Original Article

DOI: 10.14235/bas.galenos.2020.3796
Bezmialem Science 2021;9(1):35-40

Analysis of Personal, Environmental, and Occupational Factors Affecting the Activity Performance of Disabled Drivers

Engelli Sürücülerin Aktivite Performanslarını Etkileyen Kişisel, Çevresel ve Aktiviteye Ait Faktörlerinin İncelenmesi

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ABSTRACT

Objective: This study was planned to analyse environmental, personal and occupational factors on disabled drivers' performance who had been driving.

Methods: Twenty orthopedically (group II) and 20 neurologically disabled (group I) people were included in the study. Loewenstein Occupational Therapy Cognitive Assessment (LOTCA), trail making test, rapid pace walk test and alternate foot tap test, The Craig Hospital Inventory of Environmental Factors (CHIEF-SF) and semi-structured interview methods were used for assessments.

Results: Group I included 10 women and 10 men with mean age 33.9±12.05 years; group II included 19 men and 1 woman with mean age 36.5±12.45 years. Group I had not been able to comply with pre-driving test norms that needed for driving competency, controversially group II had proficient scores related to driving. Visio-motor organisation and thinking operations sub-scales of LOTCA were significantly lower than base scores ($p<0.05$) in group I. both groups defined barriers in CHIEF-SF.

Conclusion: Our study showed driving for our participant was an important activity. But lack of rehabilitation services and laws for driving might effect driving participation thus social participation. It is important to enabling driving rehabilitation services, community awareness of driving, law-maker awareness to enhance disabled people's activity performance and participation.

Keywords: Occupational therapy, disabled people, activities of daily living

ÖZ

Amaç: Bu çalışma, sürüş yapan engelli sürücülerin performansındaki çevresel, kişisel ve mesleki faktörleri analiz etmek için planlandı.

Yöntemler: Çalışmaya ortopedik 20 (grup 2) ve 20 nörolojik özürlü (grup 1) kişi alındı. Değerlendirmeler için Loewenstein Ergoterapi Kognitif Değerlendirme (LOTCA), iz sürme testi, kalk yürü testi ve sıralı ayak basma testi, Craig Hastanesi Çevresel Faktörler Envanteri (CHIEF-SF) ve yarı yapılandırılmış görüşme yöntemleri kullanılmıştır.

Bulgular: Grup 1'de 10 kadın ve 10 erkeğin yaş ortalaması 33,9±12,05 yıl, 2. grupta 19 erkek ve 1 kadında ortalama yaş 36,5±12,45 yıl olarak bulundu. Grup 1, sürüş yetkinliği için gerekli olan sürüş öncesi test normlarına uymayı başaramamış, diğer yandan olarak 2. grup sürüşe ilişkin yeterli puan almış. Visio-motor organizasyon ve düşünme operasyonları LOTCA'nın alt ölçekleri grup 1'de baz puanlardan anlamlı derecede düşüktü ($p<0,05$). Her iki grup da CHIEF-SF'de farklı bariyerler belirttiler.

Sonuç: Çalışmamız, katılımcımız için sürüşün önemli bir aktivite olduğunu göstermiştir. Ancak, rehabilitasyon hizmetlerinin eksikliği ve sürüş için yasalar sürüş katılımını ve dolayısıyla sosyal katılımı etkileyebilir. Engelli bireylerin etkinlik performansını ve katılımını artırmak için sürüş rehabilitasyon hizmetlerinin, toplum sürüş bilincini, kanun koyucu bilincini sağlamak önemlidir.

Anahtar Sözcükler: Ergoterapi, engelli kişiler, günlük yaşam aktiviteleri

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Received: 16.10.2019
Accepted: 07.01.2020

Cite this article as: Aran OT, Kayıhan H. Analysis of Personal, Environmental, and Occupational Factors Affecting the Activity Performance of Disabled Drivers. Bezmialem Science 2021;9(1):35-40.

