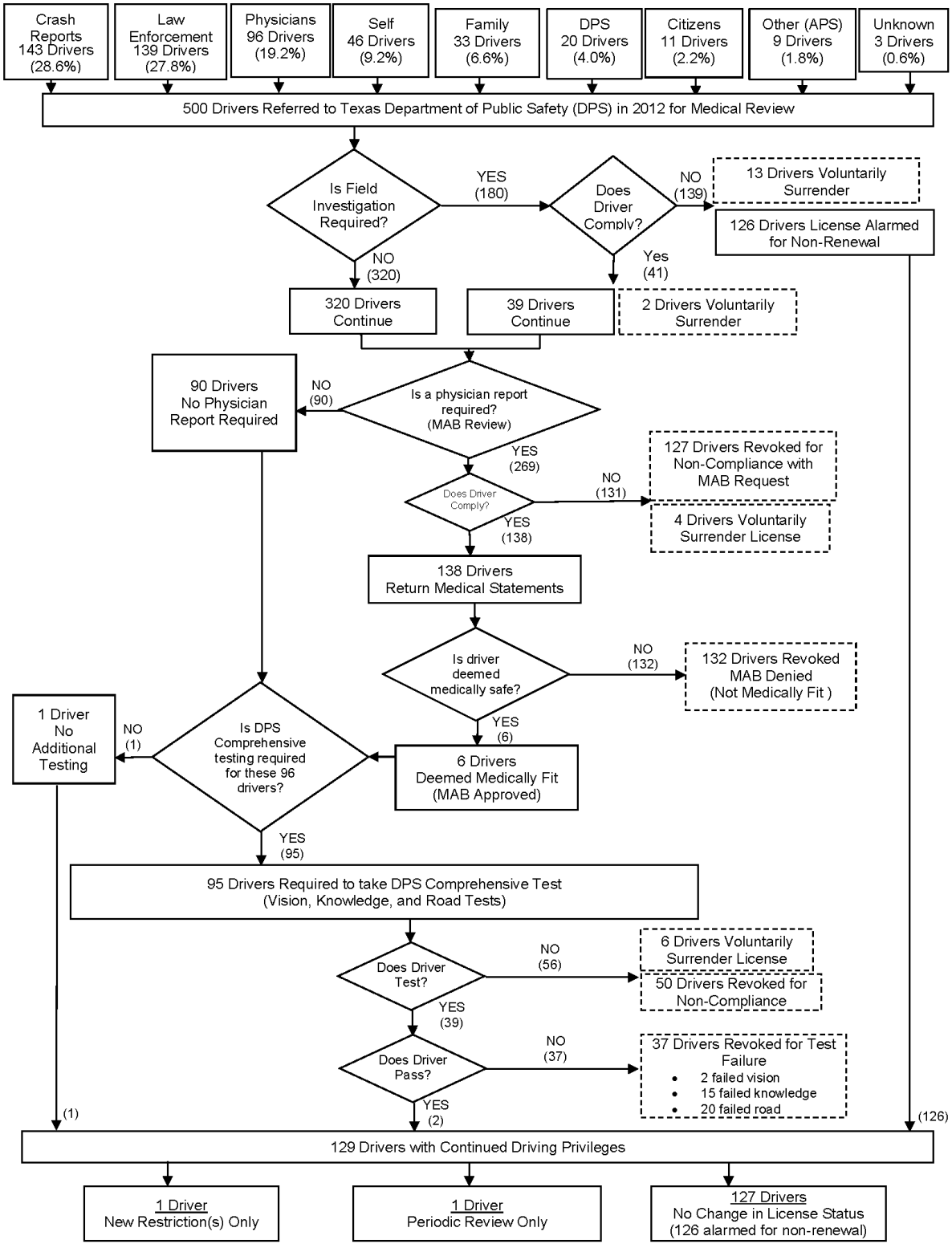

Figure E4. Medical review process and outcomes for 500 drivers referred to the Texas Department of Public Safety.

Table E16. Medical Review Process Licensing Outcomes in Texas, by Referral Source (Including License Alarmed Cases)

Referral Source	Number of Drivers	Change in License Status as a Result of Medical Review							Not Reviewed/ No Change[b] (Row %)
		New Restriction(s) Only (Row %)	Periodic Review Only (Row %)	Revoked: Medically Ineligible (MAB Denial) (Row %)	Revoked: Failed DPS Tests (Row %)	Revoked: Failed to Comply With MAB or Testing Requirements (Row %)	Voluntary Surrendered Own License[a] (Row %)	No Change (Row %)	
Crash Reports	143			56 (39%)	3 (2%)	39 (27%)	5 (3%)		40 (28%)
Law Enforcement	139			30 (22%)	15 (11%)	37 (27%)	10 (7%)		47 (34%)
Physicians	96			25 (26%)	6 (6%)	61 (64%)	2 (2%)		2 (2%)
Self	46		1 (2%)	15 (33%)	2 (4%)	25 (54%)			3 (7%)
Family Members	33	1 (3%)		1 (3%)	8 (24%)	2 (6%)	5 (15%)		16 (48%)
DPS Employees	20			4 (20%)	2 (10%)	10 (50%)		1 (5%)	3 (15%)
Concerned Citizens	11					1 (9%)	3 (27%)		7 (64%)
Other (APS, nurse)	9			1 (11%)	1 (11%)	2 (22%)			5 (56%)
Unknown	3								3 (100%)
Total	500	1 (0.2%)	1 (0.2%)	132 (26%)	37 (7%)	177 (35%)	25 (5%)	1 (0.2%)	126 (25%)

[a] In lieu of complying with medical reporting or testing requirements, the driver chose to give up licensure, and completed paperwork to formally surrender their license, rather than complete the re-examination testing.

[b] Driver did not comply with investigation; license alarmed for non-renewal. The person could legally drive until license expired. Driver not permitted to renew license until he or she participated in the field investigation and any subsequent requirements.

The outcome of "no change in license status" for the license alarmed cases may be more indicative of Departmental procedures than characteristics of the referral. For example, DPS largely considered certain sources as unreliable, requiring investigation (e.g., family, where 88% of the referrals required investigation), when, as Table 16 shows, 9 of the 10 family-member referred drivers who underwent MAB review or testing had their licenses revoked as medically ineligible or because they failed the comprehensive test. Many of the referrals for the license alarmed cases described conditions indicating drivers likely to be at high risk (see Table 13). Examples of license alarmed cases included:

- A referral from Adult Protective Services (APS) indicated that the driver had been diagnosed with Alzheimer's and APS was concerned about the individual's ability to drive.
- A crash report indicated the driver had a medical condition that caused him to have blackouts.
- A crash report indicated the driver drove the vehicle through the glass doors of a store at a high rate of speed; an EMS medic determined the driver had a seizure.
- A referral by a family member indicated the driver could barely walk, was very forgetful, had had three heart attacks in the last month, had dizzy spells and blackouts, had driven the wrong way on a street, and was a danger to other drivers.
- A referral from a law enforcement officer who stopped to assist a driver described the driver as highly confused and lost (driver had driven for nearly 60 miles before realizing she was lost). Family members of this driver advised the officer that the driver was suffering from early onset of Alzheimer's disease and also took medication for depression and anxiety.

The research team excluded these 126 drivers in investigating the outcomes of referrals by referral source following medical review/reexamination (i.e., whether medical review resulted in a revocation as medically unsafe, restricted licensure, or a periodic review requirement vs. no change in license status). Table E17 shows the licensing outcomes of the 374 drivers who underwent medical review/reexamination by referral source, and proportions of the case study sample with each outcome.

There was no change in the license status for one of the 374 drivers in the case study sample following their medical review/reexamination. Two additional drivers retained licensure, but one had new restrictions and the other was required to submit periodic medical reports. The driver with new restrictions was a 93-year-old restricted to daytime driving, no expressways, and driving within a 4-mile radius of home. A total of 371 drivers (99% of those who underwent medical review/reexamination) lost their licenses, either because they were deemed medically ineligible, they failed DPS tests, they voluntarily surrendered their licenses in lieu of submitting medical reports or attempting DPS tests, or their licenses were suspended for failing to comply with medical review/reexamination requirements (i.e., not submitting medical reports to the MAB or not taking the vision, knowledge, and road tests).

Table E17. Medical Review Process Licensing Outcomes in Texas, by Referral Source (Excluding License Alarmed Cases)

Referral Source	Number of Drivers	Change in License Status as a Result of Medical Review						
		New Restriction(s) Only (Row %)	Periodic Review Only (Row %)	Revoked: Medically Ineligible (MAB Denial) (Row %)	Revoked: Failed DPS Tests (Row %)	Revoked: Failed to Comply With MAB or Testing Requirements (Row %)	Voluntary Surrendered Own License (Row %)	No Change (Row %)
Crash Reports	103			56 (54%)	3 (3%)	39 (38%)	5 (5%)	
Law Enforcement	92			30 (33%)	15 (16%)	37 (40%)	10 (11%)	
Physicians	94			25 (27%)	6 (6%)	61 (65%)	2 (2%)	
Self	43		1 (2%)	15 (35%)	2 (5%)	25 (58%)		
Family Members	17	1 (6%)		1 (6%)	8 (47%)	2 (12%)	5 (29%)	
DPS Employees	17			4 (24%)	2 (12%)	10 (59%)		1 (6%)
Concerned Citizens	4					1 (25%)	3 (75%)	
Other (APS, nurse)	4			1 (25%)	1 (25%)	2 (50%)		
Unknown	0							
Total	374	1 (0.3%)	1 (0.3%)	132 (35%)	37 (10%)	177 (47%)	25 (7%)	1 (0.3%)

Nearly half of the referrals across all referral sources resulted in revocation for failure to comply with either providing a physician's report to the MAB or taking the DPS comprehensive exam. The majority of referrals by physicians, DPS employees, and self-referrals resulted in license revocation for failing to comply with medical review requirements.

The next most frequent medical review/reexamination outcome across all referral sources was license revocation for not meeting medical standards for driver fitness, with drivers identified through crash reports the most likely to have this medical review outcome. Revocation for medical ineligibility to drive was associated with a third or more of the referrals by law enforcement and self-referrals, and approximately one-fourth of the referrals by physicians, DPS employees, and others (each).

Across all referral sources, 10% of the drivers had their licenses revoked for failing the DPS comprehensive examination. Family members were the most likely of the referral sources to result in revocation for test failure (47%).

The only driver who received new restrictions was referred by a family member (reported age-related diminished capabilities for 93-year-old family member), and the only driver required to submit periodic medical reports was a self-referral (self-reported a heart attack the month before requesting a duplicate license). The only driver who underwent testing and received neither a license restriction nor periodic review (no change in license status) was referred by a DPS employee (26-year-old driver who failed a road test; medical/functional reason for referral was not available).

Licensing outcomes can be grouped into three broad categories. The first category is a licensing action based on medical or functional guidelines or DPS test performance. This includes revocation for being medically unsafe to drive (MAB denials) or for failing DPS tests, new license restrictions, or a periodic review requirement (collapsing across the first four outcomes in Table E17). The second category is loss of licensure when drivers opt out of participating in the medical review process. This occurs when drivers voluntarily surrender their licenses, or when they fail to comply with medical review/reexamination requirements and have their licenses revoked. Although a voluntary surrender is an active driver behavior to end licensure and failing to comply with medical review/reexamination requirements is a passive driver behavior to end licensure, drivers who opt out of the medical review process are more alike than they are to drivers who actively comply with medical review/reexamination requirements (submit medical reports and/or test). The third category is no change in license status as a result of the medical review process (the last outcome listed in Table E17). Drivers in this category retain the same licensing status they had before they were referred for medical review. Referrals that result in no change in license status following the medical review process may function as a warning flag for diminished driving safety, if such drivers are subsequently referred for medical review.

A chi-square test examining the proportional distributions of these three broad licensing outcomes showed a significant difference in medical review outcomes for six of the eight known referral sources (X^2=34.46, *d.f.*=10, p<0.005). Researchers excluded referrals from citizens and others from the chi-square analysis due to their small numbers. Table E18 presents the contingency table showing observed and expected frequencies (where the expected frequencies were calculated by multiplying the total frequencies common to the cell, and dividing by 366). A

larger number of crash report identifications, law enforcement referrals, and family member referrals than expected resulted in a licensing action based on medical/functional guidelines or DPS test performance, while a smaller number of physician referrals resulted in this outcome than expected. Self-referrals and DPS employee referrals performed nearly as expected, based on their proportions in the sample.

Table E18. Chi-Square Contingency Table Showing Observed and Expected (in Parentheses) Values for Medical Review Outcomes by Referral Source in Texas

Referral Source	Result of Medical Review on License Status			Total
	License Action: Periodic Review, Restriction, or Revocation for Medically Ineligible or Test Failure	Opt Out of Licensing: Revocation for Failure to Comply With Medical Review Requirements or Voluntary Surrender	No Change in License Status	
Crash Reports	59 (48)	44 (55)	0 (0)	**103**
Law Enforcement	45 (42)	47 (49)	0 (0)	**92**
Physicians	31 (43)	63 (50)	0 (0)	**94**
Self	18 (20)	25 (23)	0 (0)	**43**
Family Members	10 (8)	7 (9)	0 (0)	**17**
DPS Employees	6 (8)	10 (9)	1 (0)	**17**
Total	**169**	**196**	**1**	**366**

Because several assumptions/restrictions were violated for this chi square analysis (i.e., more than 20% of the expected counts are less than 5, and not all expected counts are greater than 1), a second chi-square analysis was performed using only the first two medical review outcomes (licensing action and self-imposed suspensions). In this second analysis, the chi-square test also showed a significant difference in expected versus observed medical review outcomes for the six included referral sources (X^2=13.87, *d.f.*=5, p<0.025). There were no expected counts less than 5.

It could be argued that some proportion of the drivers whose licenses were alarmed for non-renewal may have had their licenses revoked as medically ineligible or due to test failure, had they participated in the initial investigation and any subsequent DPS medical review/reexamination requirements (referring to Table E13 driver condition for these 126 cases). To estimate this proportion, researchers applied the proportion of drivers within each referral source who underwent MAB review or comprehensive testing and whose licenses were revoked because they were deemed medically ineligible or they were not able to pass the comprehensive tests (in Table E17) to the number of drivers referred by each referral source whose licenses were alarmed for non-renewal (in Table E16). This resulted in a total of 60 of the 126 license alarmed drivers who would likely have had their licenses revoked after being found medically ineligible or upon failing comprehensive tests had they undergone medical review/reexamination.

Using this approach, (i.e., applying the proportions for each outcome by referral source from Table E17 to the counts of alarmed cases for each referral source in Table E16, and summing the proportions for all referral sources within each medical review outcome) the balance of the alarmed cases would likely result in:

- revocation for 45 drivers for failing to comply with MAB or testing requirements;
- voluntary surrender for 17 drivers; and
- restriction for 1 driver.

Case Disposition Time

The time between the date the driver was referred and the DPS opened the case (for all 500 cases) ranged from 0 to 312 days, and averaged 46 days (*SD*=40.6 days; *Mdn*= 36 days). Three percent of the cases were opened the day drivers were referred (16 of 500), 19% within 15 days of referral, 39% within 30 days of referral, 62% within 45 days of referral, 77% within 60 days of referral, and 90% within 90 days of referral.

Case disposition time is presented as the number of days that elapsed between the date the DPS opened the case and the disposition date (the date a driver was notified of revocation as medically ineligible to drive, was notified of revocation for failing to comply with medical review requirements, or passed or failed DPS tests). Analyses excluded drivers whose licenses were alarmed for non-renewal as these cases remained open. Across the sample of 374 drivers, case disposition time ranged from 0 to 397 days, and averaged 73.9 days (*SD* = 48.1 days; *Mdn*= 69 days). Two cases had the same date for opening and disposition (0 days). These were both self-referred drivers who were trying to renew their licenses, both were required to take the comprehensive test prior to renewal and neither complied with testing. Thirteen percent of the cases were resolved within 30 days of the date the case was opened, 40% within 60 days, 77% within 90 days, 90% within 120 days, and 96% within 180 days of the date the case was opened. A field investigation was required in 54 of the 374 cases (14%).

The two cases with the longest intervals from case opening to disposition date (383 days and 397 days) required field investigations. In the case that lasted 383 days, a driver was identified via a crash report indicating the driver crossed two lanes, hit a pole and flipped the vehicle into a concrete wall, with the driver having no recollection of the crash. The driver did not comply with the field investigation, and the license was initially alarmed for non-renewal. The driver subsequently went into the license office and voluntarily surrendered the license. The case lasting 397 days involved a law enforcement referral of an 87-year-old driver who was heading north in a southbound lane. When the officer stopped the driver, the driver advised his vehicle wasn't operating properly due to damage on the passenger side. However, the officer observed no damage and asked the driver what year it was, to which the driver replied 1920. The driver complied with the field investigation, the outcome of which indicated a requirement for comprehensive testing. The driver failed multiple knowledge test attempts and the license was revoked for failure to pass the comprehensive tests.

