Adaptive Driving

Foundations and Frontiers
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Preview

• PhD Comics 2 Minute Thesis Contest! Video

Foundations and Frontiers

• Need for Driver Rehabilitation
• Scope of Services
• Driver Licensing Policy
• Challenges to Service Provider

• Vehicle Modifications
• In-Vehicle Technologies
• Advanced Driving Assessment
• A New Standard for Driver Licensing
Foundations: Need for Driver Rehabilitation

- Prevalence of Disability
- Roadway collisions
- Workplace injury
- Chronic disease
- Transportation Independence
- End of Institutionalization
- Growth of our Aging Population
- Criticality of Mobility and Participation for Economics

Research Note

National Center for Health Statistics (NCHS) estimates, based on a 1990 survey, that approximately 211,000 persons with disabilities used some type of adaptive equipment...

...the number of vehicles with adaptive equipment will continue to increase, as a larger proportion of the population begins to age and as access to employment, travel, and recreation continues to improve for persons with disabilities as a result of the ADA.

Driver Rehabilitation: A Growing Niche

In the decade leading up to 2001, the number of older licensed drivers increased 32% to approximately 19.1 million. In contrast, during this period the number of licensed drivers overall only increased by 13%.


Foundations: Need for Driver Rehabilitation

Erratic driving an increasing problem among returning combat veterans

Los Angeles Times

Journal of Rehabilitation Research & Development

Prevalence and characteristics of driving difficulties in Operation Iraqi Freedom/Operation Enduring Freedom combat returnees

Foundations: Scope of Services

Intake with the prescription of a family physician or specialist

- All ages
- Driver experience
- Vehicle type
- Life roles

- All medical conditions
- Cognitive
- Sensory
- Physical/Motor
- Medications

Most Frequent Diagnoses in 35 to 64 Age Group

- CVA/Stroke: 19
- TBI: 8
- Amputation: 6
- SCI: 4
- Diabetic Neuropathy: 3

Determined by 2009 Medical Record Review of Adaptive Driving Program (PITT)

Foundations: Scope of Services

On-the-Road Evaluation

- Need Training
- Fail

N=122

58 Pass

102 Continue to Drive

61 Need Training

22 Driver Cessation

3 Fail

4 Types of Clients:
- Adapted Vehicle Vs Standard Vehicle
- Novice Driver Vs Experienced Driver
Foundations: Scope of Services

Intake with the prescription of a family physician or specialist
- All ages
- All medical conditions

Current activities in service of veterans

YAPHS GRECC Newsletter

See Appendix D of VHA HANDBOOK 1173.16 to obtain full listing of currently Driver Rehabilitation Programs (providing on-road driving) by the VA

Foundations: Driver Licensing Policy

- New Drivers
  - Graduate Driver Licensing
- Experienced Drivers
  - Mandatory Physician Reporting
  - Age-Based Renewal
  - Age-Based Random Sampling

Take Driver’s Ed

Physical Exam

A Knowledge Test

Get Insurance

Certificate of Practice Completion

Take Road Test

“Is it harder to get a license than a job? Look at the steps now.”

Current activities in service of veterans

Auto anxiety: Some returning veterans struggle with driving

Feature of Palo Alto VA with Dr. Woodard and Marc Samuels

See Appendix D of VHA HANDBOOK 1173.16 to obtain full listing of currently Driver Rehabilitation Programs (providing on-road driving) by the VA
Foundations: Driver Licensing Policy

- Job-related Driving – additional concerns, different pathways

**DOT**

DOT

Within Each State

State Licensing Authority

Medical Advisory Board

Foundations: Challenges to Service Provider

- Mandatory Physician Reporting
- Immunity vs Anonymity
- Patient-Physician Relationship
- Client Dismissiveness
- Face validity of process
- Disposition to Healthcare
- Assessment Ambiguity
- Client’s view and understanding
- Causality of medical-impairment
- Prognosis vs. Current Need
- Expiration date of resolution
- Modification for future health status

