

Motor function, community reintegration and quality of life in stroke survivors with pre-stroke driving history

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Abstract

Background: Driving is an important activity of daily living associated with improved community reintegration and better quality of life. It is however unclear if there is a definite difference in the motor function, community reintegration and quality of life of stroke survivors who returned to driving and those who did not.

Methods: Stroke survivors with pre-stroke driving history participated in this cross sectional survey. Socio-demographics, clinical characteristics and driving history were documented. Motor function, community reintegration and quality of life were assessed using the Modified Motor Assessment Scale (MMAS), Reintegration to Normal Living Index (RNLI) and Health-Related Quality of Life in Stroke Patients (HRQOLISP-40) respectively. Returners and non-returners were compared using Mann Whitney U test at $\alpha_{0.05}$.

Results: Fifteen out of the 44 stroke survivors (34.1%) who participated in this study had returned to driving after their stroke. There was no significant difference in age, time since stroke onset and years of driving experience prior to stroke onset ($p > 0.05$) between returners and non-returners. There was however a significant difference in the motor function, community reintegration and quality of life between the two groups ($p < 0.01$).

Conclusion: Stroke survivors with pre-stroke driving who returned to driving after stroke had better motor function, community reintegration and quality of life compared to their counterparts who had not returned to driving.

Keywords: Return-to-driving, motor function, community reintegration, quality of life,

Résumé

Contexte : La conduite est une activité de la vie quotidienne importante associée à une meilleure réinsertion sociale et à une meilleure qualité de vie. Il n'est toutefois pas clair s'il existe une différence nette entre la fonction motrice, la réinsertion sociale et la qualité de vie des survivants d'AVC qui sont retournés au volant et de ceux qui ne le sont pas.

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Les méthodes : Les survivants d'AVC avec antécédents de conduite avant l'AVC ont participé à cette enquête transversale. Les données sociodémographiques, les caractéristiques cliniques et les antécédents de conduite ont été documentés. La fonction motrice, la réintégration en communauté et la qualité de vie ont été respectivement évaluées à l'aide de l'échelle d'évaluation de la motricité modifiée (EEMM), l'indice de réintégration dans la vie normale (IRVN) et de la qualité de vie liée à la santé chez les patients ayant subi un AVC (HRQOLISP-40). Ceux qui sont revenus à la conduite et ceux qui ne sont pas revenus ont été comparés en utilisant le test U de Mann Whitney à $\alpha_{0.05}$.

Résultats : Quinze des 44 survivants d'AVC (34,1%) ayant participé à cette étude étaient revenus à la conduite après leur AVC. Il n'y avait pas de différence significative dans l'âge, le temps écoulé depuis le début de l'AVC et les années d'expérience de conduite avant le début de l'AVC ($p > 0.05$) entre ceux qui sont revenus et ceux qui ne sont pas revenus. Il y avait cependant une différence significative dans la fonction motrice, la réintégration dans la communauté et la qualité de vie entre les deux groupes ($p < 0,01$).

Conclusion : Les victimes d'accident vasculaire cérébral avec conduite avant l'AVC qui sont revenues à la conduite après l'AVC avaient une meilleure fonction motrice, réintégration dans la communauté et une qualité de vie supérieure à celle de leurs homologues qui n'étaient pas revenus à la conduite.

Mots - clés : Retour à la conduite, Fonction motrice, Réintégration dans la communauté, Qualité de vie,

Introduction

Stroke is a serious and disabling health problem globally [1]. With improvement in healthcare services, majority of stroke survivors return to live in the community. However, about 70% are left with some degree of physical or cognitive impairments [2,3] that may hinder optimal reintegration. The residual motor impairments make community reintegration an enormous challenge to many stroke survivors by affecting their normal activities of daily living, including ability to return to driving [4,5]. Driving, an important activity of daily living for many people [6], is a complex activity that requires

full functioning of multiple systems that might have been compromised in stroke survivors [7]. Hence, return to driving post stroke signifies progress in the recovery trajectory for those who had pre-stroke driving history.

