
Background and Methodology of the Older Driver Evidence-Based Systematic Literature Review

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KEY WORDS

- driving
- community mobility
- evidence-based review
- older adults

In response to demands of health care and community-based systems, occupational therapy practitioners are eager to provide effective services that are client centered, supported by evidence, and delivered in an efficient and cost-effective manner. Findings from the scientific literature provide a source of legitimacy and authority for informing and guiding practice in all areas, including driving and community mobility with older adults. A systematic review examined studies designed to enhance the driving ability, performance, and safety of older adults. This article presents an overview of the methodology used to develop the focused questions related to the person, vehicle, infrastructure, and policy and community mobility; conduct the literature review; and establish quality control. It includes a summary of the evidence and implications of the review for clinical practice, education, and research to ultimately identify interventions effective in supporting older adult participation and engagement in occupation.

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Evidence-based practice (EBP) has been one approach to effective health care delivery since the early 1990s. Spurred on by the demands of payers, regulators, and consumers, occupational therapists and occupational therapy assistants are eager to provide effective services that are client centered, supported by evidence, and delivered in an efficient and cost-effective manner.

At the same time, many occupational therapists and occupational therapy assistants are challenged to understand how to use the best available evidence to inform their practices. Many practitioners did not acquire critical appraisal skills while in school; others acquired the skills but are still not confident in them. For both groups, taking steps to review practice-oriented literature on their own is a challenge. In addition, limited access to electronic databases and system-level constraints, such as lack of time and management support, further limit them in searching, retrieving, and appraising research evidence that could be useful to their practices.

Since 1998, the American Occupational Therapy Association (AOTA) has instituted a series of EBP projects to assist members in meeting the challenge of finding and reviewing the literature to identify evidence and then using this evidence to inform practice (Lieberman & Scheer, 2002). Following the evidence-based philosophy of Sackett, Rosenberg, Gray, Haynes, and Richardson (1996), AOTA's projects are conducted in the belief that the EBP of occupational therapy relies on the integration of information from three sources: (1) clinical experience and reasoning, (2) preferences of clients and their families, and (3) findings from the most reliable available research.

The centerpiece of AOTA's EBP projects is an ongoing program of systematic review of multidisciplinary scientific literature, using focused questions and standardized procedures to identify practice-relevant evidence and discuss its implications for

practice. Now that the findings from evidence-based reviews are being used to inform the new and revised editions of the AOTA Practice Guidelines, they will for the first time meet the acceptance criteria of the National Guideline Clearinghouse as stipulated by the Agency for Healthcare Research and Quality (1988) that “a verifiable systematic literature search and review of existing evidence published in peer-reviewed journals” (§ 3) was performed during the practice guideline development. Other innovative venues and formats have also been developed to disseminate the findings of each systematic review to practitioners. Several Web-based formats are located in AOTA’s (2007) *Evidence-Based Practice Resource Directory* on the association’s Web site and include

- Easy-to-read summaries and highlights of selected articles related to specific health conditions and areas of practice known as *Evidence Briefs* and *Structured Abstracts*;
- Syntheses of findings, methods, study limitations, and practice implications of the groups of articles selected for inclusion in focused-question literature reviews, or *Critically Appraised Topics* (CATs); and
- Summaries of findings and methods of select individual articles from focused-question, evidence-based reviews, or *Critically Appraised Papers* (CAPs).

AOTA Press is exploring publishing evidence collections that include selections from the CATs, the CAPs, and a new addition to AOTA’s EBP repertoire, *Evidence Tables*, an at-a-glance presentation of key features of selected studies. The latest dissemination venue is the *American Journal of Occupational Therapy*’s review and publication of a series of scholarly contributions from several systematic reviews of the practice-relevant literature written from an evidence-based analytic perspective, as initiated in this issue with a review of older driver safety.