Case disposition times are described below, for five sets of cases:

- 177 drivers revoked for non-compliance with the MAB request for a physician statement and/or for non-compliance with comprehensive examination requirements;
- 132 drivers revoked as medically incapable;
- 37 drivers revoked for comprehensive test failure;
- 25 drivers who voluntarily surrendered in lieu of complying with medical review/reexamination requirements; and
- 3 drivers who retained their license.

Revoked for failure to comply with MAB or comprehensive testing requirements. The average case disposition time for the 177 drivers whose licenses were revoked for failure to comply with medical review/reexamination requirements was 82 days, ranging from 0 to 282 days (*SD*=40 days; *Mdn*= 76 days). Approximately 7% of these cases were resolved within 30 days, 16% within 60 days, and 76% within 90 days of the date the case was opened.

For the 50 drivers whose licenses were revoked for failure to take the comprehensive test, the case disposition time ranged from 0 to 282 days, and averaged 102 days (*SD*=59.8 days; *Mdn*= 99.5 days). For the 127 drivers who were revoked for failure to submit medical information to the MAB, the case disposition time ranged from 13 to 189 days, and averaged 74 days (*SD*=24.8 days; *Mdn*= 72 days).

Revoked as medically ineligible. Case disposition time for the 132 drivers denied licensure by the MAB as medically ineligible ranged from 14 to 332 days and averaged 54.3 days (*SD*=35.3 days; *Mdn*= 47 days). Nineteen percent of the cases were resolved within 30 days, 73% within 60 days, 91% within 90 days, and 99% within 180 days.

Revoked after failing the comprehensive test. The average case disposition time for the 37 drivers who failed the comprehensive test was 109 days, ranging from 20 to 397 days (*SD*=69 days; *Mdn*= 110 days). Eleven percent of the cases were resolved within 30 days, 22% within 60 days, 35% within 90 days, and 89% within 180 days.

Voluntary surrender. The average case disposition time for the 25 drivers who voluntarily surrendered their licenses in lieu of completing medical review/reexamination requirements was 72.5 days, ranging from 7 to 383 days (*SD*=74.5 days; *Mdn*= 57 days). Twenty-four percent of the cases were resolved within 30 days, 60% within 60 days, 76% within 90 days, and 96% within 180 days.

Retained license status. Two of the three drivers who retained license status passed the comprehensive examination without the need for a preliminary MAB review, and a third driver was approved by the MAB without the need for further DPS testing. Case disposition times for the two drivers who passed the comprehensive exam were 6 days for one driver and 70 days for the other (who failed on the first two attempts and passed on the third). Case disposition time for the driver who required MAB review only was 37 days.

Feedback to Reporting Source

The Texas DPS did not provide feedback to any reporting source regarding the outcome of medical review, for drivers referred for medical review.

Appeal of Licensing Actions

Ninety-one of the 500 case study drivers appealed the licensing actions described above (18.2% of the case study sample). The judge found in favor of the DPS in 35 of 90 cases (39%) and in favor of the driver in 55 of 90 cases (61%). One appeal outcome was not notated in the database.

The majority of the appeals followed license revocation due to medical ineligibility (78 of 91 appeals). The MAB provided the recommendation for such revocations, but did not participate in the driver appeal process. The judge found in favor of the DPS in 23 of the 78 (29%) and in favor of the driver in 55 of 78 (71%). In 50 of the 55 cases in which the judge found in favor of the driver, the license had been revoked for the following reasons:

- seizure (14 drivers);
- blackout (10 drivers);
- diabetic reaction (18 drivers); or
- other loss of consciousness or control (8 drivers).

These 50 drivers ranged from 20 to 84, with an average age of 53.2 (*SD*=19.7; *Mdn*= 57.5). Texas DPS required a 6-month seizure-free period and a 1-year diabetic-reaction free period that could be altered based upon the MAB's review of information submitted by the treating physician. The data collectors were able to provide a reinstatement date for 35 of these 50 cases. The number of days that elapsed from the referral for medical review to the license reinstatement date for these 35 cases ranged from 145 days (4.8 months) to 960 days (2 years and 8 months), with 32 of 35 drivers reinstated at 180 days (6 months) or more following the referral date and 10 drivers reinstated a year or more following their referral. This indicates that, by the time the hearing was held, these drivers had met (or were close to meeting) the seizure-free or hypoglycemic-free period.

The five cases that were not related to losses of consciousness or control as described above, and were decided in favor of the driver involved:

- dementia (2 drivers, one who was referred by law enforcement and the other by her treating physician);
- mental/emotional/psychiatric conditions (2 drivers, one who self-referred on the renewal form, and the other who was referred by her treating physician); and
- a driver who self-reported a heart attack on the license renewal form.

These drivers ranged in age from 57 to 74. The MAB reviewed medical information submitted by these five drivers' treating physicians and deemed them medically ineligible, with one driver eligible for MAB review in 1 year. Upon appeal, the judge ruled in favor of all five drivers and their licenses were reinstated. The license of the driver deemed eligible for MAB review in one

year from the referral date (a driver with mental/emotional/psychiatric condition) was reinstated 4 months from the referral date.

For the 23 drivers deemed medically ineligible by the MAB whose licenses were revoked, and for whom the judge ruled in favor of the DPS:

- 15 involved losses of consciousness related to seizures, diabetic reactions, and unspecified blackouts;
- 6 involved dementia;
- 1 vision impairment; and
- 1 substance abuse.

For all six appeals in which the drivers' licenses were revoked for comprehensive test failure, the judge found in favor of the DPS. For six of the seven appeals in which the drivers' licenses were revoked for failing to submit medical information to the MAB or take the comprehensive test, the judge ruled in favor of the DPS. The appeal outcome for the seventh case was not described in the database.

Case Cost

Case cost could not be estimated on a case-by-case basis for this study.

Appendix F: Detailed Summary of 500-Driver Case Study in Washington

Case Study Sample Selection

The Washington State Department of Licensing (DOL) supplied a de-identified data file to the principal investigator containing a list of 2,809 passenger vehicle drivers initially referred for medical review in 2012 (drivers on periodic review had already been excluded). The dataset potentially included drivers with a commercial driver license (CDL) endorsement. The list excluded drivers referred for alcohol abuse as well as those determined to be mentally incompetent by the court. Drivers were included regardless of whether they complied with DOL requirements for reexamination.

The list contained drivers referred from all possible sources, both within and outside of the DOL. The DOL did not track referral source, so it was not possible to develop a stratified sampling plan based on referral source. The DOL cautioned that it could be difficult to discriminate drivers who self-reported a medical condition at license renewal from those referred by a license examiner, due to the nature of the discussion between the driver and examiner regarding medical conditions.

The file contained referral date, driver's date of birth, and sex. The PI reviewed referral counts to determine whether there were variations by month, age, or sex. The number of referrals by month ranged from 123 to 287, and averaged 234 (*SD*=51). The monthly proportion of referrals ranged from a low of 4% in December and 5% in November, to a high of 10% in March, July, and October; all other months accounted for 8 to 9% of the total referrals. The lower than average proportion of cases in November and December was likely the result of DOL staff working fewer hours due to holidays in these months, according to the Assistant Administrator of Driver Records. Since the pool of drivers was initially identified by Case Opened Date (a coded data element in the DOL licensing system), rather than by Date of Referral (not a coded data element, but retrieved manually from the imaged records system to meet the PI's data request), a subset of drivers referred late in the year likely did not have their cases opened until early 2013.

Proportions of medical referrals by month and by age group and sex were stable, so there was no need to adjust the sampling strategy to account for fluctuations in referral counts. The data collector selected a systematic random sample of 500 drivers by using the list of 2,809 drivers sorted by date of referral, and selecting every 5th driver (driver 5, 10, 15), until 500 cases were obtained. Because the list of drivers already excluded drivers on periodic review and drivers referred because of alcohol abuse, the only manual exclusions (once a medical file was pulled) were dually-licensed commercial motor vehicle (CMV) drivers if their referral related to operating a CMV, drivers who died before they could submit their medical reports, or drivers whose licenses had expired or been suspended when they were referred. If one of the "every 5th" drivers selected for case study met the exclusion criteria, then the prior driver on the list was sampled (the 4th driver in the set of 5 drivers).

Data Entry

A recently retired Washington DOL Medical Section customer service specialist served as a consultant to research case information and enter data into the case study database. The

sample of drivers' licensing and medical files included referral notices, medical statements, crash reports, and other documentation. The consultant provided detailed notes regarding the reason for referral, which allowed the PI to further code how drivers came to the attention of law enforcement (crash or observed driving behavior) and what officers observed that led them to refer the driver for medical review. Other details included whether drivers died within the two-year period following their medical review (based on monthly reports from the Department of Health), and whether a driver suspended as a result of a loss of consciousness or control was reinstated following the required 6-month, episode-free period, allowed for additional post-coding and analyses.

DOL policy was to cancel licensure if a medical professional indicated that a driver had an uncontrolled condition which could interfere with safe driving. Drivers with conditions that could cause a loss of consciousness or control were to be episode-free for at least 6 months in order to drive. Drivers whose licenses had been cancelled due to a loss of consciousness or control were required to submit a statement by their physician that they met this requirement before their licenses could be reinstated. In a discussion of medical review outcomes, license status depends on the window of time selected, because medical conditions could improve or deteriorate over time. Drivers whose licenses were cancelled based on an unacceptable medical report due to a loss of consciousness or control were included in the set of drivers cancelled as not medically fit in the database. To illustrate that license status for medical review cases could change over time, the researcher conducted an additional analysis and summary describing if and when drivers' licenses were reinstated following the 6-month waiting period for the subset of drivers cancelled due to a loss of consciousness or control.

Regarding the time window for determining license disposition, Washington drivers who were required to submit a medical statement from their physicians were to do so within 30 days of receiving the notice of this medical review requirement. Because the study focused on the medical review outcome, if the medical statement was received within a month or two of the 30-day requirement and the medical review process continued for that driver, the consultant coded the driver as having complied with the requirement to submit a medical report. Drivers who failed to submit a medical or vision report were mailed a second notice following the 30-day period, advising that their license would be suspended in 30 days. The consultant coded the disposition date (defined as the date the licensing agency made the decision regarding the licensing action) for such drivers as the date the notice of impending suspension was mailed (as opposed to the suspension effective date). In Washington, drivers referred by physicians as medically unsafe to drive could have licenses cancelled immediately (within 5 days), without the requirement to provide a medical statement or take DOL tests. For these drivers, the consultant coded the disposition date as the date the DOL mailed the driver the notice of cancellation[8].

If testing was required, Washington DOL sent a letter advising the driver that they had 45 days to pass the required tests (potentially including a vision screening, knowledge test, and a driving test). The letter served a dual purpose; it advised the driver of the testing requirements and also that failure to complete the re-examination requirements would result in a suspension (see Figure F1). No second notice was provided if drivers did not comply. For drivers who failed

[8] A license cancellation and a license suspension both resulted in loss of licensure; the difference was that a fee was required for license reinstatement following a suspension but not for reinstatement following a cancellation.

to comply with testing requirements, the consultant coded the disposition date as the date by which testing was to be completed (i.e., 45 days from the date the notice was mailed, representing the suspension effective date). Again, if drivers attempted a road test shortly following the suspension for non-compliance, the consultant coded the licensing outcome and disposition date based on the road test outcome, and not based on the suspension for non-compliance with testing, to focus on the medical review outcomes. Drivers were permitted three attempts to pass the road test, provided they did not perform any dangerous actions. If they failed all three attempts, a cancellation was issued, effective in 15 days. The only option for further testing was for the driver to request an interview and for the hearing officer to grant a fourth attempt. The consultant coded the disposition date for drivers who failed the road test as the date they failed the final road test attempted (and not the cancellation effective date). Licenses of drivers who performed a dangerous action were cancelled immediately. The disposition date for drivers who passed the road test was coded as the date they passed the road test (whether it was the first, second, or third attempt).

Sample Demographics

Table F1 presents the age and sex distribution of the 500 drivers selected for the case study. Overall, males represented a slightly larger proportion of the case study sample compared to females, with larger percentages of males in most age groups. The average age of the case study sample was 74.3; the median age was 79 years old.

Table F2 displays the demographics of the entire pool of drivers referred to the Washington DOL for medical review in 2012 (n=2,809). The proportions by age group are nearly identical to those in the case study sample. The average age of the total sample of referrals was 75 years (SD=16.6), and 80% of the referral sample was 65 or older.

STATE OF WASHINGTON
DEPARTMENT OF LICENSING
P. O. Box 9030, Olympia, WA 98507-9030

April 30, 2014 jas

License #:

Washington law requires the Department of Licensing (DOL) to reevaluate a driver's knowledge, skills, and abilities when we receive information giving us reason to believe that a driver may not be able to safely operate a motor vehicle. This information often comes from law enforcement officers, medical and vision specialists and other sources

As a result of this process, you must complete a re-examination of your driving abilities. **Failure to complete the re-examination by June 13, 2014 will result in the suspension of your Washington driving privilege.** Authority: RCW 46.20.305; 46.20.041

What do I have to do?
Contact any DOL driver licensing office to schedule a re-examination. The office will let you know what is required for your specific situation. The re-examination may include any or all of the following:

- Vision screening
- Knowledge test
- Driving test
- A request for more information from your medical or vision specialist

You can visit our website for office locations, an online study guide, practice knowledge test, videos of what to expect during the drive test, and much more at www.dol.wa.gov.

NOTE: this examination cannot be taken at a commercial driver training school.

What other options are available?
If you no longer wish to drive, you may surrender your license. You can do this and get an ID card at any driver licensing office.

We suggest that you check the status of your driving privilege before you drive. Find out more at **www.dol.wa.gov** or by calling Customer Service at (360) 902-3900.

Driver Records

We are committed to providing equal access to our services.
If you need accommodation, please call 360-902-3900 or TTY 360-664-0116.

Figure F1. Washington Department of Licensing reexamination requirement letter.

Table F1. Washington Case Study Sample Demographics (n=500)

Age Group	Case Study Total	Age Group Percentage of Sample	Number of Males	Number of Females	Percent Male	Percent Female
16-24	8	2%	6	2	75%	25%
25-34	12	2%	8	4	67%	33%
35-44	20	4%	12	8	60%	40%
45-54	19	4%	8	11	42%	58%
55-64	46	9%	22	24	48%	52%
65-74	76	15%	47	29	62%	38%
75-84	177	35%	96	81	54%	46%
85-94	138	28%	60	78	43%	57%
95-99	4	1%	3	1	75%	25%
Total	500	100%	262	238	52%	48%

Table F2. Demographics of All Referrals to Washington DOL for Reexamination in 2012 (n=2,809)

Age Group	Total Referrals in 2012	Age Group Percentage of Sample	Number of Males	Number of Females	Percent Male	Percent Female
16-24	57	2%	41	16	72%	28%
25-34	63	2%	37	26	59%	41%
35-44	77	3%	49	28	64%	36%
45-54	130	5%	68	62	52%	48%
55-64	241	9%	138	103	57%	43%
65-74	423	15%	237	186	56%	44%
75-84	888	32%	479	409	54%	46%
85-94	869	31%	486	383	56%	44%
95-99	61	2%	44	17	72%	28%
Total	2,809	100%	1,579	1,230	56%	44%

Figure F2 compares the proportion of medical referrals by age group for the entire referral pool (green bars) and the case study sample (red bars) to their respective proportions within the licensed driver population in 2012 (blue bars). This figure shows that drivers younger than 65 were *underrepresented* among the medical referral and case study sample, and that drivers 65 and older were *overrepresented* among the medical referral population (and the case study sample) compared to their proportion in the population of licensed drivers.

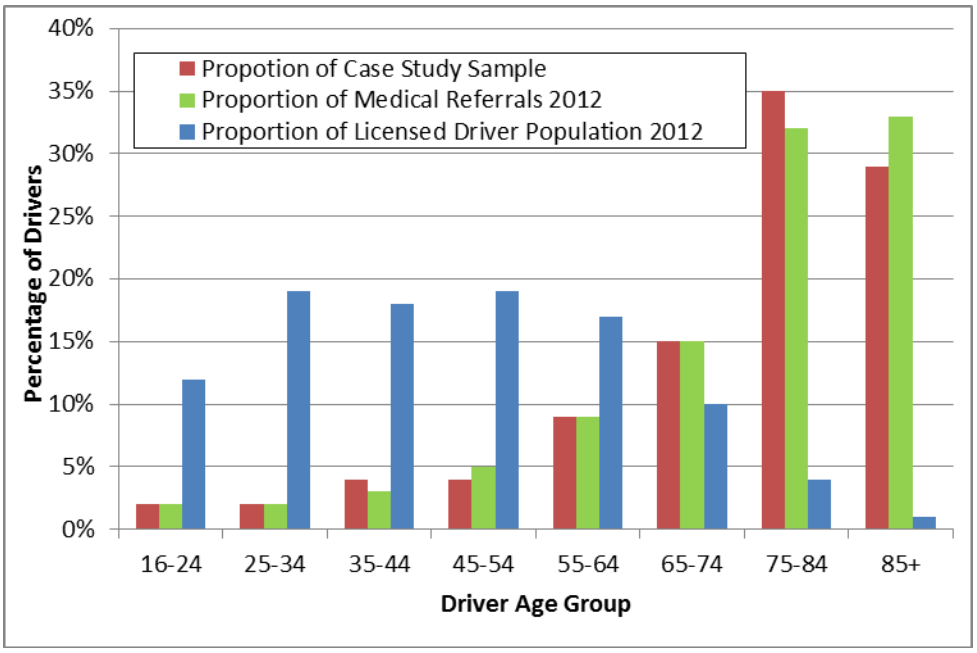

Figure F2. Comparison of case study population, medical referral population, and licensed driver population in Washington in 2012, by driver age group.