Introduction

Community mobility, an instrumental activity of daily living (IADL), is defined as "moving around in the community with the use of public or private transportation, such as driving, walking, bicycling, or accessing and riding in buses, taxi cabs, or other transportation systems" by the American Occupational Therapy Association (AOTA) (1). It is an important part of daily living which is related to social integration, participation to social roles, and role identification among others. Outside activities such as work, participating in social activity, shopping and grocery, prayer meetings, etc., for disabled persons are important, and can be accessible with community mobility. If participating in these activities is restricted by health issues, persons may feel depressed and incompetent, and limitations in the activity of daily living may occur (2). For most of the people, community mobility represents driving and independence (3). Independence, self-confidence, and community participation limitations may occur due to loss of driving ability (4).

Driving is a complex activity that depends on many factors such as attention, perception, cognitive ability, memory, experience, automatic motor performance, quick decision making, coping with different traffic situations, muscle strength of related muscles, lower extremity reaction speed, and visual range (5,6). Attention and cognitive ability is especially important for driver, passenger, and pedestrian safety (5). Besides personal factors, environmental and occupational (driving related) factors affect driving. Family/peer support, stigma, funding, traffic condition, high-way side-way driving, day and night driving, road condition, existence of other drivers, and their behaviour can be considered as environmental factors. In addition, adaptation limits, accessibility, and affordability of the car can be accepted as occupational factors of driving (4).

Disabled population of Turkey is 12% of its total population which is approximately 8 million citizen (7). According to the Turkish Republic National Police Traffic Services reports, 44,254 citizens have disabled driving licence which indicates that 0.7% are disabled people driving in Turkey (8) whereas 20% in United Kingdom (9) and 12% in United States of America (10), which shows that Turkey disabled driver rates are remarkably lower.

Current occupational therapy framework suggests that IADL's including driving may be affected by the person's body functions and performance skills which must be intervened by an occupational therapist (1,11). In addition, cognitive, perceptive ability, and executive functioning related to driving must be assessed, and problems should be addressed by occupational therapists (12,13). AOTA stated that the importance of occupational therapists in driver assessment includes client's sensory, cognitive, motor performance skills, safety concerns, environmental barriers, and ability to participate in daily living (11). With the presence of current literature that supports activity-based assessments of disabled/older drivers, the situation in Turkey consisting of physician-orientated and non-interdisciplinary manner may become a big limitation for disabled person's activity participation and performance. These reasons make the assessment and improvement of activity performance of disabled drivers in our country very important. Also, a need of interdisciplinary approaches enlightened with activity performance assessment results was noted. Pre-driving assessments of two different diagnostic groups (orthopaedic and neurological) were made to determine driving fitness for disabled people.

Method

This is methodological study embedded in two groups, clinical trials and comparisons were made with given standards. Current study was approved by Hacettepe University Ethic Committee with LUT 12/101 project number. Signed informed consent was obtained from all participants before study.

A total of 40 participants were included and divided equally into two groups: group I were participants with neurologic disorders and group II with orthopaedic disorders. Inclusion criterions were:

- age 18-65 years,
- with drivers licence,
- diagnosed with neurologic (group I) or orthopaedic disorder (group II),
- without visual and auditory problems
- with willingness to participate in the study.

Assessments

Personal Assessments

Loewenstein Occupational Therapy Cognitive Assessment (LOTCA) and trail making test (TMT) A and B were used for cognition and alternate foot tap test (AFT) and rapid pace walk test (RPW) for physical function.

LOTCA is a tool that assesses cognitive skills and visual perceptions of participants. Test includes orientation, spatial perception, visio-motor perception, thinking organization, and attention. All domains were scored between 1-4 except for risk object classification I and II domains, which were scored between 1-5 (14).

The TMT assesses visual search, scanning, speed of processing, mental flexibility, and executive functions (15). Test consists of two parts: TMT-A, which requires a person to draw lines sequentially connecting 25 circled numbers on the test paper and TMT-B, which needs the same skills as TMT-A; however, the person must alternate between numbers and letters (e.g., 1, A, 2, B, 3, C, and so on). The score for the test was scored as the amount of time required to complete the task. The TMT is commonly used for driving prediction of disabled persons (5, 16,17).

Lower extremity mobility and reaction time were assessed with RPW and AFT, respectively. Both tests' completion durations were recorded (18).