Driving cessation often seen among stroke survivors interferes with many activities of daily living needed for maintaining independent living status, such as working and shopping [8]. It can result in adverse changes in mood, reduced life satisfaction, loss of identity and social isolation [9-12]. Return to driving therefore decreases depression and reduces the sense of immobility associated with stroke [13,14]. It has also been submitted that ability to drive after a stroke is an indicator of independence, and demonstrates strong association with good social reintegration [15]. Yet, only a small proportion of survivors who were driving before the stroke return to driving. Allen *et al* [16] and Aufman *et al* [17] reported the rate of return to driving six months after admission to inpatient rehabilitation for stroke as 19% and 30% respectively. Fisk *et al* [18] had earlier reported a return rate of about 50% five-year post rehabilitation.

Driving an automobile requires a high degree of competence on many levels, including physical abilities and cognitive skills, to integrate and respond appropriately to multiple rapid and transient signals [8]. Safe driving requires intact visual, behavioural, and cognitive ability [19,20]. These abilities generally fall under three domains: motor (e.g. turning the wheel, using the foot pedals, turning on windshield wipers), visual-perceptual (e.g. recognizing traffic signs, noticing events in the periphery, parking between lines), and cognitive (e.g. being aware of speed limit, knowing the directions to the destination, planning and assessing safety in merging and switching lanes [21]). Thus, pathology that affects attention, perception, executive and motor function, and awareness of cognition and behavioural performance may lead to driving errors and result in crash [22]. These functions are often impaired post-stroke and consequently, people who have suffered a stroke have greater deficiency when driving than stroke-free individuals [19].

Considering that returning to driving post-stroke is an index of reduction in the burden of care associated with stroke and improved quality of life, it is important to investigate the potential for return to driving in stroke population. Evidence has shown that younger age at stroke onset, lower level of disability and fewer cognitive deficits are associated with return to driving after stroke [4,17, 23-24]. Most studies on return to driving after stroke focused on

driving assessment protocols and influence of cognitive and visual impairment on driving ability [8,25]. There is paucity of information on the possible differences in motor function, community reintegration and quality of life between stroke survivors who had returned to driving and those who had not. We compared the motor function, community reintegration and quality of life between stroke survivors who had returned to driving (returners) and those who had not (non-returners). Association between return to driving and socio-demographic variables (age, sex, occupation, educational status, marital status) and clinical variables (time since stroke onset, years of driving pre-stroke, (side of affection and limb dominance) among returners were also studied.

Method

Community-dwelling stroke survivors with first incident stroke and pre-stroke driving history of ≥ 2 years attending the physiotherapy clinics the University College Hospital, Ibadan and National Hospital, Abuja were purposively recruited into this cross sectional survey. Recruitment of participants spanned four (4) months. Participants were eligible to participate if they had mild to moderate disability (≤ 3 on Modified Rankin Scale); no cognitive ($\geq 24/30$ on Mini Mental State Examination) and/or no visual field or visual acuity impairments. Ethical approval was obtained from the appropriate institutional health research ethics committee. All participants gave informed consents.

A content-validated, structured questionnaire was used to obtain socio-demographic and clinical information of the participants. Relevant information on driving history and current driving status was also elicited using the same questionnaire. Motor function of participants was assessed using the Modified Motor Assessment Scale (MMAS). The MMAS [26] is an-item scale for assessing motor recovery after stroke. It is a performance-based scale scored on a 7-point Likert scale from 0-6. The quality and/or speed of performance of tasks were assessed based on the criteria for scoring each task. Obtainable scores ranged from zero to a maximum of 48. Community reintegration was assessed using the Return to Normal Living Index (RNLI). The RNLI [27] comprises 11 declarative statements graded on a visual scale from zero (does not describe my situation) to 10 (fully describes my situation). Obtained scores were subsequently transformed into percent scores. Higher scores denote better reintegration into the community. The Health Related Quality of Life in Stroke Patients (HRQOLISP-40)

was used to assess the Quality of Life (QoL). The HRQLISP-40 [28] is a 40-item disease-specific measure of quality of life after a stroke. It assesses QoL in 5 domains. Higher scores indicate better QoL. All outcomes were administered by one of the researchers (NKO).