Referral Source

Table F3 presents the proportion of referrals by referral source and average age in the sample. Because the age distribution is skewed toward drivers 65 and older and the mean is sensitive to outliers resulting in an underestimation of central tendency, the description provides the median age as well. Physicians accounted for the plurality of referrals (nearly one-third of the sample) followed by law enforcement officers and physicians. Licensing agency representatives referred nearly one-fifth of the sample. Nearly 10% of the referrals were from healthcare providers such as occupational and physical therapists, nurses, physician assistants, geriatric assessment teams, and social workers. Average age by referral source did not vary substantially; however, referrals by family members were generally the oldest drivers in the sample. Self-referrals had a lower median age than referrals by other sources, and referrals by licensing agency representatives, concerned citizens, and family members had the highest median ages.

Table F3. Proportion of Referrals by Referral Source in the Washington Case Study Sample

Referral Source	Number in Sample (%)	Average Age (n) (SD)	Median Age
Physicians	164 (32.8%)	72.6 (16.8)	78
Law Enforcement	142 (28.4%)	72.6 (17.9)	78
Licensing Agency Representative	91 (18.2%)	76.7 (15.1)	83
Other Medical & Geriatric Care Professionals	49 (9.8%)	76.5 (12.5)	79
Concerned Citizens	25 (5.0%)	77.8 (16.9)	83
Family Members	24 (4.8%)	80.1 (8.3)	82
Self (license application or renewal form)	5 (1.0%)	73.6 (9.9)	68

Reason for Referral

Physician referrals. The PI read the narratives entered by the data collector in the database describing the reason for referral and broadly categorized the medical conditions or functional impairments prompting the physicians to refer the 164 drivers in the sample. Records noted multiple medical conditions/functional impairments for a subset of the 164 drivers. For example, descriptions for 6 of the 49 drivers with dementia included one or more of the following: Parkinson's disease, diabetes, leg weakness, chronic obstructive pulmonary disease, coronary artery disease, leg swelling, seizure, pacemaker, and limitations in neck range of motion. A subset of the drivers with cognitive impairments also had one or more of the following coexisting conditions: impaired motor skills, osteoarthritis, macular degeneration, coronary artery disease, severe shortness of breath, chronic bronchitis, tremor, or Parkinson's disease. Similarly, diabetes or hypoglycemia coexisted with descriptions of peripheral neuropathy and loss of consciousness (i.e., functional impairments caused by diabetes), as well as other conditions such as dementia, Parkinson's disease, memory impairment, and mental/emotional conditions. As a result, conditions such as heart-related disorders, pulmonary disorders, musculoskeletal disorders, and diabetes are underrepresented as reasons for referral in Table F4.

The researcher selected the most likely driver impairing diagnosis or functional impairment when multiple conditions were listed. As shown in Table F4, almost half of the physician referrals were associated with dementia or cognitive impairment. Seizure disorders or other losses of consciousness were associated with 16% of the physician referrals.

Table F4. Medical Conditions or Functional Impairments Associated With Physician-Referred Drivers in the Washington Case Study Sample

Medical Condition or Functional Impairment	Number of Drivers (n=164)	Percentage of Physician Referrals
Dementia	49	30%
Cognitive impairment	29	18%
Seizures	19	12%
Loss of consciousness (resulting from hypoglycemia, ventricular tachycardia, ventricular fibrillation, and other non-specified reasons)	7	4%
Memory impairment	11	7%
Stroke or transient ischemic attack	9	5%
Visual field impairments (includes visual field defects/neglect, glaucoma, peripheral vision below standard)	5	3%
Peripheral neuropathy	3	2%
Brain injury	2	1%
Cancer	2	1%
Diabetes (poorly controlled)	2	1%
Mental/emotional conditions	2	1%
Heart conditions	2	1%
Unawareness/parks on sidewalks	1	0.5%
Too weak & de-conditioned to perform duties necessary to drive, memory problems& oxygen 24/7, poor reflex response	1	0.5%
Limitation in coordination, balance & ability to quickly respond in emergent situations	1	0.5%
Severe pulmonary issues/low oxygen levels	1	0.5%
Sleep apnea	1	0.5%
Spinal cord impairment (resulting in weakness)	1	0.5%
Lack of alertness (needs 24/7 supervision)	1	0.5%
Difficulty ambulating	1	0.5%
Dizziness	1	0.5%
Unspecified medical conditions that may affect ability to drive safely	13	8%

[a] the most likely driver impairing diagnosis or functional impairment is listed in this table, when a driver had multiple conditions cited.

Referrals from other healthcare or geriatric care providers. Forty-nine drivers were referred from healthcare providers other than physicians. Referral sources included:

- geriatric regional assessment teams (10 drivers);
- accredited registered nurse practitioners or registered nurses (10 drivers);
- occupational therapists (6 drivers);
- certified physician assistants (6 drivers);
- social workers (6 drivers);
- adult protective services (3 drivers);
- geriatric case manager (1 driver);
- geriatric mental health crisis evaluator (1 driver);
- licensed mental health counselor (1 driver);
- medical administrator (1 driver), mental health crisis responder (1 driver);
- physical therapist (1 driver);
- psychiatrist (1 driver); and
- manager of a retirement/assisted living facility (1 driver).

Table F5 summarizes the reasons provided for referral of these 49 drivers for medical review. More than three-fourths were referred due to concerns about the effects of dementia, cognitive impairments (two with coexisting impairments in their ability to move their legs), memory loss, or confusion on driving ability.

Table F5. Description of Driver's Condition That Prompted Other Healthcare or Geriatric Care Providers' Referral for Medical Review in Washington

Driver's Condition	Number of Drivers (n=49)	Percentage of Healthcare or Geriatric Care Providers' Referrals
Cognitive impairment	21	43%
Dementia	11	22%
Memory loss	5	10%
Confusion	2	4%
Loss of consciousness	2	4%
Seizure	2	4%
Somnolence	2	4%
Tremors (Parkinson's disease)	1	2%
Visual field defect	1	2%
Difficulty walking (head injury)	1	2%
25-year history of not driving	1	2%

Law enforcement referrals. The PI read the narrative describing the reason for the 142 law enforcement referrals, and coded:

- when a crash occurred;
- the driving behavior that may have brought a driver to the attention of a law enforcement officer;
- the officer's observations about the driver's condition that prompted the referral for medical review; and
- whether potentially driver impairing medication was noted in the referral narrative.

Crash involvement was noted in nearly half of the law enforcement referrals, which in and of itself would bring a driver to the attention of law enforcement. The driving behavior that either resulted in the crash or that caused the officer to make the traffic stop was provided in 62 of the 142 narratives, and is reported in Table F6. Driving the wrong way (on a one-way street, or head-on into opposing traffic on the wrong side of the road) was the most frequent driver error resulting in the traffic stop, followed by lane keeping difficulty, erratic driving, driving too slowly, and failing to stop for red traffic signals or stop signs.

Table F6. Driving Behavior That Brought Driver to the Attention of Law Enforcement, in Washington

Driving Behavior	Number of Cases With Descriptions (n=62)
Wrong way	13
Lane keeping difficulty	9
Erratic	8
Too slow	8
Driving off road (e.g., on shoulder, median, sidewalk)	5
Ran red light	5
Ran stop sign	3
Speeding	2
Stopping for no reason	2
Wide turn	2
Illegal U-turn	1
High-centered the vehicle (driver maneuvered vehicle over hump/snow/ice packed in center of lane, which was too high for vehicle undercarriage to clear.)	1
Fail to stop for officer directing traffic	1
Driving vehicle on fire	1
Backed into police vehicle during traffic stop for unsafe driving	1

Table F7 displays the driver condition that prompted the officer to refer the driver for medical review, either the officer's own observation of a mental or physical impairment, or a driver's self-report (or other passenger's report) of a medical condition or functional impairment. Such a condition was mentioned in 100 of the 142 narratives, and 7 case narratives indicated that the driver was taking potentially driver impairing medications. Confusion was noted most frequently, followed by seizures (or possible seizure) while driving.

There was no mention of driver condition in 42 narratives; 38 of the 42 involved drivers 65 or older and 31 involved drivers 75 or older. The older age coupled with driving errors (e.g., driving the wrong way, lane keeping difficulties, driving too slow, and running red lights and stop signs) characteristic of drivers with medical or functional impairments listed in Table F5 may have prompted officers to refer these drivers for medical review.

Licensing agency representative referrals. License service representatives (LSRs) were trained to observe customers as they approached their counter for obvious physical impairments such as limited mobility or strength, tremors, paralysis, use of a wheelchair or assistive device, or loss of a limb. LSRs also looked for signs of visual or mental impairments as they interviewed drivers during the application and renewal process, conducted the vision screening, and asked the medical question "*Do you have any mental or physical condition or are you taking any medications, which could impair your ability to operate a motor vehicle*?" LSRs referred to DOL guidelines to select reexaminations and to determine what evaluation or testing was required. The narratives for all 91 LSR referrals included information about the driver's condition that prompted the referral for medical review (see Table F8).

A complete vision screening that consisted of testing both eyes together, left eye, and right eye for visual acuity, phorias, horizontal field, and color was given to *all* drivers at each in-

person renewal. As shown in Table F8, 19 drivers were referred for medical review by LSRs because their vision did not meet the standard. One of these 19 also evidenced confusion at the counter.

Table F7. Description of Driver's Condition That Prompted Law Enforcement Officer's Referral for Medical Review in Washington

Driver's Condition	Number of Cases With Descriptions (n=100)
Confusion	14
Seizure or possible seizure while driving	13
Vision impairment	6
Pedal error (driver stated hit gas instead of brake)	6
Unaware of collision involvement	6
Disoriented	5
Unaware of surroundings or performance effects on other traffic	5
Lost	5
Blacked out or lost consciousness	4
Shakiness	3
Mental health issues	3
Difficulty walking	3
Dementia	3
Did not see (police vehicle with siren and lights, struck pedestrian, approaching vehicle)	3
Parkinson's disease/could not control arms, face, or legs	2
Fell asleep	2
Inattention	2
Poor understanding of rules of the road	2
Cognitive impairment	2
Physical impairments	2
Diabetes	1
Stroke	1
Slurring	1
Requires oxygen while driving	1
Protective custody warrant, bipolar and off medications	1
Memory loss	1
Low blood sugar	1
Difficulty turning head	1
Could not recall details of crash	1

The plurality of referrals from LSRs were associated with difficulty walking. These included 6 drivers using a walker and 15 using a cane. Eight had one or more additional physical impairments noted, including frailty (2 drivers), memory impairment (1 driver), shaky hands (1 driver), confusion (2 drivers), dementia (1 driver), and vision below standard (1 driver). Narratives for six drivers noted medical conditions that contributed to their difficulty walking, including arthritis, neuropathy, hip replacement, broken pelvis, broken hip, and torn ligaments.

Nine drivers were referred for review because they approached the counter using a wheel chair. Records indicated that two of these drivers had had strokes, one had amyotrophic lateral sclerosis (ALS), one used continuous oxygen, and another had chronic obstructive pulmonary disease.

Fifteen drivers were referred due to limited strength and/or mobility. One had had a stroke that resulted in paralysis of one arm and a brace on their leg. One had cerebral palsy, one a neurological condition, and one surgery.

Three drivers were referred due to the LSR's observation of slow movements. Two of these three had had strokes, one with cognitive impairments. The third was noted as confused.

Both drivers referred with limited neck range of motion had osteoporosis.

Table F8. Description of Driver's Condition That Prompted License Service Representative's Referral for Medical Review in Washington

Driver's Condition	Number of Drivers (n=91)	Percent of LSR Referrals
Difficulty walking (includes approaching counter using a cane or walker)	35	38%
Wheel chair (on approach to counter)	9	10%
Vision below standard	19	21%
Limited strength/mobility	15	16%
Slow movements	3	3%
Cognitive impairment	3	3%
Confusion	3	3%
Requires use of supplemental oxygen/labored breathing with oxygen	2	2%
Limited neck range of motion	2	2%

Family member referrals. Table F9 summarizes the reasons provided for the 24 family-member referrals. Most were referred based on concerns about effects on function and safe driving performance of dementia, cognitive impairments (one resulting from a stroke), confusion, decision-making impairments (one stroke-related), and memory loss (one resulting from head trauma).

Impairments in physical abilities included a driver with a left leg amputation below the knee, one driver with limited neck range of motion due to neck surgery, who also had poor balance and confusion, and one with strength and mobility limitations including difficulty walking and confusion due to a stroke.

Table F9. Description of Driver's Condition That Prompted Family Member Referrals for Medical Review in Washington

Driver's Condition	Number of Drivers (n=24)	Percent of Family Member Referrals
Dementia	7	29%
Cognitive impairments	4	17%
Memory loss	2	8%
Confusion	1	4%
Decision-making impairment	1	4%
Slow reactions	4	17%
Difficulty walking	1	4%
Limited neck range of motion, poor balance, confusion	1	4%
Fainting	1	4%
Leg amputation	1	4%
Multiple crashes	1	4%

Referrals from other concerned citizens. Table F10 summarizes the reasons provided for the 25 referrals by concerned citizens (other than family members). Drivers referred due to concerns about dementia included one who also had limited neck strength, one who was involved in multiple crashes, and one with coexisting congestive heart failure. Others were referred with combinations of cognitive and physical impairments (short-term memory loss, easily disoriented, inability to process information, dystonia, slow reaction time, ambulation issues). Another was described as emotionally unstable, confused, with vision problems. Three drivers were referred due to physical impairments (difficulty walking, turning head, and lifting arm as the result of a broken neck in the past; slow reactions, fatigue, and difficulty walking; and tremors, muscle spasms, and weakness due to reflex sympathetic dystrophy). One of the two drivers referred with limited vision had macular degeneration, and one also had loss of feeling in their feet.

Table F10. Description of Driver's Condition That Prompted Concerned Citizen Referrals for Medical Review in Washington

Driver's Condition	Number of Drivers (n=25)	Percent of Concerned Citizen Referrals
Dementia	8	32%
Cognitive and physical impairments	4	16%
Poor driving performance	4	16%
Physical impairments	3	12%
Seizures	2	8%
Vision impairments	2	8%
Blackout causing crash	1	4%
Emotionally unstable, confused, and poor night vision	1	4%

Self-referrals. Five case study drivers responded in the affirmative to the medical question on the license renewal form "*Do you have any mental or physical condition or are you taking any medications, which could impair your ability to operate a motor vehicle*?" Two indicated they had experienced strokes, one Parkinson's disease and mild cognitive impairment, one reported difficulty turning their head and neck and that they had had a hip replacement. The medical condition for the fifth driver was not specified in the narrative.

Medical Review Requirements

When the Medical Section received a referral (Driver Evaluation Request) from a medical professional or from law enforcement, a customer service specialist evaluated the information provided on the form and determined the action to be taken. Referrals from physicians and law enforcement did not always result in the requirement for a driver to have a physician or vision specialist's report. The DOL decisions included (1) no action was taken; (2) the driver must submit medical or vision information from their physician; (3) the driver must take a knowledge and/or skill test; or (4) immediate license cancellation. If a referral from a physician indicated the person should not drive, the Department promptly mailed a notice of immediate cancellation (cancellation within 5 days of the date of the letter, rather than the customary 45 days following a letter of cancellation), with notice of an opportunity to contest the action. If the referral was from the public, the driver was asked to submit documentation from

their health or vision care provider to verify or deny the referral before any further action was taken.

Drivers referred by LSRs because they exhibited signs of confusion, memory loss, or difficulty responding to routine questions were selected for reexamination testing and were also issued a Physical Examination Report. Drivers referred by LSRs who used a walker, crutches, or wheelchair, had other limited motor function or loss of limbs, severe tremors resulting in an inability to grip an object, and who had no restrictions or had not been tested since their original license, were selected for reexamination (on-road test). Drivers referred by LSRs because they demonstrated some difficulty gripping an object due to tremors or hand deformity, or demonstrated limited range of motion and/or strength in limbs, torso, head, or neck were required to undergo an In-Vehicle Assessment (which differed from the reexamination/on-road test).