Environmental Assessment

Craig Hospital Inventory of Environmental Factors-Short Form (CHIEF-SF) was used for environmental assessments. CHIEF-SF assesses physical, attitude-related, environmental, and political barriers and frequency of these barriers in the participant's perspective. In addition, driving importance and satisfaction were assessed using visual analogue scale (VAS) with a score ranging from 0-10 in which higher score indicates better satisfaction and importance. Family and peer support before and after driving, self-confidence about driving, and family and peer confidence about driving were assessed using a semi-structured interview. All questions apart from car and environment related problems were scored with a five-point likert scale (1: highly positive, 2: positive, 3: not sure, 4: negative, and 5: highly negative).

Tests used in our study were suggested to determine the driving ability in clinical settings (13,19). Required scores for accepting proficiency for driving are: ≤78 s for TMT-A; ≤180 s for TMT-B; ≤8 s in RPW; and 7.42 s for AFT.

SPSS 21.00 software was used to analyse data. Quantitative data were described with mean ± standard deviation and qualitative data were described with percent (%) values. Normality of data was evaluated with visual (histogram and stem-leaf plots) and analytic (Kolmogorov-Smirnov/Shapiro-Wilk tests) methods. Significance was set an alpha level of 0.05 ($p<0.05$). Frequencies and descriptive statistical methods were used for semi-structured interviews and likert scales. Test results were compared with test norms with one way analysis of variance test. LOTCA results were compared to base scores of subtests due to the lack of Turkish mean scores.

Results

A total of 20 participants (10 women and 10 men) were recruited for group I and 20 participants (19 men and 1 woman) for group II. The mean age of group I was 33.9±12.05 years and group II was 36.5±12.45 years.

Both groups included participants with different diagnosis such as multiple sclerosis (MS) (n=4), myopathy (n=3), meningomyelocele (n=3), neuropathy (n=2), ataxia (n=2), hemiplegia (n=2), and spinal cord injury (n=2) in group I and poliomyelitis (n=6), lower extremity amputation (n=6), traumatic brachial plexus injury (n=1), crash injury (n=1), and shoulder arthrodesis (n=1) in group II.

A total of three participants diagnosed with myopathy and spinal cord injury from group I and six participants with polio, lower limb amputation, and crush injury from group II were unable to apply for RPW and AFT.

Table 1 presents standard values for driving competency and mean scores of TMT A and B, RPW, AFT, and p values and VAS scores for driving importance and satisfaction. Table 2 presents CHIEF-SF scores. Table 3 presents LOTCA scores for two groups.

Group II had better results than group I in LOTCA. A statistically significant difference between group I and LOTCA base scores ($p<0.05$) were noted. Group I had effected LOTCA visual-spatial perception and thinking operations scores which might be related to driving skills. Group I could not meet RPW and AFT required scores for driving which indicates increased lower extremity reaction time. In addition, other test scores for group I and all tests for group II were sufficient. Driving importance and driving satisfaction were high in both groups. Mean scores

Table 1. Clinical test results and comparison

	Group I	p	Group II	p	Test norms
Trail making test A	62.11±35.74	0.06	39.61±13.02	0.001	≤78 s
Trail making test B	154.17±85.26	0.19	105.62±37.05	0.001	≤180 s
Rapid pace walk test	19.74±10.17	0.001*	6.93±4.92	0.35	≤8 s
Alternate foot tap test	10.71±9.69	0.07	4.75±0.85	0.001	≤7.42 s
VAS importance	8.55±1.63		9.25±1.29		-
VAS satisfaction	7.05±3.26		8.90±1.71		-

*p<0.05, VAS: Visual analogue scale

Table 2. Environmental barrier scores (CHIEF-SF)

CHIEF-SF	Group I	Group II
Politics	4.0±4.2	3.4±4.6
Physical/structural	4.2±4.2	1.8±2.3
Work/school	3.3±4.2	1.8±2.7
Behaviour/support	4.8±4.8	1.5±2.5
Services/assistance	5.3±5.1	2.0±3.7
Total	21.7±14.3	10.6±11.0

CHIEF-SF: Craig Hospital Inventory of Environmental Factors-Short Form

Table 3. Loewenstein occupational therapy cognitive assessment results and comparison

