

# Vehicle modification prescription for drivers with disabilities: development of consensus based prescription guidelines to optimise user interfaces and safety

Dr Marilyn Di Stefano<sup>ab</sup> and Dr Rwth Stuckey<sup>b</sup>

<sup>a</sup> VicRoads, Melbourne, Australia. <sup>b</sup> La Trobe University, Melbourne, Australia.

## Abstract

Vehicle modifications (VMs) may be essential to ensure drivers with disabilities can access and drive motor vehicles independently and safely: safer driver-vehicle interfaces are an important contributor to meeting the goals of "Toward Zero" for this driver group. Occupational therapy driver assessors (OTDAs) routinely prescribe vehicle modifications based on individualised assessments. Following stakeholder consultation, safe systems and human factors analysis and a literature review, we identified resource gaps in information to support a licensing authority approved, and evidence based, VMs prescription process. Using an action research approach, we established content validity for items and developed consensus-based draft VMs prescription guidelines ready for trialling by OTDAs.

## Introduction and Aims

The independence of drivers with disabilities (DWDs) relies on application of the safe system approach: optimising safer human-machine interfaces through VMs such as alternative primary/secondary controls and access/egress enhancements (Brouwers et al., 2010). OTDAs have primary responsibility to recommend VMs to drivers and driver licensing authorities (DLAs). Currently no resources provide detailed guidance to support the complex process of the VM prescription to match human factor requirements and individual capacities (Di Stefano & Stuckey, 2015). We sought to (a) clearly articulate components and stages of VMs prescription process, (b) establish content validity for items, and (c) confirm practicability of items for a draft set of consensus-based guidelines.

## Methods

A literature review, ergonomic and safe system driving task analysis, and targeted project advisory group (PAG) (including expert OTDAs, DWDs, key advocacy groups and funding/regulating agencies) informed the participatory action research study design. A survey investigating DWDs experiences (reported elsewhere), focus groups (FGs), and PAG consultation, were used at different stages. Action research processes utilise user expertise to investigate phenomena, developing meaningful outcomes and optimising ownership and application (Koshy, et.al. 2010).

We synthesised evidence from DWDs survey results, literature/resource review, and ergonomic/task analysis to develop draft VMs guidelines (e.g. Di Stefano et al, 2015; European Committee for Standardisation, 2013; Henriksson & Peters, 2004; Herriotts, 2005; Norweg et al., 2011). In the absence of an available purpose-specific survey tool, an instrument was designed and ratified by the PAG then distributed to all practicing OTDAs in the DLA. The survey gathered demographic information (15 items) and elicited current practice ratings on a 4 point scale ('yes all the time', 'sometimes', 'never', 'don't know', 'not applicable')(49 items), and comments to action statements.

FGs systematically reviewed/validated all items, and sought item consensus agreement on inclusion (as "essential" or "desirable") and feedback (e.g. clearer wording). Quantitative and qualitative data were analysed. In the absence of practice domain prescribed criteria, the PAG unanimously determined that  $\geq 90\%$  should be the objective cut-off for consensus agreement levels for guideline items.

## Results

Practice guideline categories included:

1. General assessment and prescription principles (e.g. standardized assessment results),
2. Person-centered and human-machine factors (e.g. impairments, inability to access standard control configurations),
3. System factors impacting VMs provision (e.g. DLA requirements),
4. Driving as an occupation (e.g. worker vehicle requirements),
5. VMs training issues (e.g. access to equipment),
6. VMs evaluation
7. In-vehicle evaluation, and
8. On-road driving in traffic.

Fifty three OTDAs (81.5% of total) returned questionnaires and/or attended FGs. No-one suggested new, or rejected, items or categorizations. Collated survey and FG item responses confirmed consensus agreement for 39 of 49 items as "essential inclusion". Content analysis identified suggested wording changes to improve item clarity/meaning related to two themes (a) OTDA role clarification and differentiation (e.g. reliance on vehicle installer for compliance) and (b) current practice limitations (e.g. accessing equipment to trial).

## Discussion and Implications

We (a) clearly articulated components of the prescription process, (b) established item content validity, and (c) confirmed practicability of items for this first international draft set of consensus-based OTDA VMs guidelines, now ready for trialing. Enhanced road safety via consistent prescription processes and safer human – machine interfaces is the ultimate goal of the new guidelines.

**Acknowledgements** ISCR for project funding, VicRoads, DMA & AQA for in-kind support

## Bibliography

- Brouwers, M. C., Kho, M. E., Browman, G. P., Burgers, J. S., Cluzeau, F., Feder, G., . . . Zitzelsberger, L. (2010). AGREE II: advancing guideline development, reporting and evaluation in health care. *Canadian Medical Association Journal*, 182(18), E839-E842. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3001530/>
- Di Stefano, M., Stuckey, R., Macdonald, W., & Lavender, K. (2015). Vehicle modifications for drivers with disabilities: developing the evidence base to support prescription guidelines, improve user safety and enhance participation. Retrieved on 2<sup>nd</sup> February 2018 from: <http://www.iscrr.com.au/living-with-brain-or-spinal-cord-injury/assistive-technology/disability-and-driving-vehicle-modifications-vms>
- Di Stefano, M., & Stuckey, R. (2015). Ergonomic considerations for vehicle driver-cabin configurations: Optimising the fit between drivers with a disability and motor vehicles. In I. Soderbach (Ed.), *International Handbook of Occupational Therapy Interventions*. Switzerland: Springer International Publishing.
- European Committee for Standardisation. (2013). Car-Adaptations for Disabled Drivers: Requirements, test methods and best practise guidelines. Brussels: CEN - European Committee for Standardisation.
- Henriksson, P., & Peters, B. (2004). Safety and mobility of people with disabilities driving adapted cars. *Scandinavian Journal of Occupational Therapy*, 11(2), 54-61.

- Herriotts, P. (2005). Identification of vehicle design requirements for older drivers. *Applied Ergonomics*, 36, 255-262.
- Koshy, E., Koshy, V., & Waterman, H. (2010). *Action Research in Healthcare*: SAGE Publications
- Norweg, A., Jette, A. M., Houlihan, B., Ni, P., & Boninger, M. L. (2011). Patterns, predictors, and associated benefits of driving a modified vehicle after spinal cord injury: Findings from the National Spinal Cord Injury Model Systems. *Archives of Physical Medicine and Rehabilitation*, 92(3), 477-483.