Drivers who failed the vision-screening test (except color) were issued a Visual Examination Report (also referred to as a "vision certificate"), which they were instructed to take to an ophthalmologist or optometrist for completion, and return within 30 days to the DOL medical unit. Drivers who answered "Yes" to the medical question on the license application and renewal forms were provided with a Physical Examination Report ("medical certificate") in an envelope addressed to the issuing License Service Office; they were advised that the form must be returned in 30 days to avoid suspension.

Immediate cancellations (no physician or vision specialist's report required, and no DOL testing). The licenses of 50 drivers were cancelled immediately, based on the information in the referral report, without the need for a medical or vision statement, or testing. Forty-six of the 50 drivers were referred by physicians, and the remaining 4 by other healthcare providers (2 by nurses and 2 by certified physician assistants). The immediately cancelled drivers ranged from 24 to 98, with a median age of 70.5 (M=65.6, SD=20.6). These 50 referrals were associated with:

- dementia (23);
- seizures or epilepsy (17);
- syncope or other loss of consciousness due to heart conditions (2); and
- psychiatric/emotional conditions, cancer (sedation from medications), uncontrolled dizziness, hepatic encephalopathy, traumatic brain injury, uncontrolled diabetes, hemi-neglect and right-arm weakness, and multiple medical conditions with poor insight into the effects on driving and non-compliance with medications (8).

Requirement to submit a physician's or vision specialist's statement. Of the remaining 450 drivers, 199 (39.8% of the total sample of 500) were required to submit more detailed information about their medical or vision condition, and 251 drivers were not. The medical and/or vision information was based on an examination performed within the preceding 90 days. Both a physician and a vision statement were required for 33 drivers, only a physician statement was required for 123 drivers, and only a vision statement for 43 drivers.

Fifty-seven drivers (11.4% of the total sample of 500 drivers) did not submit the required information and consequently lost their licenses. Among these, 6 voluntarily surrendered their licenses in lieu of submitting the medical information, and 51 received a license suspension for failing to comply with the reporting requirement. The median age of the 6 drivers who voluntarily surrendered licenses was 73 (range 63 to 86, *M*=74.2, *SD*=10.8) and the median age for the 51 drivers suspended for failing to comply with the medical or vision reporting requirement was 79 (range 27-92, *M*=70.5, *SD* =19). Five of the 6 drivers who voluntarily surrendered and 5 of the 51 drivers who were suspended for failure to comply with the medical reporting requirements were also required to take the road test as a part of the medical review process.

Medical fitness to drive. Based on the information submitted in the medical and vision statements for the 142 drivers who complied with the reporting requirement, 19 were deemed medically not safe to drive, and their licenses were cancelled. The medical conditions/functional impairments associated with these 19 drivers were:

- seizures/epilepsy or other loss of consciousness (11 drivers);
- dementia (4 drivers);
- sleep disorder (1 driver);
- diabetes with poor insulin management and temporary loss of consciousness (1 driver);
- vision below licensing standard (1 driver); and
- psychiatric/emotional condition (1 driver).

Combining these 19 drivers with the 50 drivers whose licenses were immediately cancelled as a result of the information presented in physician or other medical professionals' referrals as described earlier, results in a total of 69 drivers (13.8% of the total sample of 500) receiving license cancellations because they were not medically safe to drive.

Subtracting the 69 drivers cancelled as not medically fit and the 57 drivers suspended for failing to submit medical and/or vision statements from the total sample of 500 results in 374 drivers deemed medically fit. Of these, 21 were licensed without further DOL testing, and 353 drivers were required to take the DOL tests. Included within the set of 353 drivers required to take the DOL tests were the 251 drivers who were not required to submit a physician examination or vision specialist report. Driver compliance with DOL testing requirements, and test outcomes are described below.

DOL test requirements. Of the 353 drivers required to take the DOL tests, 229 were required to take all three tests (vision, knowledge, and road), 55 the knowledge and road tests only, 35 the vision and road tests only, and 34 the road test only.

Sixty-four drivers voluntarily surrendered their licenses in lieu of testing (or in lieu of completing testing) and an additional 160 had their licenses suspended for failing to comply with the testing requirements. The drivers who voluntarily surrendered their licenses (30 females and 34 males) ranged from 38 to 94, with a median age of 81(*M*=77.3, (*SD*=13.8). Fifty-five drivers who voluntarily surrendered did not attempt the road test (including 2 who attempted and failed

the knowledge test), and 9 voluntarily surrendered after failing an initial road test attempt. The 160 drivers who were suspended for failing to comply with the testing requirements (83 females and 77 males) ranged from 23 to 97, with a median age of 80.5 (*M*=77.9, *SD*=11.7). One additional applicant for an original license failed the knowledge test and obtained an ID card in lieu of continuing testing (a 48-year-old female).

Of the remaining 128 drivers who attempted the DOL tests, 81 passed and retained licensure (39 females and 42 males), and 47 drivers failed and had their licenses cancelled (18 females and 29 males). Forty-four of the 47 drivers' licenses were cancelled following road test failure and three following knowledge test failure (these drivers were not permitted to take the road test). The drivers who failed the DOL tests ranged from 35 to 95, with a median age of 86 (*M*=81.6, *SD*=11.5). The 81 drivers who passed the DOL tests ranged from 19 to 93, with a median age of 78 (*M*=72.3, *SD*=16.3). Among the 81 drivers who passed the road test and retained their licenses were 4 drivers who failed the knowledge test. These four drivers were permitted to take the road test, which they passed. The LSR evaluated their knowledge of rules of the road during the on-road test.

Combining the 81 drivers who were medically fit and passed the DOL tests with the 21 drivers deemed medically fit who required no additional testing, results in 102 drivers out of the total sample of 500 (20.4%) with continued licensure, following medical review.

Requirement for examination by driver rehabilitation specialist. At the time these data were collected, the Washington DOL did not refer drivers to driver rehabilitation specialists for their assistance in making fitness to drive determinations.

Medical Review Outcomes

Figure F3 shows the referral sources and the licensing process and outcomes across the sample of 500 case study drivers referred for medical review. Table F11 presents the licensing outcomes for the total sample of 500 drivers, as well as by referral source.

There was no change in the license status for 12% of drivers in the sample following their medical review/reexamination. They neither received new restrictions, nor were required to submit periodic medical and/or vision reports. An additional 8% retained licensure, but either had new restrictions and/or were required to submit periodic medical/vision reports. Just over 79% of the sample lost licensure as a result of medical review, either because they were deemed not medically fit, they failed DOL tests, they voluntarily surrendered their licenses in lieu of submitting medical/vision reports or attempting DOL tests, or their licenses were suspended when they failed to comply with medical review requirements.

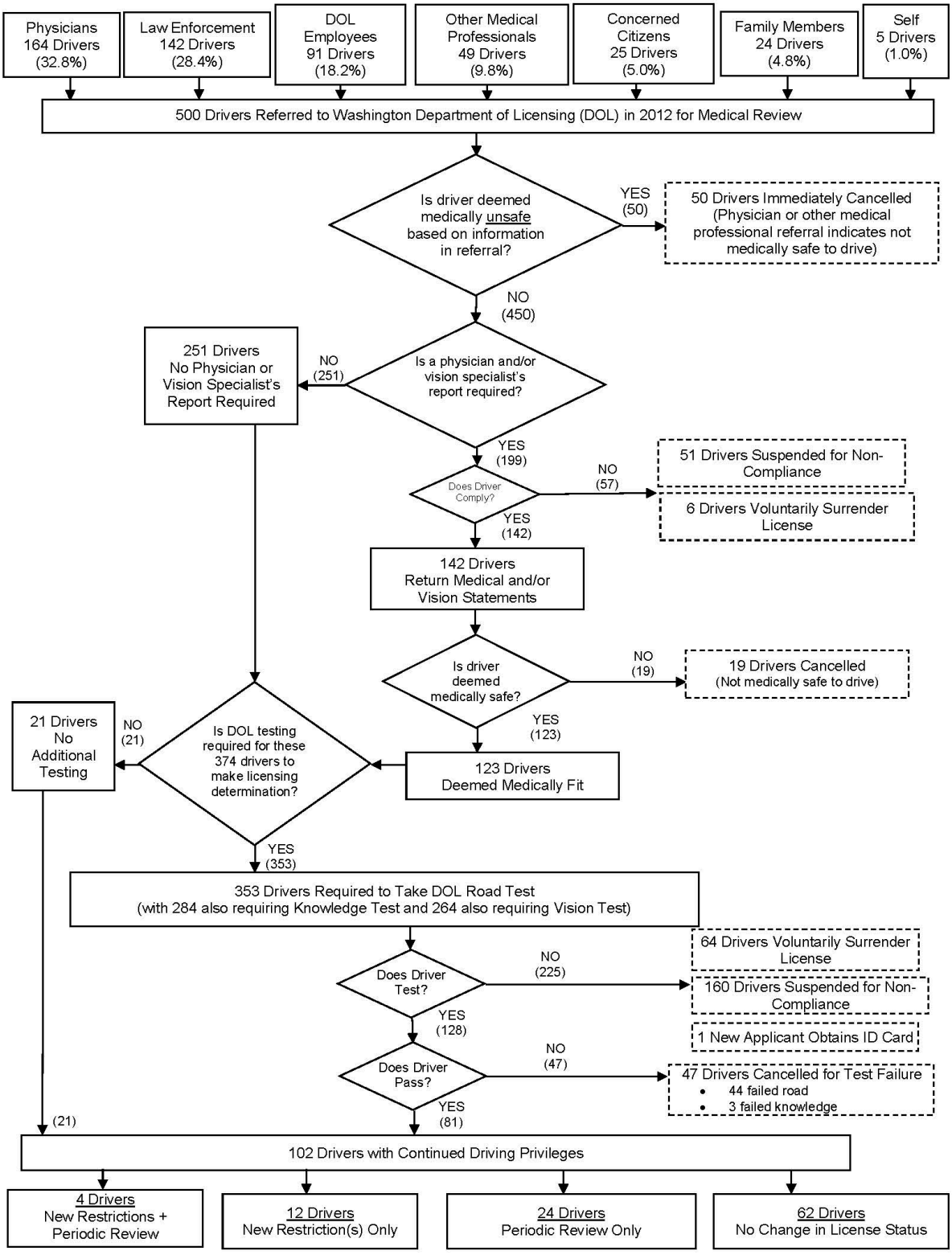

Figure F3. Medical review process and outcomes for 500 drivers referred to the Washington Department of Licensing.

Table F11. Medical Review Process Licensing Outcomes in Washington, by Referral Source

Referral Source	Number of Drivers	Change in License Status as a Result of Medical Review							
		New Restriction Only (Row %)	Periodic Review Only (Row %)	New Restriction + Periodic Review (Row %)	Cancellation (Medically Unfit) (Row %)	Cancellation (Test Failure) (Row %)	Suspension (Fail to Comply With Reexam Requirements) (Row %)	Voluntary Surrendered Own License[a] (Row %)	No Change (Row %)
Physicians	164	4 (2.4%)	3 (1.8%)	1 (0.6%)	50 (30.5%)	9 (5.5%)	64 (39.0%)	16 (9.8%)	17 (10.4%)
Law Enforcement	142	6 (4.2%)	8 (5.6%)	2 (1.4%)	7 (4.9%)	10 (7.0%)	66 (46.5%)	10 (7.0%)	33 (23.2%)
DOL Employee	91	1 (1.1%)	1 (1.1%)		1 (1.1%)	22 (24.2%)	26 (28.6%)	38 (41.8%)	2 (2.2%)
Other Medical Professionals	49		1 (2.0%)		6 (12.2%)	3 (6.1%)	28 (57.1%)	4 (8.2%)	7 (14.3%)
Concerned Citizens	25	1 (4.0%)	6 (24.0%)			1 (4.0%)	14 (56.0%)	1 (4.0%)	2 (8.0%)
Family Members	24		5 (20.8%)	1 (4.2%)	5 (20.8%)	1 (4.2%)	11 (45.8%)	1 (4.2%)	
Self	5					1 (20%)	2 (40.0%)	1 (20.0%)	1 (20%)
Total	500	12 (2.4%)	24 (4.8%)	4 (0.8%)	69 (13.8%)	47 (9.4%)	211 (42.2%)	71 (14.2%)	62 (12.4%)

[a] In lieu of complying with testing requirements, or following one or two test failures, the driver chose to give up their licenses and completed paperwork to formally surrender their license, rather than complete the re-examination testing. Includes 1 new applicant (age 48) referred by a DOL employee. The applicant failed the road test and was therefore not given a license, so she obtained an ID card. This driver was never licensed, so the license could not be suspended.

Licensing outcomes can be grouped into three broad categories. The first is a licensing action based on medical or functional guidelines or DOL test performance. This includes cancellation for those found medically unsafe to drive, cancellation for failing DOL tests, license restrictions, or a periodic review requirement (collapsing across the first 5 outcomes in Table F11). The second category is loss of licensure when drivers opt out of participating in the medical review processes (either by voluntarily surrendering their licenses, or not complying with medical reporting or testing and being suspended). The third category is no change in license status as a result of the medical review process (the last column in Table F11). Drivers in this category retained the licensing status they had before they were referred for medical review. A referral that results in no change in license status following the medical review process *may* serve as a warning flag for diminished driving safety, if that driver is subsequently referred for medical review. This project focused on initial referrals for medical review, so the data could not be used to validate this potential benefit.

The most likely outcome for each of the seven referral sources shown in Table F11 was a driver opting out of licensure (either a suspension for failing to comply with medical review reporting and/or testing requirements, or voluntarily surrendering the license). Nearly half of the physician-referred drivers, half of family-member referrals, and more than half of law enforcement referrals, self-referrals, referrals by concerned citizens, other medical professionals, and DOL employees resulted in loss of licensure as the result of a driver opting out of the medical review process.

Referrals by law enforcement were *the most likely* of the referral sources to result in no change in license status, while those by family members and DOL employees were the *least likely* to result in no change in license status. Referrals by physicians and family members were *more likely* than referrals by the other five sources to result in a licensing action based on medical/functional guidelines or DOL test performance.

A chi-square test using these three broad licensing outcomes showed a significant difference in medical review outcomes for the seven referral sources (X^2=44.28, d.f.=12, p<0.005). Table F12 presents the contingency table showing observed and expected frequencies (where the expected frequencies are calculated by multiplying the total frequencies common to the cell, and dividing by 500). A larger number of physician referrals than expected resulted in a licensing action based on medical/functional guidelines or DOL test performance, while a smaller number of law enforcement referrals resulted in this outcome than expected.

A slightly smaller number of physician referrals than expected resulted in no change in license status, while a larger number of law enforcement referrals than expected resulted in no change in license status. Referrals by family members followed the same pattern as physician referrals. Referrals by other medical professionals followed the same pattern as law enforcement referrals.

Slightly fewer referrals by DOL employees than expected resulted in a licensing action based on medical/functional guidelines or DOL test performance; however, many fewer than expected referrals by DOL employees resulted in no change in license status. Self-referrals and referrals by concerned citizens performed as expected, based on their proportions in the sample.

Table F12. Chi-Square Contingency Table Showing Observed and Expected (in parentheses) Values for Medical Review Outcomes by Referral Source

Referral Source	Result of Medical Review on License Status			Total
	License Action: Periodic Review, Restriction, or Cancellation for Medically Unfit or Test Failure	Opt Out of Licensing: Suspension for Failure to Comply With Medical Review Requirements or Voluntary Surrender	No Change in License Status	
Physicians	67 (51.17)	80 (92.50)	17 (20.34)	**164**
Law Enforcement	33 (44.30)	76 (80.09)	33 (17.61)	**142**
DOL Employee	25 (28.39)	64 (51.32)	2 (11.28)	**91**
Other Medical/Geriatric Care Professionals	10 (15.29)	32 (27.64)	7 (6.08)	**49**
Concerned Citizens	8 (7.80)	15 (14.10)	2 (3.10)	**25**
Family Members	12 (7.49)	12 (13.54)	0 (2.98)	**24**
Self	1 (1.56)	3 (2.82)	1 (0.62)	**5**
Total	**156**	**282**	**62**	**500**

The types of new restrictions applied to the licenses of 16 drivers with continued licensure included combinations of the following:

- corrective lenses (9 drivers);
- outside mirror on both sides (7 drivers);
- seat cushion (2 drivers);
- inside rearview mirror (2 drivers); and
- automatic transmission (2 drivers).

There were no time of day, geographic, or roadway type or maximum posted speed limit restrictions placed on case study drivers as a result of undergoing medical review.