Evidence-based reviews of literature relevant to occupational therapy and older driver safety will add additional dimensions to our understanding of the foundations of this emerging area of practice. The safety of older drivers and the consequences for themselves and others have been broadly recognized as a major public health issue in which injury prevention and occupational therapy interventions have key roles (AOTA, 2005).

Authors of each of the four articles used the same set of standardized procedures and methods to appraise and synthesize articles selected for review. They move beyond the brief summary format (e.g., CATs and CAPs) to contextualize their findings in a scholarly EBP perspective. Readers will note that findings are pivotal both for defining the issues of older drivers within the scope of occupational therapy practice and for furthering investigation into intervention effectiveness and efficacy.

Older Drivers in the EBP Project

AOTA has identified older driver safety as an emerging area of practice. For more than 30 years, occupational therapists and occupational therapy assistants have had important roles in driving programs, including the development and delivery of services to people with a wide range of disabilities and across the lifespan (Gowland & Simoes, 1984). More recently, with the recognition of the changing demographics, AOTA has partnered with several health care organizations, policymakers, government agencies, and other advocacy groups to address older driver safety and community mobility (Brachtesende, 2003). These include the National Highway Traffic Safety Administration, the American Medical Association, the American Society on Aging, and the AARP.

In 2002, AOTA and the National Highway Traffic Safety Administration cosponsored a Consensus Conference on Older Drivers that brought together government agency representatives, occupational therapists and occupational therapy assistants, physicians, and others involved in aging issues and older adult driving (AOTA, 2003). Participants reached a consensus that strongly supported all efforts to increase occupational therapy’s capacity to meet the needs of older drivers. In response to these recommendations, AOTA established an Expert Panel in Driving to guide AOTA’s Older Driver Initiatives to increase the capacity of occupational therapists to meet the growing needs of older drivers, produce educational and tool kit materials according to Consensus Conference recommendations, and more clearly define occupational therapy’s role with older drivers across all practice settings.

One of the Older Driver Initiatives was to develop the *Occupational Therapy Practice Guidelines: Driving and Community Mobility for Older Adults* (Stav, Hunt, & Arbesman, 2006; available at www.aota.org). Because AOTA’s Practice Guidelines are now informed by systematic evidence-based reviews of the multidisciplinary literature, AOTA requested and received funding from the Centers for Disease Control and Prevention to first conduct a systematic evidence-based review of multidisciplinary literature relevant to occupational therapy-based older driver rehabilitation therapies and then to publish a clinical practice guideline on older adult driving (Stav et al., 2006). This Practice Guideline incorporates the results of the evidence-based review and concepts from the *Occupational Therapy Practice Framework: Domain and Process* (AOTA, 2002) and “provides an overview of the occupational process for community mobility among older adults” (Stav et al., 2006, p. 1).

Method

The first step in the evidence-based literature review project process was development of questions that were specific to the topic of older adult driving. These focused questions were used to direct the literature review. A public health approach (Christoffel & Gallagher, 1999) was used to develop the focused questions because the emphasis in the review was on health promotion and injury prevention for the entire community. Those in public health and injury prevention use the Haddon Matrix (Runyon, 1998) to determine the potential causes of an injury. According to the Haddon Matrix, the causes of an injury are based on the interaction of the person, the social environment, and the physical environment with the agent, which is the force or substance that causes a change. In the case of older adult drivers, the older adult is the person; the agent is the car; the physical environment is the infrastructure, which includes roads, lighting, and signage; and the social environment includes policy and community mobility issues. An expert panel reviewed the interventions that were developed to correspond to each area. The following four questions resulted:

1. *The person:* What is the evidence for the effect of interventions to address cognitive and visual function; motor function; driving skills intervention; self-regulation and self-awareness; and the role of passengers and family involvement in the older adult's driving ability, performance, and safety?

2. *Policy and community mobility:* What is the evidence for the effect of policy and community mobility programs (e.g., alternative transportation, walkable communities, education, and pedestrian programs) on the older adult's participation?