Data analysis

Data were summarised using descriptive statistics. Mann Whitney U test was used to examine the differences in motor function, community reintegration and QoL among stroke survivors who had returned to driving (returners) and those who had not (non-returners). Chi-square test was used to investigate the association between selected socio-demographic (sex, occupation, educational status, marital status), clinical variables (side of affectation and limb dominance), and each of motor function, community reintegration and quality of life among the returners. Level of significance was set at $p < 0.05$.

Results

Forty-four stroke survivors (37 males, 7 females) participated in this survey. The mean age of the participants was 56.3 ± 8.9 years (range = 39-75 years). The time since stroke onset was 23.55 ± 35.80 weeks (12-228 weeks) while years of driving experience before stroke onset was 20.05 ± 14.24 years (2-50 years). The socio-demographic and clinical characteristics of the participants are as presented in table 1.

About a third of the stroke survivors (34.1%) had returned to driving after stroke. There was no significant difference in the age of returners and non-returners ($p = 0.19$). However, returners were younger (53.80 ± 7.30 years) than non-returners (57.52 ± 9.52 years). Returners were mostly males (93.3%), had tertiary education (86.7%) and all were married ($n = 15$). There was no significant difference in years

of driving experience prior to stroke onset ($p = 0.90$) and time since stroke onset ($p = 0.97$) between returners and non-returners. Returners had significantly higher motor function score, community

Table 1: Demographic and Clinical Characteristics of the Participants (N=44)

Characteristics	Frequency (n)	(%)
<i>Gender</i>		
Male	37	84.1
Female	7	15.5
<i>Occupation</i>		
Highly skilled	22	50
Artisan/ Self employed	7	15.9
Business/ Semi skilled	6	13.6
Unemployed	2	4.5
Retired	7	15.9
<i>Marital status</i>		
Single	2	4.5
Married	37	84.1
Divorced	3	6.8
Widowed	2	4.5
<i>Level of Education</i>		
None	1	2.3
Primary	3	6.8
Secondary	9	20.5
Tertiary	31	70.5
<i>Limb Dominance</i>		
Right	39	88.6
Left	5	11.4
<i>Side of Affectation</i>		
Right	26	59.1
Left	18	40.9
<i>Return to Driving</i>		
Yes	15	34.1
No	29	65.9
Mean Age (years)	56.3 ± 8.9	

reintegration score and health-related quality of life score ($p < 0.01$) than the non-returners (Table 2).

Table 2: Comparison of age, motor function, community reintegration and HRQOL between returners and non-returners

	Returners (n=15)	Non-Returners (n= 29)	U- value	P-value
	Mean rank	Mean rank		
Age (years)	19.17	24.22	167.50	0.22
Motor Function	31.90	17.64	76.50	0.01*
Community Reintegration	34.83	16.12	32.50	0.01*
HRQOL	32.53	17.31	67.00	0.01*

*significant at $p < 0.05$

Keys

HRQOL= Health related quality of life

There was no significant association between return to driving and each of sex and level of education among returners ($p>0.05$). Return to driving was not associated with side of brain lesion, although majority of returners (60.0%) had right hemispheric stroke

Perrier *et al* [30]; Tan *et al* [31] and Yu *et al* [32]. These authors reported an association between younger age and return to driving among stroke survivors with pre-stroke driving history. All the participants who returned to driving in this study were males. This is in line with the report of McNamara *et al* [33] that male stroke survivors tend to return to driving more than their female

Table 3: Association between return to driving and socio-demographics and selected clinical variables of participants