Case Disposition Time

The time between the date the driver was referred and the date the DOL opened the case ranged from 0 to 127 days, with a median of 5 days (M=5.8, SD=8.9). Just over one-fifth of the cases were opened the day they were referred (108 of 500, including all but 3 of the LSR referrals and all but 1 of the self-referrals), 57% were opened within 5 days following the referral, 95.2% within 15 days of referral, and 99% within 30 days of referral.

Case disposition time is presented as the number of days that elapsed between the date the DOL opened the case and the date the DOL determined the license action (disposition date). Across the sample of 500 drivers, case disposition time ranged from 0 to 229 days, with a

median of 46 days (*M*=51.5, *SD* = 37.7). Nineteen of the 500 cases were resolved the same day they were opened (18 were voluntary surrenders and 1 obtained an ID card; all were LSR referrals). Seventeen percent were completed within 15 days, 24% of the cases were completed within 30 days, 45% within 45 days, 75% within 60 days, and 87% within 90 days of the date the case was opened.

Case disposition times are described below, for four sets of cases:

- 50 drivers' licenses were immediately cancelled as a result of the referral (requiring no additional medical information or testing);
- 76 drivers who either were determined not medically fit so had licenses cancelled following the DOL's review of a physician examination report or who were suspended for failure to submit the requested physician's report (and required no DOL tests);
- 21 drivers who were deemed medically fit following the DOL's review of a physician examination report, with no additional testing required; and
- 353 drivers deemed medically fit and required to take the DOL road test.

Immediate cancellations. Forty-six of the 50 immediate cancellations were referrals submitted by physicians and 4 were submitted by other medical professionals (nurses or physician assistants). These 50 cases required no additional medical information (no physician examination report was required). Case disposition time ranged from 2 to 35 days, with a median of 6 days (*M*=7.4, SD=5.4). Forty-nine cases were completed within 15 days of the case-opened date.

Cancellations based on a physician examination report. Based on information provided by the treating physician or vision specialist (when a physician or vision examination report was required for a medical review determination), 19 drivers were determined to be not medically safe to drive and their licenses were cancelled. Case disposition time for these drivers ranged from 2 to 73 days, with a median of 34 days (*M*=32.4, *SD* = 19.6). Forty-seven percent of these cases were completed within 30 days and 84% within 60 days.

Another 51 drivers were required to submit a physician and/or a vision examination report and failed to do so, resulting in license suspension. Case disposition time for these 51 drivers ranged from 13 to 129 days, with a median of 36 days (*M*=37.5, *SD* = 15.1). Ten percent of these cases were completed within 30 days, 94% within 45 days, and 98% within 60 days. The case that took 129 days was an LSR referred driver who failed the vision test upon renewal (requiring a vision examination statement), and also a road test. The driver did not return the vision statement, but was not suspended until failure to comply with the road testing requirement.

Of the 6 drivers who voluntarily surrendered their licenses in lieu of submitting physician or vision examination reports, five did so on the day they were advised of the medical review requirement, and the sixth driver voluntarily surrendered 46 days following the notice of the medical review requirement.

Medically fit and no further testing required. The disposition time for the 21 drivers deemed medically fit, with no additional DOL testing required to make a licensing

determination, ranged from 8 to 106 days, with a median of 34 days (*M*=40.3, *SD*=26.9). Thirty-eight percent of these cases were completed within 30 days, 71% within 45 days, and 81% within 60 days. Notes were provided for one of the two cases with disposition times over 60 days. A case which took 105 days was actually completed within 53 days when the driver was initially suspended for failing to submit the medical statement. The driver remained suspended for 55 days until the medical statement was submitted to the medical department indicating the driver's medical condition was under control, allowing the suspension to be lifted and the license reinstated. This is an example of how the PI instructed the data collector to code disposition dates to reflect the outcome resulting from the referral for medical review if a driver complied shortly after the DOL-permitted window for submitting a medical statement.

Medically fit and required to undergo DMV testing. The disposition time for the 353 drivers required to undergo DOL testing before a licensing determination could be made ranged from 0 to 229 days, with a median of 50 days (*M*=62.2, *SD*=37.9).

Twelve percent of these cases (43 of 353) had disposition times of 30 days or less, 66% were completed within 60 days, 83% within 90 days, and 91% within 120 days. Delay in cases longer than 90 days generally involved either a suspension for failing to submit a medical report, which was then submitted in the near term, or a suspension for not completing the road test within 45 days of the notice of the road test requirement, which was lifted shortly thereafter when the driver passed the road test. Drivers whose licenses were suspended for failing to submit a medical report and who subsequently submitted the report and passed the DOL tests did not have valid licenses between their suspension date and the date they passed the test. The PI chose to extend the observation of the medical review period beyond the point where these drivers were temporarily suspended for failing to submit a medical report (and were subsequently relicensed within a short period of time), to provide a more accurate indication of licensing outcomes following medical review.

In addition, cases in the sample requiring a road test that were opened in late 2011 through the spring of 2012 may show longer disposition times than cases opened later in the year because of a change in DOL processing of reexamination cases. Prior to the spring of 2012, a regional secretary acted as the "middle person" between the medical review department, the driver, and the license service office (LSO). The medical review department advised the regional secretary to send the driver a notice of the reexamination requirement and to send a reexamination packet to the LSO. The LSO then advised the regional secretary of the outcome of the road test (or failure to comply), and the secretary advised the medical review department of the outcome. This process led to delays in the process and increased case disposition time. In the spring of 2012, the regional secretary was eliminated from the process, and the medical department began sending the driver and the LSO the notice of reexamination requirements. The LSO reported directly back to the medical review department. Of the 60 cases with disposition dates longer than 90 days, 47 were prior to May 1, 2012, (78%) and 13 were associated with cases opened on or after May 1, 2012 (22%). Cases longer than 90 days accounted for 33.6% of the cases opened before May 1, 2012, requiring a road test (47 of 140) and only 6.1% of the cases opened on or after May 1, 2012, requiring a road test (13 of 213).

Table F13 presents a summary of case disposition times for the 353 drivers required to take the DOL road test based on medical review requirements and licensing outcomes.

Table F13. Case Disposition Times for 353 Drivers Required to Take and Pass DOL Tests, by Licensing Outcome

Licensing Outcome	Number of Cases	Case Disposition Time (Days)			
		Range	Average	Standard Deviation	Median
Passed and Were Licensed	81	2-193	70.5	39.4	66
Cancellation for Test Failure	47*	7-199	75.8	38.8	64
Suspension for Non-Compliance With Testing Requirement	160	25-229	62.7	31.3	50
Voluntary Surrender	64	0-199	41.3	41.6	36

*excludes new applicant (age 48) who failed knowledge test and obtained an ID card. Applicant was never licensed so could not have licensure.

Feedback to Reporting Source

The Washington DOL did not provide feedback to any reporting source regarding the outcome of medical review, for drivers referred for review.

Appeal of Licensing Actions

An individual could contest the cancellation of their driver's license due to medical conditions and/or failing the skill test. The DOL included a form for requesting a hearing in the mailing with the notification of cancellation letter. People were given 15 days to notify the department in writing of their desire to contest. The hearings were normally conducted by phone with a hearing examiner ("medical interview"). Drivers who contested the decision made by the hearing officer during the medical interview were permitted to request a formal hearing by submitting a letter within 10 days. Drivers who contested the decision made during the formal hearing could appeal to the Superior Court of the county in which they resided.

Nineteen of the 500 case study drivers requested a departmental interview (3.8% of the sample), 9 related to a "not medically fit" cancellation and 10 to cancellation for failure to pass the road test. Results of the interview sustained the cancellation for 15 drivers of 19 drivers (79%). Three of these drivers requested a formal hearing, which also sustained the cancellation. One of these three drivers appealed to the Superior Court, which also sustained the cancellation.

The results of the departmental interview reversed the cancellation for three drivers (one cancelled for use of prescription medications causing sedation, one cancelled due to a seizure, and one cancelled due to a sleep disorder).

The licensing outcome for the remaining case study driver was suspension for failing to submit a medical statement. The data collector provided notes describing licensing actions in the 2 years following the disposition coded for this study as follows. A year and a half following the suspension for failure to provide a medical statement, the driver submitted a medical statement indicating the medical condition was not under adequate control, and the DOL suspended the driver due to an unacceptable medical statement. Five months later, the driver requested an interview, but the interview had not been conducted at the time data were collected for this study, so the outcome of the hearing is unknown.

Case Cost

The data collector provided an estimate of the cost to process each medical review case based on the approximate time of 1.5 staff hours required to process a referral for cases where a reexamination road test was not required (at an average cost of $20/hour, for a total of $30). When both a medical certification and a road test were required, the estimate applied to each case was 3 hours, at a cost of $20/hour ($60 total). She considered multiple testing opportunities in the case estimates when they occurred. Additional staff time and costs to the Department were included in the estimate when a driver appealed the licensing decision. This included 1 staff hour to schedule the hearing and send out discovery and process continuance requests, at an average cost of $20 per hour. In addition 1 hour of hearing examiner time was required to conduct the hearing and draft the order, at an average cost of $35 per hour.

Across the full sample of 500 cases, the cost ranged from $20 to $220, with a median of $40 per case (*M*=$43.56, *SD*=$33.96).

Case cost for the 50 drivers who were immediately cancelled without the requirement to submit a medical/vison statement or to take DOL tests averaged $24.40 (range $20-$60, *SD*=$11.63). Five of these cases involved costs for a driver appeal. Case cost for the 6 drivers who voluntarily surrendered in lieu of submitting a medical statement ranged from $20 to $40, and averaged $36.67 (*SD*=$8.16). Case cost for the 51 drivers who were suspended because they did not submit the requested medical or vision statement ranged from $20 to $40 and averaged $21.96 (*SD*=$6.00).

Case cost for the 19 drivers cancelled as a result of an unacceptable medical/vision statement (and therefore no further DOL testing permitted) ranged from $20 to $80 and averaged $26.32 (*SD*=$14.98; median = $20). Two of these cases involved appeals. For the 21 drivers deemed medically fit as a result of information provided in the medical/vision statement with no DOL testing required, case cost ranged from $20 to $60 and averaged $29.52 (*SD*=$12.03; *Mdn*=$20). The single case that cost $60 involved an initial cancellation as medically unfit due to a seizure that was reversed 16 days later as the result of a hearing and review of a second medical statement.

Case cost for the 81 drivers who took and passed DOL tests as part of their medical review requirement ranged from $40 to $180 and averaged $72.59 (*SD*=$33.38; *Mdn*=$60). This subset of drivers included 21 drivers who also were required to submit a physician's statement. Case cost for the 47 drivers who failed the DOL licensing tests and whose licenses were therefore cancelled ranged from $40 to $200 and averaged $95.74 (*SD*=$45.81; *Mdn*=$80). Fourteen drivers in this subset were also required to submit physician's statements as part of their medical review process. Case cost for the 160 drivers whose licenses were suspended for not complying with the DOL testing requirements ranged from $20 to $220 and averaged $30 (*SD*=$20.43; *Mdn*=$20). The data collector included costs post-suspension for failure to test for one driver who attempted the road test 6 months following the suspension, failed all three attempts, and appealed the suspension. The suspension was sustained. This case, the outlier in the set, cost $220. Case cost for the 64 drivers who voluntarily surrendered their licenses in lieu of DOL testing or following one or more attempts ranged from $20 to $120, and averaged $45 (*SD*=$21.67; *Mdn*=$40).

Additional Analyses

License reinstatements following cancellation for seizure or other loss of consciousness or control. As described earlier, identifying the license status of any particular driver is often a function of when the researcher reviews the driver's license file. Drivers who received a cancellation due to a seizure or other loss of consciousness or control were coded for the study as cancelled/medically not fit. License reinstatement in Washington required drivers to submit an acceptable report from their treating physician indicating that they had been episode-free for at least 6 months, before their licenses could be reinstated following a cancellation due to a loss of consciousness or control.

Four of the 11 drivers (36.4%) whose licenses were cancelled due to seizures or other losses of consciousness submitted an acceptable physician's statement sometime within the 2 years following the case study disposition date, resulting in license reinstatement. The time period between the license cancellation and the reinstatement for these 4 drivers was 17 days, 98 days, 475 days, and 693 days. The driver whose cancellation was released after 17 days requested a hearing subsequent to the cancellation. The hearing officer reviewed new medical information and found in favor of the driver.

Drivers deceased following medical review. Date of death was easily accessible for the data collector and was used to determine when a case should be excluded (deceased prior to submitting medical review information or undergoing required tests). Since death date was formally a part of the licensing file and was readily accessible, the data collector noted when a case study driver died following medical review to further characterize the medical/functional condition of medical referrals. Sixty-four of the case study drivers (12.8% of the sample) were reported to the DOL as deceased within the two-year period following their case disposition dates. This included 44 males and 20 females. The range of days between license disposition and death was 3 to 684 days, and averaged 301 days (*SD* = 196). At the time of their referral, these drivers ranged from 42 to 94 years, with an average of 78.0 years (*SD* = 13.2 years). Nineteen were referred by a physician and 8 by other medical professionals, 15 by law enforcement, 15 by a DOL representative, 5 by concerned citizens, one by family, and one was a self-referral. Ten of the 64 had maintained licensure as a result of their medical review, 9 had been cancelled as medically unsafe, 31 had been suspended for failing to comply with medical review requirements, 6 had been cancelled for failing DOL tests, and 8 voluntarily surrendered their licenses.

Appendix G: Detailed Summary of 500-Driver Case Study in Wisconsin

Case Study Sample Selection

The Wisconsin Department of Motor Vehicles (DMV) supplied a de-identified data file to the PI containing a list of 3,315 passenger vehicle drivers initially referred for medical review in 2012 (duplicate referrals in 2012 as well as drivers already under periodic review had been excluded). The dataset contained drivers referred from all possible sources, both within and outside of the DMV, via a Driver Condition or Behavior Report (Form MV3141, see Figure G1). The list potentially included dually licensed drivers referred via adverse condition or behavior reports while operating a commercial motor vehicle (CMV) and drivers with alcohol abuse (although medical review was not the primary path for drivers with alcohol abuse).

The dataset *did not* contain drivers who disclosed a medical condition to a field agent during a license transaction (i.e., for initial licensure, renewal licensure, or for a duplicate license). An affirmative response to one question on the license application/renewal form required an applicant to submit a physician-completed medical examination report, and possibly undergo DMV testing: "*In the past year, have you had a loss of consciousness or muscle control, caused by any of the following conditions? If Yes, check condition and give date*." The listed conditions were:

- traumatic brain or head injury;
- diabetes;
- heart;
- lung;
- mental;
- muscle or nerve;
- seizure disorder; and
- stroke.

Applicants who responded in the affirmative were provided with a medical examination form to have completed by their physician. The completed form was processed in the DMV general queue and not the behavior report queue; the behavior report queue was reserved for people reporting concerns about another individual (MV3141 referrals) and was a heightened priority queue. It was not possible, without a massive manual undertaking by the DMV, to identify drivers who self-reported a medical condition. Therefore, researchers were not able to document the proportion of drivers in Wisconsin who underwent medical review as a result of self-reporting a medical condition, and the medical review outcomes of such self-reports.

The licensing agency removed the license number before transmitting the list to the PI. The DMV did not provide birthdate (or age), or driver sex for the list of referred drivers, as this would have required a manual lookup. The DMV did not track referral source, removing any possibility of developing a stratified sampling plan based on referral source.

DRIVER CONDITION OR BEHAVIOR REPORT

MV3141 1/2013

The following information is submitted for consideration as "Good Cause" for Departmental action as authorized under section 343.16 Wisconsin Statutes. Advanced age alone, cannot be considered as good cause. **Positive driver identification must be established.** License plate number only is **not** sufficient.

Health Care Professional complete back of form.
All others, complete front of form.

This information may be subject to Wisconsin's Open Records Law.

Submit to: Wisconsin Department of Transportation
Medical Review
PO Box 7918
Madison, WI 53707-7918

Telephone: (608) 266-2327
FAX: (608) 267-0518
Email: dmvmedical@dot.wi.gov

Driver Name – First, Middle, Last	Birth Date	Driver License Number	State of Issuance

Address, City, State, ZIP Code

Driver Condition – Check appropriate boxes. **Describe below.**

- ☐ Physical Condition
- ☐ Mental/Emotional Condition
- ☐ Blackout, Seizure, Fainting Spell
- ☐ Lack of Knowledge of Traffic Laws
- ☐ Confused/Disoriented
- ☐ Alcohol/Other Drugs
- ☐ Defective Vision
- ☐ Obstructing Traffic

Describe in detail incidents or conditions, which brought this driver to your attention. Give specific information such as dates, places, accident reports, all other available information to support the Department's action. Hearsay or second-hand information will not be accepted.

Type of Enforcement Action Taken	Incident Date	Time	Report Date (m/d/yy)

Title and Signature of Person Completing this Form X	Print Full Name	(Area Code) Telephone Number

Address, City, State, ZIP Code

If this report is being completed by private citizens or family members, the full name, address and signature of a second or additional person who can **verify** the above information is REQUIRED. A signature verifies the information to be true and correct.