3. *The infrastructure:* What is the evidence for the effect of modifications of the infrastructure of the physical environment (e.g., roadways, signage, lighting) on the older adult's driving ability, performance, and safety?

4. *The automobile:* What is the evidence for the effect of automobile-related modifications on the driving ability, performance, and safety of the older adult? This would include changes by the industry that enhance or hinder the older adult's driving ability, performance, and safety.

Search terms for the review were developed by the project coordinator in consultation with the authors of each question and with an advisory group of occupational therapists and an occupational therapy assistant with expertise in driving. A medical research librarian conducted all searches to confirm and improve search strategies. Search terms used for all questions included *elderly, older driver, aging, automobile driver, automobiles, traffic safety, automotive engineering, automobile driver simulators, automobile driver examination,*

driving behavior, motor vehicles, vehicle operation, vision tests, roads and streets, highway markings, traffic signals, signage, glare effects, pavements, illumination, public transportation, communities, physical mobility, environment, transportation, transportation needs, pedestrians, headlights, braking, vision aids, glare, sensory aids, instrument displays, visual environment, highway safety, driver education, and traffic accidents. In addition, a filter based on one developed by McMaster University (www.urmc.rochester.edu/hslt/miner/digital_library/evidence_based_resources.cfm) was used to narrow the search to research studies. The medical librarian and the project coordinator discussed the searches and findings to ensure that key articles or areas of research had not been overlooked. The search consisted of peer-reviewed literature published between 1980 and 2004, and the databases searched included MEDLINE, TRIS Online, Ergonomics Abstracts, PsycINFO, Society for Automotive Engineers, EiCompendex Engineering, EiCompendex Plus, AgeLine, Sociofile (now Sociological Abstracts), and CINAHL. For the infrastructure question, the search consisted of peer-reviewed literature published from 1999 to 2004, and the databases searched included TRIS Online, Ergonomics Abstracts, EiCompendex Engineering, EiCompendex Plus, and MEDLINE. Information before 1999 was taken from the *Highway Design Handbook for Older Drivers and Pedestrians* (Staplin, Lococo, Byington, & Harkey, 2001), published by the U.S. Department of Transportation's Federal Highway Administration, because this document provided guidelines for the highway design for communities across the United States. Consolidated information sources such as the Cochrane Database of Systematic Reviews were also included in the search. These databases are peer-reviewed summaries of journal articles and provide a system for clinicians and scientists to conduct evidence-based reviews of selected clinical questions and topics. Published reports such as those from the Transportation Review Board were also included in the review, and bibliographies of selected articles were reviewed for potential articles. SafetyLit (www.safetylit.org), which reviews the injury prevention literature and has a section on older adult driving, was also reviewed through the beginning of 2006.

The individual working on each focused question and the project coordinator reviewed the articles according to their quality (scientific rigor and lack of bias) and levels of evidence. Guidelines for reviewing quantitative studies were based on those developed by Law (2002) and colleagues to ensure that the evidence was ranked according to uniform definitions of research design elements. *Level I studies* included systematic reviews, meta-analyses, and randomized controlled trials. *Level II studies* included two-group nonrandomized studies such as cohort and case control studies.

Level III studies included one-group nonrandomized studies, such as before-and-after and pretest-and-posttest designs. *Level IV and V studies* (descriptive studies, case reports, case series, and expert opinions) and dissertations, book chapters, and conference proceedings were not considered for the review. Thirteen thousand abstracts were reviewed for the 4-question search, and 56 articles met the inclusion and exclusion criteria for the questions. Of these, 26 were Level I studies, 22 were Level II, and 8 were Level III.