Foundations: Challenges to Service Provider

State Licensing Authority

Advisory Board

Drivers

Physicians

Police Officers

Driver Rehabilitation Specialists
Frontiers: Vehicle Modifications

- Primary Controls
  - Steering
  - Braking & Gas
  - Ignition/Gear Shifting/Parking Brake

- Secondary Controls
  - Turn Signals/Wipers/Headlights
  - Air Conditioning/Radio
  - Windows/Hood/Trunk/Gas Tank
  - Horn/Hazard Flashers

Frontiers: Vehicle Modifications

- Driver Seating
  - Entry/Egress
  - Posture
  - Securement
- Infotainment Systems?
- More???
Frontiers: Advanced Driving Assessment

Example of Senior Driver Ombudsman Service

Training for:
- Law Enforcement
- Licensing Authority
- Health Professionals
- Senior Drivers

Frontiers: Advanced Driving Assessment

Example of Purnima Kuria and Paul Cooper
Driver Rehabilitation Program

- Person-Aware
- Context-Aware
- Complimenting
- Supplementing

Frontiers: In-Vehicle Technologies

- Driver Assistance
- Collision Avoidance
- Autonomous Vehicles
- Event Data Recorders
- In-Vehicle Data Recorders
- Intelligent Transportation Systems

http://www.its.dot.gov/application_areas.htm
Frontiers: In-Vehicle Technologies

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Intelligent Transportation Systems

- Event Data Recorders
- In-Vehicle Data Recorders
- Intelligent Transportation Systems

Multi-modal Data Sources

Continuous Data Collection

Crash Related Data Collection

Frontiers: Advanced Driving Assessment

Framework for Scenario of Supervised Driving

In Theory... Driver Capability = f(performance) + f(competency)

In Practice...

Certified Driver Rehabilitation Specialist

Nationally Credentialed/Certified Driver Education Teacher

Driver Licensing Authority State Test Administrator

Family and Friends

Frontiers: A New Standard for Driver Licensing

78 novice and experienced drivers evaluated with a standard vehicle
**Frontiers: A New Standard for Driver Licensing**

**NAViSection Design Progression**
- Automated Detection
- Maximal Attention to Client

**NAViSection Design Components**
- A. Steering Wheel Magnets
- B. Wireless Steering Wheel Contact Sensor
- C. Evaluator Brake Switch and Web Cam
- D. CDRS Event Logger
- E. Data Acquisition and Receiver Unit
- F. Event Recording and Witness Logger Program
- G. DriveCap In-Vehicle Data Recorder
Frontiers: A New Standard for Driver Licensing

NAViSection System Installation

Updates:
- Wireless network of phones added to test accelerometers for vehicle movement and steering wheel movement
- OBDII replaced by Rear Speed Radar

Frontiers: A New Standard for Driver Licensing

NAViSection System Evaluation – Automatic vs. Manual Log

Frontiers: Advanced Driving Assessment

NAViSection Benchmarking – the difference in Supervised Driving

Other FLEET MGMT tools include SmartDrive and DriveCam for example
Frontier Work

- Causality of Error: clinical assessment, prior history, self-perception
- Classification of Error: cognitive, sensory, motor
- Capture of Error: NAVIsection
- Categorization of Error: operation (interface, completion), decision
- Criticality of Error: likelihood, potential severity

Data Interpretation for Enhanced Reporting

Data Collection for Client Education

Intelligent Driver Training
Intelligent Driver Referral
Adaptive Driver Licensing
Adaptive Driving Simulators

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You may ask questions, but I may point you to a book or the stack of literature on my desk

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Jessica Cox was born without arms but that did not stop her from fulfilling her dreams of becoming a black belt, scuba diver, first ever armless pilot!

Institute of Electrical and Electronics Engineers (IEEE) boldly announced that its members had "selected autonomous vehicles as the most promising form of intelligent transportation, anticipating that they will account for up to 75 percent of cars on the road by the year 2040."
“Can more sophisticated biometrics & testing combined with more sophisticated vehicles and roadways lead to extended and flexible licensing for the elderly and enhance safety of elderly drivers at the same time?”

Martin Wachs
Rand Corporation & University of California