LOTCA	Group I (n=20)	p	Group II (n=20)	p
Place	3.95±0.22	0.31	4.00	1.00
Time	4.00	1.00	4.00	1.00
Object identification	4.00	1.00	4.00	1.00
Shapes identification	4.00	1.00	4.00	1.00
Overlapping figures	4.00	1.00	4.00	1.00
Object constancy	3.80±0.5	0.07	3.94±0.22	1.00
Spatial perception	3.85±0.4	0.15	4.00	1.00
Praxis	4.0	1.00	4.00	1.00
Copying geometric forms	3.90±0.3	0.15	4.00	1.00
Reproduction of a two-dimensional model	3.75±0.5	0.03*	3.90±0.30	0.15
Pegboard construction	3.75±0.7	0.07	4.00	1.00
Colored block design	3.65±0.7	0.01*	3.80±0.41	0.03*
Plain block design	3.55±0.8	0.01*	3.75±0.44	0.018
Reproduction of a puzzle	3.5±0.8	0.009*	3.90±0.30	0.15
Drawing a clock	3.85±0.4	0.15	4.00	1.00
Categorization	3.9±0.8	0.001*	4.60±0.50	0.002*
ROC: unstructured	4.55±0.68	0.004*	4.90±0.30	0.15
ROC: structured	4.50±0.76	0.004*	4.90±0.30	0.07
Pictorial sequence A	3.70±0.9	0.15	4.00	1.00
pictorial sequence B	3.45±1.05	0.01*	3.75±0.44	0.01*
Geometrical sequence	3.70±0.7	0.07	3.95±0.22	0.31
Attention	3.85±0.36	0.07	4.00	1.00

*p<0.05, ROC: Risk object classification

of importance were 8.55±1.63 in group I and 9.25±1.29 in group II. Satisfaction mean scores were 7.05±3.26 in group I and 8.90±1.71 in group II.

Family support before and after driving, self-confidence about driving, family and peer confidence about driving, and car and environment related problems were assessed with semi-structured interviews which are shown in Table 4. Family and peer support increased after driving. Self-confidence was high in both groups; however, peer confidence was lower in group I than in group II. In addition, low self-confidence of two participants in group I was noteworthy that they continue driving with their low confidence.

Discussion

A total of 40 participants were included in this study, who had been driving with their disability. This study aimed to investigate participants driving competency according to literature values, environmental, and physical barriers effecting their driving. Our research found that drivers with neurological disorders had physical and cognitive barriers for their driving ability.

Various studies showed cognitive function affects driving ability (16,17,20-22). Our results show a low motor perception and thinking organizations scores of LOTCA in both groups, which means sensory-perceptual and perceptual-motor ability could affect driving. Therefore, specialized trainings for driving skill for disabled is a current issue in rehabilitation in Turkey, which is not included in the perspectives of rehabilitation services. We suggest that assessment and rehabilitation programs that build sensory, perceptual, and motor abilities are needed to improve driving abilities of disabled in our country.

TMT A and B, AFT, and RPW results of group II were better than test norms which show better driving ability. However, RPW and AFT of group I did not match test minimum standards. Based on these results, group I needs detailed assessment about their driving ability to ensure safe driving, although pre-driving assessments in our country must include literature-supported assessment methods to improve and prevent traffic safety for disabled and other drivers. Marshall et al. (5) mentioned that TMT A and B parts were predictors of driving in stroke survivors. The American Medical Association suggested the use of current test to predict driving ability in older adults (19).

CHIEF-SF was used to assess environmental barriers of participants, which include political, physical, social, services/support, and work/school related barriers. Both groups defined barriers in all parameters; however, the highest barriers defined by group I was services/support, whereas group II was politics and services/support. Salar's master thesis suggested that activity