The articles and studies were appraised using a CAP format. The CAP consisted of a description of the study, an appraisal of its strengths and weaknesses based on its study design and methodology, and the findings relevant to the provision of driving and community mobility-related intervention with older adults. The article was chosen if the study either included occupational therapy within the intervention or was within the scope of occupational therapy practice and included interventions to the person, community mobility, the infrastructure, or the automobile to support or improve older driver performance. Policy analyses related to driver licensing were also included in the review. Except as noted, all review authors were occupational therapists with expertise in the area of driving. In addition, they were able to review the research literature from an evidence-based perspective.

The process of completing the CAPs was different for each question. For the policy and community mobility question, for example, the CAPs were written by the reviewer of each focused question. A human factors consultant with expertise in ergonomic issues of older adult driving and a graduate student completed the CAPs for the infrastructure question. The car question was completed by the review author in conjunction with a graduate student. The project coordinator reviewed each article and the completed CAP for unanswered questions, for discrepancies in interpretation of the results, and to ensure that the implications were clear.

Review authors for the car, person, and policy and community mobility questions also completed the CAT, or summary and appraisal of the key findings, clinical bottom, and implications for occupational therapy of the articles included in the review for each question. An occupational therapist who is also a human factors engineer completed the CAT for the infrastructure question. The CATs were also reviewed by the project coordinator and AOTA staff to ensure quality control.

Summary of the Older Driver Evidence-Based Literature Review

The results from the studies reported in the evidence-based literature review reflect the Haddon Matrix, which suggests there are multiple factors contributing to older driver crashes,

injuries, and fatalities. The literature suggests that individually and collectively, the person, social environment, physical environment, and car all contribute to older driver crashes. As a result of the multifaceted influence on older driver safety, interventions to support older adult performance and safety in driving should target each of the factors contributing to crashes.

The following four articles in this issue summarize the findings of the older driver evidence-based literature review specific to each of the four questions included in the review. The summaries highlight the value of specific interventions in relation to the person, vehicle, infrastructure, community mobility, and licensure policies. Studies specific to the person emphasize the need for occupational therapists and occupational therapy assistants to consider multiple avenues of intervention rather than solely considering adaptive equipment to support driving performance. With regard to policies, the literature reveals that licensure laws can influence fatality rates through driving restrictions and increased relicensing requirements. Community mobility studies reveal that older adults are not entirely comfortable with using many of the transit services currently available. The literature related to the infrastructure identifies elements of the physical context such as intersection design, signage, roadway markings, lighting, construction, and vehicle design that support older driver performance.

Strengths and Limitations of the Studies

The older driver evidence-based literature review yielded many high-quality studies. Of the 56 studies included in the review, nearly half (25) of the articles reviewed were at the highest level (Level I) of evidence, and 22 of the articles were at the second highest level (Level II) of evidence. Many of the studies were population based and, thus, their results can be generalized more broadly. The review also included literature and reports from different health-related disciplines and the fields of engineering and human factors and international literature.

Several limitations of the review and of the individual studies need to be considered. The breadth of the review was limiting in that it produced a broad range of interventions because of its foundation in the Haddon Matrix and subsequent inclusion of the person, social environment, physical environment, and car. In addition, the studies varied between the well and disabled populations because of the difficulty in generalizing from one group to another.

Although the diversity of disciplines that conducted the studies offers a broad perspective, only three of the studies came from the occupational therapy literature. The limited representation from the occupational therapy literature restricts direct applicability of the results to occupational

therapy practice. Literature from the occupational therapy community specific to driving does exist; however, it tends not to focus on research and therefore does not present evidence to shape practice.

Use of the Fatal Accident Reporting System database as the outcome variable was a limitation in several of the population-based studies. Although the Fatal Accident Reporting System is a widely used, well-respected national database, it does not include all traffic incidents, only fatalities. Other studies used state crash databases that have inclusion criteria such as a tow-away or \$1,500 of damage. These databases do not include smaller incidents such as parking lot crashes, personal property damage, or running over curbs. Studies using traffic violations also have limitations because of non-reported incidents and potential law enforcement leniency with older adults (Staplin, Gish, & Wagner, 2003).