Print Name	(Area Code) Telephone Number

Address, City, State, ZIP Code	X (Signature) (Date – m/d/yy)

Figure G1. Wisconsin *Driver Condition or Behavior Report* (MV3141), page 1 of 2.

This side must be completed by an MD, DO, PA-C or APNP only.

This information is not subject to Wisconsin's Open Records Law; it is, however, available to the driver upon request.

Driver Name – First, Middle, Last	Birth Date	Driver License Number	State of Issuance

Address, City, State, ZIP Code

Describe in detail patient's current medical condition(s) and diagnosis.
Give specific information to support the Department's action.

YES	NO		
☐	☐	1.	Is this patient able to safely operate a motor vehicle at this time? A "No" answer will result in immediate cancellation of all license classes and endorsements. The department cannot test a person who is deemed medically unsafe.
☐	☐	2.	If the answer to #1 is "Yes", do you recommend a complete re-examination of patient's driving ability (knowledge, sign and skills tests)?

Print Full Name	Medical License Number
Mailing Address, City, State ZIP Code	(Area Code) Telephone Number
Signature of MD, DO, PA-C or APNP **X**	Date (m/d/yy)

Figure G1 (Cont'd). Wisconsin *Driver Condition or Behavior Report* (MV3141), page 2 of 2.

The PI reviewed referral counts to determine whether there were monthly variations. The number of referrals by month ranged from 232 to 329, and averaged 276 (*SD*= 29.6). The monthly proportion of referrals ranged from a low of 7% in December and September, to a high of 10% in May; all other months accounted for approximately 8 to 9% of the total referrals. Based on the rather stable proportion of referrals by month, there was no need to adjust the sampling strategy to account for fluctuations in referral counts. The DMV sorted the dataset by date of referral and driver license number within referral date, and numbered the list sequentially from 1 to 3,315. The data collector selected a systematic random sample by selecting every 6th driver on the list (driver 6, 12, 18, 24), until 500 cases were obtained.

Because the list already excluded drivers on periodic review, and most drivers referred for alcohol abuse, the only manual exclusions for the study sample were those involving:

- adverse driving by a dually-licensed driver while operating a commercial motor vehicle;
- drivers with alcohol abuse;
- drivers were referred for medical review who died before they could submit their medical reports or test;
- drivers whose licenses were cancelled because they moved out of State (and as a result did not return their medical information); and
- drivers whose licenses were already expired, cancelled, or suspended at the time of their referral for medical review.

If one of the "every 6th" drivers selected for case study met the exclusion criteria, the data collector selected the *prior* driver on the list (the 5th driver in the current set of 6 drivers). The "already expired, cancelled, or suspended license" exclusion criterion was imposed mid-data collection; although several such cases entered early were identified and replaced, three remained within the sample.

Data Entry

A recently retired Wisconsin DMV Medical Review Department employee served as a consultant to research case information and enter data into the case study database. The sample drivers' licensing and medical files included scanned images of referral notices (Condition or Behavior Reports), medical statements, occupational therapist evaluations, crash reports, and other documentation. The consultant provided detailed notes regarding the reason for referral, which allowed post coding by the PI to further describe how drivers came to the attention of law enforcement (crash or observed driving behavior), and what the officer observed about the person's condition that led to referring the driver for medical review. He included several other details in the database notes field which allowed for additional analyses, such as:

- whether a physician included findings by an occupational therapist, geriatrician, or neuropsychological evaluation when referring a patient for review;
- whether case study drivers died within the two-year period following their medical review;

- whether a driver whose license was cancelled as a result of a seizure was re-licensed following the required 3-month seizure-free period; and
- whether drivers who voluntarily surrendered their licenses were granted an instruction permit.

These post-coded variables are described in more detail below.

The DMV did not refer drivers to driver rehabilitation specialists for an expert opinion on fitness to drive prior to a licensing determination. However, physician referrals were often based on the findings of an occupational therapy assessment, a neuropsychological evaluation, or a geriatric assessment. Physicians who based their opinions of fitness to drive on such assessments included this information with their referral. Rather than code in the database that the DMV referred the driver to a driving specialist for an opinion on fitness to drive (which was not part of the Wisconsin driver medical review process), the consultant noted when physicians included such an evaluation as part of their referral for medical review.

The consultant noted if and when a case study driver died following their medical review. This was possible because each month the State Vital Records Office, Division of Public Health submitted a "deceased file" to the DMV, allowing the DMV to update the customer record automatically with a deceased notation. The consultant used this information to determine when a case should be excluded (deceased prior to submitting medical review information or undergoing required tests); the PI requested notation of death and the date, to further characterize the medical/functional condition of medical referrals in Wisconsin.

At the time of data collection Wisconsin had a law requiring drivers with seizure disorders to be episode-free for at least 3 months. Drivers whose licenses were cancelled due to a seizure or loss of consciousness were required to submit a statement by their treating physician that they had met this requirement before their licenses were reinstated. In a discussion of medical review outcomes, license status is dependent on the window of time selected, because medical conditions can improve or deteriorate over time. If any of the case study drivers had their licenses cancelled based on an unacceptable medical report due to a seizure/loss of consciousness or control, they were included in the set of drivers coded as cancelled/not medically fit in the database. An additional analysis describes if and when licensure was reinstated following the 3-month waiting period for the subset of drivers cancelled due to a seizure/loss of consciousness or control.

In Wisconsin, if a driver undergoing medical review failed the road test twice, he or she could either surrender their license or have it cancelled. Drivers who voluntarily surrendered could obtain an instruction permit allowing them to drive only with another licensed driver (similar to an instruction permit for initial license applicants). An instruction permit was valid for 12 months and could be renewed multiple times, until/or unless a physician reported to the DMV that the driver was no longer medically fit to continue driving. The data collector noted if drivers who voluntarily surrendered also received an instruction permit, and if and when they passed the DMV road test and had their licenses re-instated.

Regarding the window for determining license disposition, drivers required to submit a medical statement from their physicians had to do so within 30 days of receiving notice. Because

this study focused on the medical review outcome, if the medical statement was received within a month or two of the 30-day requirement and the medical review process continued for that driver, the consultant coded the driver as having complied with the requirement to submit a medical report. If DMV testing was required, the DMV mailed the driver a letter advising of a 20-day requirement to pass a vision screening, traffic sign test, and general traffic knowledge test. The computer system actually permitted 30 days for testing, providing the driver held a valid license. Drivers could attempt the written tests up to five times during that 30-day time period, before their licenses were cancelled. Drivers who failed the written tests five times were required to wait 12 months from the date of the first failed attempt before further attempts were permitted. Case study drivers who failed the knowledge test five times were coded in the database as cancelled for failing the knowledge test, with the disposition date the date of the fifth attempt.

If drivers passed the written tests before the 30 days elapsed, a road test appointment was scheduled. Due to wait times for road test appointments in some areas, the Medical Review Department extended the time period for test completion to the scheduled road test date. Medical Review's goal was for drivers to complete both the written and driving tests within 60 days of the date the letter requiring tests was mailed, but some drivers were provided time beyond the 60 days to complete all tests. The time window was determined on a case-by-case basis depending on a number of factors, including how well the driver had performed on previous road tests and availability of future road test appointment dates, along with the degree of concern raised by the information in the initial driver condition report. Drivers who failed two road tests and wished to retain licensure were required to surrender their driver's license and obtain a learner's permit, permitting practice with a driving instructor before taking a subsequent road test. But this was at the discretion of the examiner in the field who administered the road test. The consultant coded the date and outcome of the final road testing opportunity (the second or third, if attempted), to characterize the true outcome of the medical review process.

Sample Demographics

Table G1 presents the age and sex distribution of the 500 drivers selected for the case study. Overall, males represented 60% of the sample, and larger percentages of males than females were present in most age groups. The median age of drivers in the sample was 78 (range 16 to 98, M=70.6, SD=19.3). Drivers 55 and older comprised 81% of the sample.

Researchers were unable to compare the demographics of the sample to the entire pool of drivers referred for medical review in 2012, as extracting the sex and birthdate of all 3,315 drivers would have required a time consuming manual undertaking for DMV staff.

Table G1. Wisconsin Case Study Sample Demographics (n=500)

Age Group	Case Study Total	Age Group Percent of Sample	Number of Males	Number of Females	Percent Male	Percent Female
16-24	20	4%	14	6	70%	30%
25-34	19	4%	13	6	68%	32%
35-44	34	7%	18	16	53%	47%
45-54	24	5%	13	11	54%	46%
55-64	44	9%	29	15	66%	34%
65-74	64	13%	37	27	58%	42%
75-84	181	36%	108	73	60%	40%
85-94	109	22%	67	42	61%	39%
95+	5	1%	0	5	0%	100%
Total	500	100%	299	201	60%	40%

Drivers65 and older accounted for 72% of the case study sample, but only 17.2% of the licensed population of drivers in the same year. Males and females were equally represented among the population of licensed drivers (49.9% and 50.1%, respectively).[9] If the sample of 500 drivers is representative of the entire pool of drivers referred for medical review in 2012 via Behavior/Condition Reports, this indicates that males and older drivers were overrepresented among the population of drivers referred for medical review, compared to their proportion in the licensed driver population.

Referral Source

Table G2 presents the proportion of referrals by referral source and median and average age, as the age distribution of the sample was skewed toward drivers65 and older, and the average is sensitive to outliers. The majority of the sample was referred by law enforcement. Physicians accounted for slightly over one-fourth of the referrals. Physician-referred drivers were older on average than drivers referred by law enforcement. DMV representatives, family members, the courts, and others each referred less than 5% of the sample, with drivers referred by family members among the oldest in the sample. Among those listed as "other" referrals were four occupational therapists, a nurse/wellness director at the driver's apartment complex, and a private investigator.

As noted earlier, self-referrals were not represented in the pool of 3,315 drivers referred in 2012 via Behavior and Condition Reports as it was not possible to identify the pool of drivers who underwent medical review as a result of self-reporting a medical condition during a licensing transaction.

[9] Federal Highway Administration. (2013). *Highway Statistics, 2012*. Table DL-22 Licensed Drivers by State, Sex, and Age Group. Washington, DC: Author.

Table G2. Proportion of Referrals by Referral Source in the Wisconsin Case Study Sample

Referral Source	Number in Sample (%)	Average Age (SD)	Median Age
Law Enforcement	331 (66.2%)	69.1 (19.9)	77
Physician	142 (28.4%)	73.2 (17.8)	80
DMV Representative	4 (0.8%)	68.5 (14.6)	70.5
Family Member	14 (2.8%)	85.1 (6.4)	86
Other Concerned Citizen	2 (0.4%)	37.5 (4.9)	37.5
Court	1 (0.2%)	56	56
Other	6 (1.2%)	76.7 (12.8)	80
Total	500 (100%)	70.6 (19.2)	78

Reason for Referral

Law enforcement officers. The PI read the consultant's narrative describing the reason for referral, and coded:

- when the narrative indicated that a crash occurred;
- the driving behavior that may have brought a driver to the attention of a law enforcement officer;
- the officer's observations about the driver's condition that prompted the referral for medical review; and
- whether potentially driver impairing medication was noted in the referral narrative.

Crash involvement was noted in 170 of the 331 law enforcement referrals (51%), which in and of itself would bring a driver to the attention of law enforcement. The driving behavior that either resulted in the crash or that caused the officer to make the traffic stop was provided in 265 of the 331 narratives (see Table G3). Failing to yield and driving the wrong way were the most frequent driving violations mentioned in the law-enforcement referrals. Other frequently mentioned driving errors were lane-keeping difficulty, erratic driving, striking parked vehicles, and crossing into an oncoming traffic lane.

Table G4 displays the driver condition that prompted the officer to refer the driver for medical review, either the officer's own observation of a mental or physical impairment, or a driver's self-report (or other passenger's report) of a medical condition or functional impairment. Such a condition was mentioned in 227 of the 331 narratives, and an additional 33 cases indicated that the driver was taking potential driver impairing medications. Confusion was noted most frequently, followed by observations of poor physical condition, and conditions causing loss of consciousness (diabetic reactions, falling asleep, blackouts, seizures).

Table G3. Driving Behavior That Brought Driver to the Attention of Law Enforcement

Driving Behavior	Number of Cases
Fail to Yield	24
Wrong Way	23
Lane-Keeping Difficulty/Weaving	23
Erratic	22
Struck Parked Vehicle	22
Cross Into Oncoming Traffic Lane	21
Run Off Road	17
Rear-End Crash	15
Pedal Error (wrong pedal or slipped off brake)	17
Ran Stop Sign	9
Ran Red Light	7
Driving Too Slow	7
Observation of Multiple Violations	6
Speeding	6
Unsafe Lane Change	5
Reckless	5
Backing Crash	4
Struck Pedestrians	3
Stopped for No Reason	3
Observation of Near Crashes	3
Driving on Flat Tires	3
Driving Without Headlights at Night	3
Driving in Wrong Lane	3
Obstructing Traffic	2
Poor Lane Positioning During Turn	1
Passed School Bus With Flashing Lights	1
Passed in No Passing Zone	1
Operating While Intoxicated	1
No Turn on Red Violation	1
Following Too Close	1
Wrong Gear (Mistook Reverse for Drive)	1
Drove Through Railroad Crossing With Flashing Lights	1
Unsafe Pass	1
Drove Through Blocked Fire Scene	1
Mistakenly Drove Someone Else's Car Home From Store	1

Table G4. Description of Driver's Condition That Prompted Law Enforcement Officer's Referral for Medical Review

Driver's Condition	Number of Cases
Confusion	53
Physical Condition (e.g., difficulty walking; shakiness, lethargic, lacking in strength, balance, coordination, mobility)	34
Diabetic Reaction	17
Disoriented	16
Blacked Out	16
Fell Asleep	15
Vision Problems	15
Lost	10
Denial of Driving Problems	11
Seizure	11
Looked but Didn't See	7
Dementia	7
Parkinson's Disease	6
No Recollection of Crash	6
Slow Reaction Time	5
Driver Questioned Own Safe Driving Ability	5
Hit and Run	3
Narcolepsy	2
Slurring	2
Slow Speech	2
Bipolar	2
Peripheral Neuropathy	2
Unable to Follow Officer's Instructions	1
Tourette's	1
Stroke	1
Panic Attack	1
Multiple Medical Conditions	1
Migraine	1
Medical Event	1
Huntington's Disease	1
High Blood Pressure	1
Hearing Impairment	1
Foot Slipped Off Brake	1
Dilated Pupils	1
Can't Read or Write	1
Abandoned Vehicle With 2 Flat Tires Mid-Intersection	1

Physicians. Among the 142 referrals from physicians, 8 mentioned potentially driver impairing medication. In 21 cases, the physician noted input from an occupational therapist, neuropsychologist, geriatric assessment team, or hospital psychiatrist. The PI read the consultant's narratives describing the reason for referral to determine the medical condition prompting the physician to refer their patient for medical review. The reasons provided for the 142 physician referrals are shown in Table G5. Cognitive limitations including dementia and memory impairments were the most frequently described medical conditions in the referring physicians' reports. Seizures were also a frequent cause for referral. Wisconsin did not have a mandatory reporting law, but some physicians appeared to believe there was, as indicated by this

physician comment, "patient has had several episodes of unresponsiveness and has been started on anti-seizure medication; am notifying DOT per State statute."

Table G5. Description of Driver's Medical Condition or Functional Impairment That Prompted Physicians' Referrals for Medical Review

Medical Condition or Functional Impairment	Number of Cases
Dementia	29
Cognitive Impairment	19
Multiple Medical Conditions	19
Memory (often in combination with impairments in judgment, visuospatial abilities, and attention)	16
Seizure (4 with indications of non-compliance with medical regime)	14
Unspecified Medical Condition Affects Ability to Drive Safely	6
Physical Condition (weakness, limitations in range of motion)	5
Confusion (some with disorientation)	4
Stroke	4
Syncope	3
Visuospatial Deficit	3
Blackout	2
Traumatic Brain Injury	2
Neurological Condition	2
Blurred Vision	1
Change in Medical Condition	1
Concussion	1
COPD	1
End Stage Renal Disease	1
Episodes of Unresponsiveness	1
Driving Under Influence of Drugs (tested positive in ER for opiates, benzodiazepines, THC, following crash)	1
Macular Degeneration	1
Sleep Apnea	1
Poor Judgment	1
Multiple Recent Crashes	1
Slow Reaction Time With Poor Memory	1

Family members. The Driver Behavior or Condition Reports submitted by 14 family members described the following conditions:

- cognitive impairment, dementia, or confusion coupled with getting lost while driving (3 drivers);
- multiple medical conditions (4 drivers);
- physical condition including impairments in strength, coordination, balance, reaction time (4 drivers);
- recent multiple crashes (1 driver);
- peripheral neuropathy (1 driver); and
- vision (1 driver).