Table 4. Semi-structured interview results

	Group I		Group II	
	N	%	N	%
Family support				
Highly positive	7	35	8	40
Positive	2	10	8	40
Uncertain	-	-	1	5
Negative	3	15	-	-
Highly negative	8	40	3	15
Peer support				
Highly positive	9	45	9	45
Positive	3	15	9	45
Uncertain	2	10	1	5
Negative	1	5	1	5
Highly negative	5	25	-	-
Family support after driving				
Highly positive	8	40	9	45
Positive	1	5	8	40
Uncertain	2	10	1	5
Negative	4	20	1	5
Highly negative	5	25	1	5
Peer support after driving				
Highly positive	8	40	9	45
Positive	3	15	9	45
Uncertain	4	20	1	5
Negative	2	10	1	5
Highly negative	3	15	-	-
Self confidence about driving				
Very high	12	60	8	40
High	1	5	12	60
Mild	4	20	-	-
Low	1	5	-	-
Very low	2	10	-	-
Peer confidence				
Very high	7	35	9	45
High	5	25	9	45
Mild	-	-	1	5
Low	4	20	1	5
Very low	4	20	-	-

barriers and participation of people with spinal cord injury include political, services/support, and behaviour, which supports our participants' defined barriers (23). Laws and regulations were defined as barriers in CHIEF-SF in our study. Traffic laws for disabled people in our country support physician-based assessments which might result to non-activity based assessments for driving ability and proficiency. Laws and regulations were thought to be a limitation for disabled people's driving because some of disabled driving candidates could not get driver's licence due to non-activity based assessments.

Driving interest and motivation to driving were reported as important in safe driving by Lundqvist and Rönnberg (24). Current study also showed interest to affect driving behavior, and capitalize driving problems related to behavior. In this study, participants indicated high driving importance and satisfaction that might be related to safe driving and activity willingness.

Family support before driving was negative in 55% of group I and 20% from group II. Social (peer support) before driving were negative in 40% of the group I and 10% from group II. After starting driving family and peer support changed to 45% negative in group I and 10% in group II. These negative attitudes before driving may be a result of stigma about disabled people and families and peers' protection instinct. Upon the start of driving, family and peer support increased in both groups. This change might had been affected with the observation of the participant's driving ability. When families and peers thought that disabled relatives are safe while driving, they were capable of supporting their relatives to drive. Although stigma for disabled driving was a problem, occupational therapists and driver rehabilitation services must inform the community about disabled driving to prevent stigma and enhance family/peer support for driving.

Study Limitations

This study included different disability groups, which might alter homogeneity of results and might be accepted as a limitation of the study. The other limitation is that we were unable to analyse the driving ability while disabled participants were driving. We concluded our findings based on clinical assessments; however, assessments made behind the wheel might reflect clearer results.

Conclusion

Rehabilitation for disabled people in our country includes basic physical trainings as isolated range of motion, walking exercises, etc. However, driving which includes many sensory, motor, and perceptual factors, must be rehabilitated in a perspective of specialized activity rehabilitation programs (24). To start and improve driver rehabilitation in our country, approaches to the rehabilitation must not be physician-focused but an interdisciplinary model.

Community-based rehabilitation studies should be prepared for community information about disabled driving in Turkey. With these applications stigmas, negative family/peer supports, activity limitations, and social isolation of the disabled may decrease. Further studies including these perspectives may improve the disabled driving skills and their perception on driver rehabilitation by related health practitioners. In addition, we suggest cross-cultural studies to improve perception of law-makers and governmental departments about driving rehabilitation and current situation in developed countries. Finally, future positive changes in laws and regulations, enabling of disabled drivers may result in an increase in participation as mentioned in the International Classification of Disability.

Acknowledgements

This study was a part of first author's Master of Philosophy thesis. Authors would like to thank all participants of this study and Hacettepe University Faculty of Health Sciences Occupational Therapy Department.

Ethics

Ethics Committee Approval: Current study was approved by Hacettepe University Ethics Committee with LUT 12/101 project number.

Informed Consent: Signed informed consent was obtained from all participants before study.

Peer-review: Externally peer reviewed.