In addition to the weaknesses inherent in databases, crash, injury, and fatality databases capture only one extreme of driving performance. The range of driving performance includes safe driving, near misses, getting lost, and minor incidents in which occupational therapists and occupational therapy assistants are concerned.

Many of the non-population-based studies were limited by small sample sizes. Many of the studies examining interventions to the person had limitations related to lack of control groups, small sample size, and learning effects.

Finally, much of the literature addressing the infrastructure is not based on research but rather on a professional report because of the current status of the science in the engineering and human factors industry. Readers need to be cognizant of the lack of empirical evidence and the limitations and application of the recommendations.

Implications for Clinical Practice, Education, and Research

The various studies included in the literature review used approaches both familiar and unfamiliar to occupational therapists and occupational therapy assistants and included performance skill-based interventions, education, modifications to the vehicle, infrastructure design, and policy and community mobility programs. On the basis of the current literature, occupational therapists should be prepared to provide interventions that are both direct and consultative in nature to meet the multifaceted factors contributing to older driver performance and safety.

The older driver evidence-based literature review revealed that successful interventions share some common features. Effective interventions were found to include

- Approaches focused on the client's performance skills and client factors;

- Comprehensive licensing programs that consider the impact of aging and illness on performance skills, performance patterns, and client factors;
- Community-building efforts for collaborative transportation services that meet the needs of all stakeholders;
- Technology to support performance in this instrumental activity of daily living (IADL) and community mobility;
- Collaboration with municipal planning entities and roadway engineers regarding the design of elder-friendly infrastructures that tailor the activity demands relative to age-related performance skill and client factors, regional performance patterns, and the context; and
- Consultation with automobile manufacturers specific to elder-friendly vehicle design that considers performance skills and client factors altered by aging and illness, the contexts in which older adults drive, and the performance patterns older adults follow.

The evidence presented in the evidence-based literature review suggests growing opportunities for occupational therapy practice outside of traditional medical settings. There are opportunities for occupational therapists to serve as consultants to medical review boards, community planning boards, transportation safety programs, policymaking groups, aging agencies, transit authorities, and automobile manufacturers. If one views these population-based interventions within the growing public health aspect of occupational therapy practice, the opportunities are plentiful. The case can be made that occupational therapists and occupational therapy assistants have an important role not only in helping older adults return to driving when illness or injury has impaired performance but also in the prevention of occupational disengagement, injury, and fatality.

Occupational therapy professional programs are well suited to guide new therapists to address driving and community as an IADL and describe the specialization of driving rehabilitation and community mobility for the older adult population. At present, students take coursework in psychosocial issues, gerontology, and community-based practice and learn concepts related to occupational analysis, assessment, intervention planning, public health, injury prevention, and population-based services. Most educational programs offer content specific to driving rehabilitation but to a varying degree across programs. Concentrated efforts should be made by all educational programs to include a synthesis of the topics covered here to address driving rehabilitation, older drivers, and community mobility. Professional programs can facilitate these learning experiences through cooperative relationships with area clinical programs, guest lecturers, and site visits to driving rehabilitation programs. Overall, educational programs need to foster recognition of driving and community mobility as

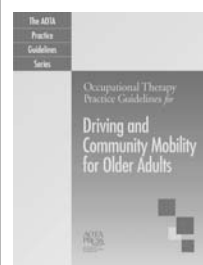
an IADL and within the scope of both general and specialized occupational therapy practice.

It is clear that more well-designed studies addressing the benefits of occupation-based interventions and outcomes related to occupational performance and participation are needed. Although it is unfortunate that only three of the articles reviewed included occupational therapy, the positive side is that researchers in other disciplines see the value of conducting research related to older drivers. In summary, there is evidence that interventions to the person, vehicle, policy and community mobility, and infrastructure can be effective in supporting driving and community mobility among older adults. This document not only serves as a guideline for practice but also provides suggestions for occupational therapy research and education. ▲

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