Others. Among the six referrals from "other sources" were four occupational therapists who reported that "we are concerned that the driver's underlying medical conditions may affect his or her ability to operate an automobile safely." A private investigator referred a driver, stating that the individual experienced physical and cognitive deficiencies as a result of a stroke. And one nurse who functioned as the wellness coordinator at the driver's residence referred an individual because of concerns about confusion, disorientation, and getting lost while driving.

Concerned Citizens. The two referrals from concerned citizens indicated that one driver had experienced several seizures over the past year, while the other reported daytime sleepiness while driving.

DMV employees. The four referrals from DMV employees during licensing transactions resulted from the following behaviors:

- a loud and combative license applicant;
- observation of a turn from the wrong lane outside the DMV with driver confusion on follow-up;
- questionable cognitive impairment observed during test for school bus endorsement (and failure); and
- follow-up assistance for a driver with a letter from his physician that he should have his driving abilities assessed.

Courts. There was one referral from the courts, from a prosecuting attorney who indicated that the crash-involved driver informed him that he was on a heart monitor.

Medical Review Requirements

Medical review requirements could include submission of more detailed medical information from a driver's physician, vision specialist or both; passing the DMV vision, knowledge, and road tests; or no other requirements/immediate cancellation.

No medical reporting or testing requirements. A driver's license could be immediately cancelled based on the information provided in a physician-submitted Driver Condition or Behavior Report, without any additional information from the treating physician or DMV testing. Physicians completed the second page of the Driver Condition or Behavior Report (form MV3141, shown in Figure G1) which included two questions:

(1) Is this patient able to safely operate a motor vehicle at this time?

(2) If the answer to #1 is "Yes," do you recommend a complete re-examination of patient's driving ability (knowledge, sign, and skills tests)?

A response of "No" to the first question resulted in immediate cancellation of all license classes and endorsements. The Department was not permitted to test a person deemed medically unsafe.

Licenses of 82 of the 500 drivers in the case study sample (16.4%) were immediately cancelled, based on the information provided by the physician on the MV3141 form. One driver's license was expired at the time his physician referred him, and he should have been excluded from the sample. The physician recommended against driving as the patient's condition would not improve. As a result, the DMV mailed the driver a letter denying renewal based on the physician's recommendation. Table G6 presents the medical conditions/functional impairments associated with these referrals and the number of drivers with each.

Table G6. Medical Conditions/Impairments and Number of Cases in Wisconsin Sample Cancelled as Medically Not Safe to Drive

Medical Condition	Immediate cancellations based on physician referral information	Cancellations based on medical and vision statements	Total
	Number of Cases	Number of Cases	
Alzheimer's or Other Dementia	33	11	44
Seizures/Epilepsy	13	7	20
Multiple Medical Conditions (often including poor memory and judgment)	18	10	28
Stroke	4	1	5
Musculoskeletal Conditions	3	6	9
Parkinson's Disease	2	2	4
Substance Abuse	2	0	2
COPD	2	1	3
Sleep Apnea	1	1	2
Diabetes	1	5	6
Traumatic Brain Injury	1	0	1
Psychiatric/Emotional	1	1	2
Vision (Macular Degeneration or Visual Field Limitation)	1	1	2
Heart Disease	0	1	1
Total	**82**	**47**	**129**

Requirement to submit a physician's or vision specialist's statement. Of the remaining 418 drivers, 312 drivers (62.4% of the total sample of 500) were required to submit more detailed information about their medical or vision condition, and 106 drivers were not. The medical and/or vision information was to be based on an examination performed within the preceding 90 days. Both a physician and a vision statement were required for 30 drivers, only a physician statement was required for 272 drivers, and only a vision statement for 10 drivers. Ninety-one drivers (18.2% of the total sample of 500 drivers) did not submit the required information and lost their licenses. Of these 91 drivers, 19 voluntarily surrendered their licenses in lieu of submitting the medical information and were issued a State Identification card, and 71 drivers received licenses cancellation for failing to comply with the reporting requirement. An additional driver's license had already expired at the time of the crash that resulted in the referral by the law enforcement officer; this driver should have been excluded from the case study

sample. The DMV flagged this driver's record with notation that a favorable medical report would be required at the time the driver applied for license reinstatement.

Medical fitness to drive. Based on the information submitted in the medical and vision statements for the 221 drivers who complied with the reporting requirement, 47 were found medically unfit to drive and their licenses were cancelled (see Table G6). Combining these 47 drivers with the 82 who received immediate license cancellations as a result of the information presented in the Behavior and Condition Reports results in a total of 129 drivers (25.8% of the total sample of 500) whose licenses were cancelled because they were deemed not medically safe to drive.

Subtracting the 129 drivers cancelled as not medically fit and the 91 drivers cancelled for failing to submit medical and/or vision statements from the total sample of 500 results in 280 drivers deemed medically fit. Of this set of 280 drivers, 45 were licensed without any further DMV testing, and 235 were required to take and pass the DMV tests before a licensing determination could be made. Included within the set of 235 drivers who were required to take the DMV tests was the set of 106 drivers who were not required to submit a physician examination or vision specialist report. Driver compliance with DMV testing requirements, and test outcomes are described below.

DMV test requirements. Of the 235 drivers required to take the DMV tests, 209 were required to take all three tests (vision, knowledge, and road) and 26 drivers only the knowledge and road test. The subset of 26 drivers excluded from the vision test requirement were required to submit a vision specialists' statement, and complied with that requirement (removing the need for the DMV vision test).

Thirty-nine drivers voluntarily surrendered their licenses in lieu of testing (or in lieu of completing testing) and an additional 38 drivers had their licenses cancelled for failing to comply with the testing requirements. The drivers who voluntarily surrendered their licenses (20 females and 19 males) ranged from 48 to 94, with a median age of 84 (M=82, SD=8.4). Fifteen who voluntarily surrendered did not attempt any of the tests, 11 surrendered after taking the knowledge test, and 13 voluntarily surrendered after failing the road test. Eleven of the drivers who voluntarily surrendered their licenses obtained an instruction permit, valid for 12 months and only while driving with another licensed driver. The 38 drivers whose licenses were cancelled for failing to comply with the testing requirements (16 females and 22 males) ranged from 39 to 96, with a median age of 82 (M=82, SD=12). The license of one of these drivers was already suspended for unpaid fines at the time or referral for medical review by the law enforcement officer; this driver should have been excluded from the case study sample. The DMV notated the driving record that before he or she could be relicensed, all DMV tests needed to be passed.

Of the remaining 158 drivers who attempted the DMV tests, 122 passed with continued licensure (52 females and 70 males), and 36 drivers failed and had their licenses cancelled (14 females and 22 males). Of the 36 drivers who failed and whose licenses were cancelled, 23 failed the knowledge test and their licenses were cancelled; they were not permitted to take the road test; 13 drivers' licenses were cancelled for failing the road test. The drivers who failed the DMV

tests ranged from 22 to 93, with a median age of 78 (M=75.6, *SD*=16.1). The 122 drivers who passed the DMV tests ranged from 22 to 94, with a median age of 78 (*M*= 71.8, *SD*=15.7).

Combining the 122 drivers who were medically fit and passed the DMV tests with the 45 drivers deemed medically fit with no testing requirements, results in 167 drivers out of the total sample of 500 (33.4%) with continued licensure following medical review.

Medical Review Outcomes

Figure G2 shows the referral sources and the licensing process and outcomes across the sample of 500 case study drivers referred for medical review. Table G7 presents the licensing outcomes for the total sample of 500 drivers, as well as by referral source.

There was no change in the license status for 62 of the 500 drivers in the case study sample (12.4%). They neither received new restrictions, nor were required to submit periodic medical and/or vision reports. An additional 105 drivers (21% of the sample) retained licensure, but either had their licenses restricted and/or were required to submit periodic medical/vision reports.

A total of 333 drivers (66.6% of the sample) lost their licenses as a result of medical review, either because they were deemed not medically fit, failed DMV tests, voluntarily surrendered their licenses in lieu of submitting medical/vision reports or attempting DMV tests, or failed to comply with medical review requirements.

Licensing outcomes can be grouped into three broad categories. The first is a licensing action based on medical or functional guidelines or DMV test performance. This includes cancellation as medically unsafe to drive, cancellation for failing DMV tests, license restrictions, or a periodic review requirement (collapsing across the first 5 outcomes in Table G7). The second category is loss of licensure when drivers opt out of participating in the medical review process (either by voluntarily surrendering their licenses, or not complying with medical reporting or testing and receiving license suspension). The third category is no license action as a result of the medical review process (the last column in Table G7). Drivers in this category retained the same license status they had before they were referred for medical review. Referrals resulting in no change in license status following the medical review process may function as a warning flag for diminished driving safety, if that driver is subsequently referred for medical review. This project focused on initial referrals for medical review, so the data could not be used to validate this potential benefit.

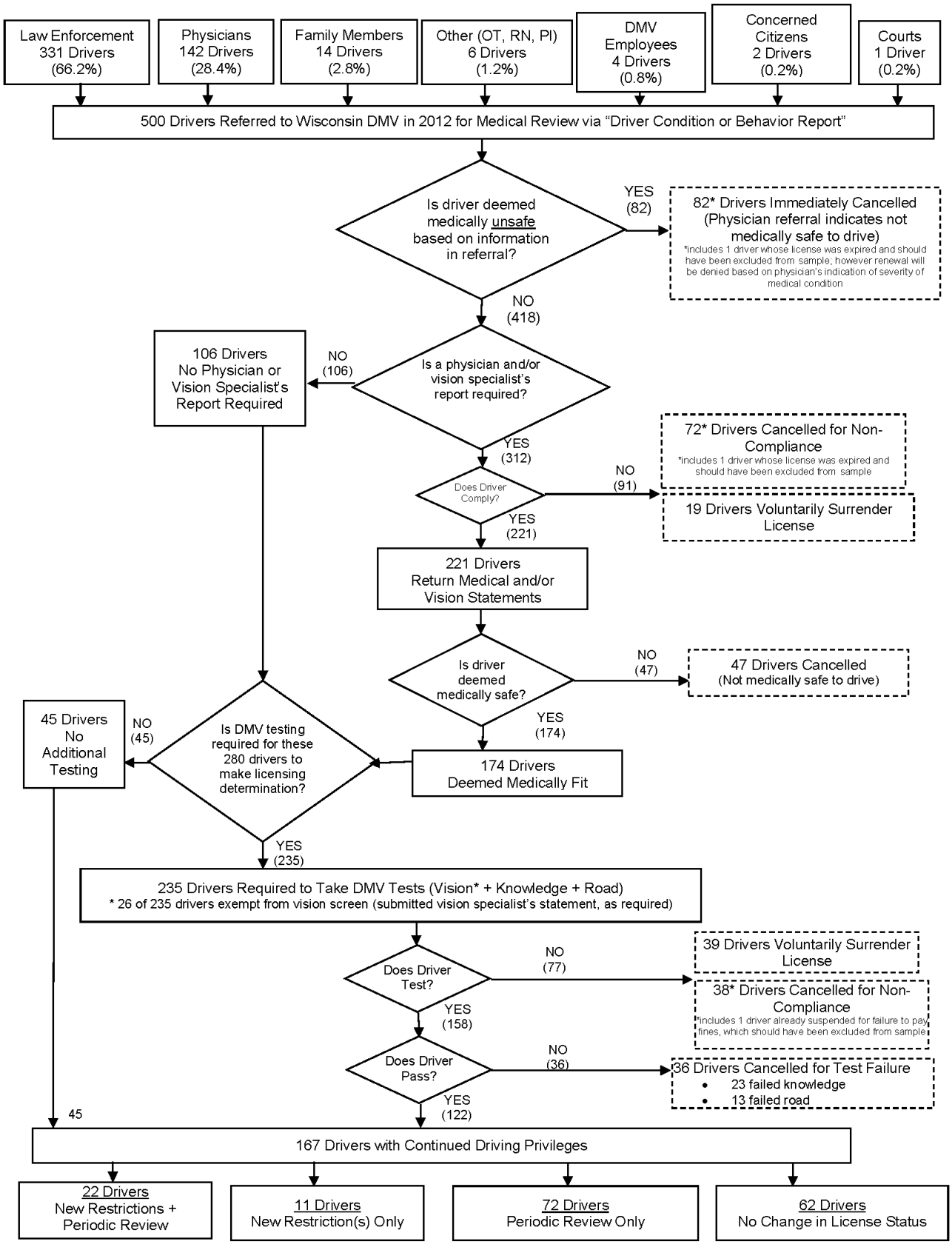

Figure G2. Medical review process and outcomes for 500 drivers referred to the Wisconsin Department of Motor Vehicles.

Table G7. Medical Review Process Licensing Outcomes, by Referral Source

Referral Source	Number of Drivers	Change in License Status as a Result of Medical Review							
		New Restriction Only (Row %)	Periodic Review Only (Row %)	New Restriction + Periodic Review (Row %)	Cancellation (Medically Unfit) (Row %)	Cancellation (Test Failure) (Row %)	Cancellation (Fail to Comply With Reexam Requirements) (Row %)	Voluntary Surrendered Own License[a] (Row %)	No Change (Row %)
Law Enforcement	331	11 (3.3%)	51 (15.4%)	11 (3.3%)	41 (12.4%)	27 (8.2%)	90 (27.2%)	46 (13.9%)	54 (16.3%)
Physicians	142		15 (10.6%)	7 (4.9%)	85 (59.9%)	7 (4.9%)	13 (9.2%)	9 (6.3%)	6 (4.2%)
Family Member	14			4 (28.6%)	1 (7.1%)	1 (7.1%)	4 (28.6%)	3 (21.4%)	1 (7.1%)
"Other" (Physical Therapists, Nurse, and Private Investigator)	6		3 (50%)		1 (16.7%)		2 (33.3%)		
DMV Employee	4		1 (25%)			1 (25%)	1 (25%)		1 (25%)
Other Concerned Citizen	2		1 (50%)		1 (50%)				
Courts	1		1 (100%)						
Total	500	11 (2.2%)	72 (14.4%)	22 (4.4%)	129 (25.8%)	36 (7.2%)	110 (22%)	58 (11.6%)	62 (12.4%)

[a] In lieu of complying with testing requirements, or following one or two test failures, the driver chose to give up their licenses, and completed paperwork to formally surrender their license, rather than complete the re-examination testing.

Comparing these broad licensing outcomes for cases referred by law enforcement and physicians (who together referred 95% of the sample), indicates that physician referrals were *more likely* than law enforcement referrals to result in licensing action based on medical or functional guidelines or DMV test performance, and *less likely* to result in no action. Referrals by law enforcement were *more likely* than physician referrals to result in drivers opting out of licensure.

Table G8 presents the contingency table showing observed and expected frequencies (where the expected frequencies were calculated by multiplying the total frequencies common to the cell, and dividing by the total 473). A smaller number of physician referrals than expected resulted in no change in license status, while a larger number of law enforcement referrals resulted in this outcome than expected. More physician referrals than expected resulted in a licensing action based on medical/functional guidelines or DMV test performance, while fewer law enforcement referrals resulted in this outcome than expected. A chi-square test using these three categories showed a significant difference in medical review outcomes for these two referral sources (X^2=57.11, d.f.=2, p<0.005). No statistical tests of significance were performed for cases referred by the remaining sources in Table G7, due to the small sample sizes. However, the 14 cases referred by family members had outcomes in similar proportions as those referred by law enforcement. Of the cases referred by family members, 43% resulted in a change in license status based on medical or functional guidelines or DMV test performance, 50% resulted in self-selected cancellations, and 7% resulted in no action. The majority of cases referred by the "other category" (which included occupational therapists, a nurse, and a private investigator) resulted in a change in license status based on medical or functional guidelines or DMV test performance (66.7%), with no cases resulting in no change in license status. These outcomes were similar to those shown by the physician referrals.

Table G8. Chi-Square Contingency Table Showing Observed and Expected (in parentheses) Values for Medical Review Outcomes by Referral Source

Referral Source	Result of Medical Review on License Status			Total
	License Action: Periodic Review, Restriction, or Cancellation for Medically Unfit or Test Failure	Opt Out of Licensing: Cancellation for Failure to Comply With Medical Review Requirements or Voluntary Surrender	No Change in License Status	
Law Enforcement	141 (178)	136 (111)	54 (42)	**331**
Physicians	114 (77)	22 (47)	6 (18)	**142**
Total	**255**	**158**	**60**	**473**

The types of new restrictions applied to the licenses of 33 drivers included combinations of the following:

- daytime only (16 drivers);
- radius of home (12 drivers), including:
    - 10 miles (4 drivers);
    - 20 miles (3 drivers);
    - 5 miles (1 driver);
    - 8 miles (1 driver);
    - 15 miles (1 driver);
    - 30 miles (1 driver); and
    - 35 miles (1 driver).
- no freeway (11 drivers);
- corrective lenses (10 drivers);
- max speed 45 mph (7 drivers);
- specific geographic areas (3 drivers), including:
    - only on roads in the State of Wisconsin;
    - only within the town of Sliger; and
    - only within the city limits of Burlington.
- adaptive equipment (2 drivers), including:
    - hand operated accelerator and hand operated brake pedal;
    - complete hand controls, steering knob, automatic transmission, and a hand-operated dimmer switch.
- other restrictions (12 drivers), including combinations of:
    - max speed 55 mph (5 drivers);
    - automatic transmission (6 drivers);
    - right outside mirror (4 drivers);
    - right outside wide angle mirror (1 driver); and
    - power steering (1 driver).