Authorship Contributions

Concept: O.T.A., H.K., Design: O.T.A., H.K., Data Collection or Processing: O.T.A., Analysis or Interpretation: O.T.A., H.K., Literature Search: O.T.A., Writing: O.T.A.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

References

1. The American Occupational Therapy Association. Occupational therapy practice framework: Domain and process, 2nd ed. American Journal of Occupational Therapy. 2008.p.625-83.
2. Beverly Foundation. Community Effectiveness in Safeguarding at-risk senior drivers. Pasadena, Calif: Beverly Foundation, 1998.
3. AA Foundation for Traffic Safety. Beverly Foundation: Transportation alternatives for seniors: high cost problems low cos solutions. In: Safety AFfT, 2004.
4. Bolding D, Adler C, Tripton-Burton M, Verran A. Occupational Performance and The Performance Areas: Evaluation and Intervention. In: Pendleton H. Mc , Schultz-Krohn W, editors. Pedretti's Occupational Therapy Practice Skills for Physical Dysfunction. USA: Elsevier; 2006.p.264-95.
5. Marshall SC, Molnar F, Man-Son-Hing M, Blair R, Brosseau L, Finestone HM, et al. Predictors of driving ability following stroke: a systematic review. Top Stroke Rehabil 2007;14:98-114.
6. Wheatley CJ, Pellerito JM Jr, Redepenning S. The Clinical Evaluation. In: Pellerito JM, Jr, editor. Driver Rehabilitation and Community Mobility: Principles and Practice. Missouri, USA: Elsevier, Mosby; 2006.p.103-65.
7. Turkish Republic State Institute of Statistics. Turkey Disability Survey. In: State Institute of Statistics TR, editor. Ankara: State Institute of Statistics Press, 2006.
8. Turkish Republic National Police Department Traffic Services. Turkish Republic National Police Department Car and Driver Licence Statistics,. In: Turkish Republic National Police Department Traffic Services, editor. Turkish Republic National Police Department Traffic Services, 2010.
9. Tong S, Brougton J, Tong R. Data gathering on disability and driving statistics, Stage 2:final report. United Nations: Department for Transport; 2007.
10. U.S. Department of Transportation, Bureau of transportation statistics. Freedom to Travel. Washington, DC 2003.
11. The American Occupational Therapy Association. Driving and Community Mobility. American Journal of Occupational Therapy 2010;64:112-25.
12. Korner-Bitensky N, Bitensky J, Sofer S, Man-Son-Hing M, Gelinas I. Driving evaluation practices of clinicians working in the United States and Canada. Am J Occup Ther 2006;60:428-34.
13. Stapleton T, Connelly D. Occupational therapy practice in predriving assessment post stroke in the Irish context: findings from a nominal group technique meeting. Top Stroke Rehabil 2010;17:58-68.
14. Katz N, Itzkovich M, Averbuch S, Elazar B. Loewenstein Occupational Therapy Cognitive Assessment (LOTCA) battery for brain-injured patients: reliability and validity. Am J Occup Ther 1989;43:184-92.
15. Reitan RM. The relation of the trail making test to organic brain damage. J Consult Psychol 1955;19:393-4.
16. Akinwuntan AE, Feys H, De Weerdt W, Baten G, Arno P, Kiekens C. Prediction of driving after stroke: a prospective study. Neurorehabil Neural Repair 2006;20:417-23.
17. Mazer BL, Korner-Bitensky NA, Sofer S. Predicting ability to drive after stroke. Arch Phys Med Rehabil 1998;79:743-50.
18. Classen S; National Highway Traffic Safety Administration; American Occupational Therapy Association. Consensus statements on driving in people with Parkinson's disease. Occup Ther Health Care 2014;28:140-7.
19. American Medical Association. Physician's Guide to Assessing Older Driver. American Medical Association, 2010.
20. van Zomeren AH, Brouwer WH, Minderhoud JM. Acquired brain damage and driving: a review. Arch Phys Med Rehabil 1987;68:697-705.
21. Galski T, Bruno RL, Ehle HT. Prediction of behind-the-wheel driving performance in patients with cerebral brain damage: a discriminant function analysis. Am J Occup Ther 1993;47:391-6.
22. Cox DJ, Quillian WC, Thorndike FP, Kovatchev BP, Hanna G. Evaluating driving performance of outpatients with Alzheimer disease. J Am Board Fam Pract 1998;11:264-71.
23. Salar S. The Effects of Environmental Factors to Community Participation and Life Satisfaction in People with Spinal Cord Injury. Ankara: Hacettepe University; 2011.
24. Lundqvist A, Rönnberg J. Driving problems and adaptive driving behaviourafter brain injury: A qualitative assessment. Neuropsychol Rehabil 2001;11:171-85.