Case Disposition Time

The time between the date the driver was referred and the date the DMV opened the case ranged from 0 to 198 days, with a median of 20 days (*M*= 23.1, *SD*=21.5). Thirty-six percent of the cases were opened within 15 days of the date of the referral, 82% within 30 days of referral, 93% within 45 days of referral, and 95% within 60 days.

Case disposition time is presented as the number of days that elapsed between the date the DMV opened the case and the date the DMV determined the license action (disposition date). Across the sample of 500 drivers, case disposition time ranged from 0 to 380 days, and averaged 39 days (*SD* = 38.7; *Mdn*= 34 days). Forty-four percent of the cases were completed within 30 days and 84% within 60 days of the date the case was opened.

Case disposition times are described below, for four sets of cases:

- 82 drivers with immediate license cancellations as a result of the referral (requiring no additional medical information or testing);
- 138 drivers whose licenses were cancelled because they were deemed medically unfit following the DMV's review of a physician examination report, or who failed to submit the requested physician's report (and required no DMV tests);
- 45 drivers who were deemed medically fit following the DMV's review of a physician examination report, with no additional testing required; and
- 235 drivers deemed medically fit and required to take the DMV vision, knowledge, and road tests.

Immediate cancellations. All 82 immediate cancellations resulted from referrals submitted by physicians and required no additional medical information for the Medical Review Department to determine the licensing action (i.e., no physician examination report was required). In all 82 cases, the decision to cancel the driver was made on the date the case was opened, resulting in 0 days for case disposition time.

Cancellations based on a physician examination report. Based on information provided by the treating physician (when a physician examination report was required for a medical review determination), 47 drivers were determined to be not medically safe to drive and their licenses were cancelled. The median case disposition time for these drivers was 21 days (Range 0-74 days, *M*=25.1, *SD* = 15.7). Sixty-eight percent of these cases were completed within 30 days and 98% within 60 days. Of particular interest in this set of cases was one that took 51 days for the cancellation determination to be made. In this case, the physician originally approved the driver for driving, so the driver began the testing process with the DMV, and passed the written tests. However, two DMV staff at the testing location emailed the Medical Review Unit with grave concerns about his inability to ambulate, and his safety and theirs in the vehicle for the road test. The Medical Review Unit forwarded the emails to the physician, who reversed his opinion about the driver's medical fitness to drive, indicating the defects had not been obvious in office visits, where he presented in a wheelchair.

Another 91 drivers who were required to submit a physician's examination report either failed to do so and received license cancellations (71 drivers) or voluntarily surrendered their licenses in lieu of submitting the medical forms (19 drivers). An additional driver's license was expired on the date of referral by law enforcement following a crash, so the case disposition time was 0 days; this driver should have been excluded from the case study sample. Excluding this driver, the median case disposition time for these 90 drivers was 45 days (Range 6-76 days, *M*=38, *SD* = 14.8 days). Thirty percent of these cases were completed within 30 days and 97% within 60 days.

Medically fit and no further testing required. The median disposition time for the 45 drivers deemed medically fit, with no additional DMV testing required, was 21 days (Range 7-94, *M*= 28.3, *SD*=21.4). Seventy-six percent of these cases were completed within 30 days, and 91% within 60 days.

Medically fit and required to undergo DMV testing. Excluding the 2 drivers whose licenses were expired when they were referred for medical review, the median disposition time for the 233 drivers required to undergo DMV testing was 47 days (Range 5-298, *M*=56.9, *SD*=39.7).

Seventy percent of these cases (164 of 233) had disposition times of 60 days or less, while 85% (199 of 233) had disposition times of 90 days or less. Delay in cases longer than 90 days generally involved either a cancellation for failing to submit a medical report, which was then submitted in the near term, or the receipt of an instruction permit and re-licensing in a short period following a voluntary surrender (such drivers were not coded as voluntary surrenders if they were re-licensed within a short period following their surrender). One

exception was a driver who passed the road test on the fifth attempt (142-day case disposition time). Drivers whose licenses were cancelled for failing to submit a medical report and who subsequently submitted the report and passed the DMV tests could not legally drive between their cancellation date and the date they passed the test. Drivers with an instruction permit were restricted to driving with another licensed driver. Observation of the medical review period extended beyond the point where theses drivers' licenses were cancelled for failing to submit a medical report or surrendered and then obtained an instruction permit (and were subsequently relicensed within a short period of time), to provide a more accurate indication of licensing outcomes following medical review.

Table G9 presents a summary of case disposition times for the 233 drivers required to take the DMV tests based on medical review requirements and licensing outcomes.

Table G9. Case Disposition Times for 233 Drivers Required to Take and Pass DMV Tests, by Licensing Outcome

Licensing Outcome	Number of Cases	Case Disposition Time (Days)			
		Range	Average	Standard Deviation	Median
Passed and Were Licensed	121[a]	5-298	64.9	47.6	52
Cancellation for Test Failure	36	34-141	59.2	25.5	55
Cancellation for Non-Compliance With Testing Requirement	37[a]	32-151	47.4	24.9	38.5
Voluntary Surrender – Attempted No Tests	15	9-74	28.1	18.7	22
Voluntary Surrender – Attempted Knowledge Test Only	11	16-49	29.7	9.5	27
Voluntary Surrender- Attempted Knowledge & Road Test	13	18-109	58.2	29.3	56

[a] excludes driver already suspended

Feedback to Reporting Source

The Wisconsin DMV did not provide feedback to any reporting source regarding the outcome of medical review.

Case Cost

Case cost could not be estimated on a case-by-case basis for this study. The Medical Review Department provided a general estimate of costs based on the following scenarios.

To process a referral for cases where DMV-administered testing was not conducted required approximately an hour at a cost of $30 (cost of one-employee hour including benefits). This estimate included the time spent receiving, filing, reviewing and responding to initial follow-up information received from a referral.

The knowledge (written test) and road test together plus time counseling the driver required an additional 1 hour and 20 minutes, resulting in a total time of 2 hours and 20 minutes, at a cost of $70 (wages and benefits). This time and cost would be applied for each testing attempt.

Cases were referred to the MAB only as appeals; the MAB in Wisconsin was not involved in the initial review and licensing determination. Additional costs for cases appealed included 160 minutes (in addition to the times described above). This time included preparing each case for the review (pulling all relevant data, making copies, etc.). It also included time for the case during the review (15 minutes each) and closing the case with additional notes at the end (preparing narratives, etc.). The DMV cost for the additional 160 minutes was $80, plus each of the three medical professionals participating in board review was paid $25 plus mileage.

Appeal of Licensing Action

Fifteen of the 500 case study drivers (3%) appealed the licensing decision. In 14 of the 15 cases, the drivers' licenses had been cancelled because their physicians deemed them medically unsafe, and 9 of these were immediate cancellations following a physician referral. The reasons the drivers were not medically safe were:

- Alzheimer's disease/dementia (9 drivers);
- memory impairment (2 drivers); and
- diabetes, Parkinson's disease, and unspecified mental condition (1 driver each).

The driver who was deemed medically fit was required to take and pass the DMV tests, but did not comply with this requirement and his license was therefore cancelled.

The Medical Advisory Board was involved in 4 of the 15 appeal cases, and in all 4 cases, the driver was denied licensing following the board review. All four cases involved dementia or memory impairments.

The 11 appeal cases that did not undergo MAB review are described next. In 8 of the 11 cases, the DMV mailed the drivers a letter advising of the need for their physicians to complete a medical examination report or narrative summary of their medical condition. The reports or summaries were never submitted, so no board review was conducted. In another case, the DMV advised the driver that he needed to have his physician submit the results of a driving safety evaluation prior to a board review. Those results were never submitted, so no board review was conducted. In one case, a driver was scheduled for a board review, but did not appear. Finally, in one case, the driver requested a judicial review, which is performed through the court system rather than by the Medical Review Board. No results were ever sent to DMV by the court so the review must not have been conducted. The data collector noted that this driver had been ticketed three times for driving without a license since driving license cancellation.

Additional Analyses

License reinstatements following seizure-free period. As described earlier, identifying the license status of any particular driver is often a function of when the researcher reviewed the driver's license file. Drivers who received a license cancellation due to a seizure were coded for the study as cancelled/medically not fit. Wisconsin had a mandatory 3-month waiting period for licensing drivers with seizures, and license reinstatement required drivers to submit a report from their treating physician indicating that they had been seizure free during that period. The consultant noted if and when these drivers submitted an acceptable medical statement and had their licenses re-instated, to illustrate that license status could change as health status improved or deteriorated.

Of the 20 drivers whose licenses were cancelled following referrals indicating seizures, 13 (65%) submitted an acceptable physician's statement after the 3-month waiting period, and their licenses were reinstated. The time period between the license cancellation and the reinstatement ranged from 48 to 637 days, with a median of 102 days (M=156.8, SD=167.3). Excluding the 637-day outlier, the average time between cancellation and reinstatement was 116.8 days (SD = 88.5 days). A timeframe less than 90 days indicates that the driver was seizure free between the referral date and the cancellation date, as in the example of the driver re-instated after 48 days. There were 92 days between this driver's referral for a seizure and license re-instatement.

Of the seven drivers whose licenses remained cancelled at the time of data collection, one was issued a State identification card and one died seven months following license cancellation.

License reinstatements following voluntary surrender. Of the 39 drivers who voluntarily surrendered their licenses in lieu of or during the DMV testing phase of their medical review process, 11 obtained an instruction permit after failing one or two road test attempts. Of these 11 drivers, 3 eventually passed the road tests on subsequent attempts and their licenses were validated. The time between voluntary surrender and re-licensure for these drivers were 72 days, 355 days, and 372 days. One driver received a restriction to driving a vehicle with an automatic transmission.

Of the eight drivers who did not have their licenses reinstated, the permits of three drivers expired, one driver was issued a State identification card, one driver's permit was cancelled following two additional road test failures, and one driver's permit was cancelled following a medical report from her physician indicating she was no longer safe to drive. Two other drivers appeared to have valid permits (as of the time these data were collected).

Drivers deceased following medical review. Fifty-two of the case study drivers (10.4% of the sample) were reported to the DMV as deceased within the 2-year period following their case disposition dates. The range of days between license disposition and death was 7 to 660 days, with a median of 277.5 days (M= 294, SD = 168.3). At the time of their referral, these drivers ranged from 52 to 96, with an average of 80 (SD = 11; Mdn=82). The referral sources for these 52 drivers were:

- law enforcement (23);
- physician (27);
- occupational therapist (1); and
- family member (1).

The license status following medical review for these 52 drivers was:

- licensed with periodic review and no new restriction (3 drivers);
- cancelled as medically unsafe (17 drivers);
- cancelled for failing to comply with medical review requirements (20);
- cancelled for failing DMV tests (2 drivers);
- voluntarily surrendered their licenses (9 drivers); and
- expired at the time of the referral (1 driver).

Appendix H: Age Statistics by Referral Source and State

State	Age Statistic (Years)	Full Sample	Referral Source									
			Physician	Law Enforcement	Self	Family Member	License Agency Employee	Concerned Citizen	Crash Report	Courts	Other	Unknown
Maine	n	500	32	2	427	1	4	--	--	--	1	33
	Range	16-92	24-92	35-75	16-91	78	32-89				79	33-90
	Average	**61.0**	**69.8**	**55.0**	**60.0**	**78**	**57.5**				**79**	**64.3**
	SD	16.9	15.4	28.3	16.7	0	23.1				0	17.6
Ohio	n	500	49	146	294	2	3	--	--	4	--	2
	Range	16-99	48-99	26-94	16-88	88-89	51-82			53-91		30-87
	Average	**54.8**	**80.5**	**72.3**	**41.1**	**88.5**	**64.6**			**80.5**		**58.5**
	SD	25.5	12.5	17.1	21.4	0.7	15.8			18.4		40.3
Oregon	n	500	368	77	--	23	17	8	5	--	2	--
	Range	16-98	16-96	24-98		43-94	23-94	64-90	19-87		70-80	
	Average	**73.3**	**72.8**	**73.1**		**79.9**	**77.3**	**80.1**	**52.2**		**75**	
	SD	16.7	16.4	18.1		11.5	16.9	9.2	30.1		7.1	
Texas	n	500	96	139	46	33	20	11	143	--	9	3
	Range	19-98	20-94	22-98	20-95	40.97	26-94	33-95	19-93		65-91	77-89
	Average	**66.2**	**70.5**	**70.6**	**57.6**	**83.1**	**73.4**	**74.2**	**55.2**		**77.9**	**84.0**
	SD	20.6	20.9	18.0	21.1	11.3	18.0	19.8	19.1		10.0	6.2
Washington	n	500	164	142	5	24	91	25	--	--	49	--
	Range	19-98	23-98	19-97	66-90	63-95	34-94	19-93			32-90	
	Average	**74.3**	**72.6**	**72.6**	**73.6**	**80.1**	**76.7**	**77.8**			**76.5**	
	SD	16.2	16.8	17.9	9.9	8.3	15.1	16.9			12.5	
Wisconsin	n	500	142	331	--[a]	14	4	2	--	1	6	--
	Range	16-98	17-98	16-96		74-94	51-82	34-41		56	61-90	
	Average	**70.6**	**73.2**	**69.1**		**85.1**	**68.5**	**37.5**		**56**	**76.7**	
	SD	19.2	17.8	19.9		6.4	14.6	4.9		0	12.8	

[a] Not available for inclusion in sample.

Appendix I: Age Statistics by Medical Review Outcome and State

State	Age Statistic (Years)	Full Sample	Medical Review Outcome							
			New Restriction Only	Periodic Review only	New Restriction + Periodic Review	Loss of Licensure: Medically Unfit	Loss of Licensure: Test Failure	Loss of Licensure: Fail to Comply With Medical Review/Re-exam Requirements	Voluntary License Cancellation	No Change in License Status
Maine	n	500	1	360	8	19	8	1	4	99
	Range	16-92	66.0	16-92	44-81	42-88	31-87	72.0	64-86	16-91
	Average	**61.0**	**66.0**	**59.5**	**65.8**	**72.5**	**73.0**	**72.0**	**76.0**	**61.8**
	SD	16.9	0.0	17.1	13.1	12.2	18.4	0.0	9.2	16.1
Ohio	n	500	10	212	15	34	8	90	6	120
	Range	16-99	16-69	16-93	19-92	27-89	69-99	29-95	76-94	16-93
	Average	**54.8**	**48.5**	**44.0**	**67.5**	**72.4**	**83.5**	**74.2**	**86.8**	**48.4**
	SD	25.5	16.8	23.9	24.2	17.9	10.3	15.3	6.2	23.5
Oregon	n	500	3	31	13	336	22	85	8	2
	Range	16-98	58-70	22-94	60-90	16-98	36-96	26-97	71-94	63-90
	Average	**73.3**	**64.3**	**68.6**	**82.1**	**71.4**	**80.1**	**78.7**	**82.3**	**76.5**
	SD.	16.7	6.0	17.1	7.5	17.9	12.5	11.8	8.6	19.1
Texas	n	500	1	1	---	132	37	177	25	127
	Range	19-98	93.0	66.0		20-93	49-94	19-95	61-97	24-98
	Average	**66.2**	**93.0**	**66.0**		**61.0**	**80.4**	**64.0**	**82.4**	**67.1**
	SD	20.6	0.0	0		20.0	11.5	22.4	9.7	18.7
Washington	n	500	12	24	4	69	47	211	71	62
	Range	19-98	22-87	31-93	81-88	22-98	35-95	23-97	38-94	19-93
	Average	**74.3**	**73.8**	**74.9**	**85.0**	**65.0**	**81.6**	**76.1**	**76.6**	**70.0**
	SD	16.2	17.8	15.5	2.9	21.2	11.5	14.1	13.9	17.5
Wisconsin	n	500	11	72	22	129	36	110	58	62
	Range	16-98	44-94	18-94	52-92	16-98	22-93	22-96	48-96	19-92
	Average	**70.6**	**78.5**	**60.9**	**78.0**	**70.0**	**75.6**	**70.1**	**82.5**	**66.2**
	SD	19.2	14.8	19.2	10.8	20.6	16.1	20.1	7.5	20.2

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