	Returned to driving Frequency	%	χ^2	P-value
<i>Sex</i>				
Male	14	93.33	1.453	0.23
Female	1	6.67		
<i>Occupation</i>				
Highly Skilled	10	66.67		
Artisan/ self employed	2	13.33		
Business/ Semi skilled	3	20.00	6.69	0.15
Unemployed	0	0.00		
Retired	0	0.00		
<i>Marital status</i>				
Single	0	0.00		
Married	15	100.00	4.306	0.23
Divorced	0	0.00		
Widowed	0	0.00		
<i>Level of Education</i>				
None	0	0.00		
Primary	2	13.33	7.438	0.06
Secondary	0	0.00		
Tertiary	13	86.67		
<i>Limb Dominance</i>				
Right	13	13.33	0.88	0.77
Left	2	86.67		
<i>Side of Affectation</i>				
Right	6	40.00	3.431	0.06
Left	9	60.00		

Discussion

Of the forty-four participants in this survey, only about a-third (34.1%) had returned to driving after their stroke events. This is consistent with findings from earlier studies that reported the rates of return to driving after a stroke as ranging between 30% and 66% [13,17,29-30]. Participants who returned to driving were comparable to those who did not return to driving in age, sex and marital status. Previous studies had similarly reported no difference in sex and marital status between stroke survivors who returned and those who did not return to driving after a stroke [8,15,29]. Nonetheless, participants who returned to driving were younger than those who did not. This finding is comparable to the reports of

counterparts. This could be because of the social role expected of males. In this community, male gender is associated with provision for family needs and activities such as driving. Expectations from family members could compel male stroke survivors to return to driving earlier than their female counterparts in order to satisfy the societal role expectations. It could also be that males might have better initial post stroke clinical status than their female counterparts, which made it easier for them to recover motor function and return to driving after a stroke event. Their initial post stroke clinical functions were however not assessed in this study.

Side of brain lesion was not significantly associated with return to driving. However, more

individuals with right hemispheric stroke returned to driving than those with left hemispheric stroke in a ratio of 3:2. This could be because the Nigeria rule of road permits right-hand traffic with a resultant left-hand drive. This may have given an advantage to individuals with left hemiparesis and right limb dominance. These individuals probably found it easier returning to driving given the location of the gear system and pedals, which are on the right side of the driver's sitting position. However, the long term effect may be detrimental considering that patients with right hemispheric strokes are more prone to hemispatial neglect than their counterparts with left hemispheric stroke [34].

Participants who had returned to driving (returners) had better motor function than those who had not. This affirms the importance of motor function as a major contributor to return to driving after stroke. It could be that only participants with minimal impairments at stroke onset or those who recorded improvement in motor function over time were able to return to driving. Driving is a functional task which requires a certain level of motor function to execute. Motor function has been adjudged a key component and predictor of driving after stroke [17,19,23,30]. Evidence suggests that stroke survivors with cognitive impairments coupled with low motor function of the lower extremity are less likely to be able to return to driving after stroke [17]. It is also possible that driving in itself as a task has led to improvement in motor function in returners.

Stroke survivors who had returned to driving (returners), recorded better community reintegration than those who had not returned to driving. This is in congruence with the findings of Finestone *et al* [15]. Finestone *et al* [15] reported a significant difference in community reintegration between stroke survivors who had returned to driving and those who had not. Their study showed community reintegration score of those who had returned to driving to be almost twice that of those who had not returned, which is comparable with the finding from this study. Driving status has significant influence on community reintegration after stroke [35]. The improvement in community reintegration of the participants could also be due to their improved motor function which had been reported to enhance community reintegration after stroke by Olaleye *et al* [36].

Our findings showed that community-dwelling stroke survivors who had returned to driving had better quality of life compared to those who had not. Factors that independently affect quality of life among stroke survivors have been

reportedly shown to be improved by driving. For instance, depression and dependence in ADL have been widely associated with poor quality of life post stroke [37-39]. Driving decreases depression and reduces the sense of immobility associated with stroke [13,14]. Driving a car implies mobility, independence and freedom for a stroke patient [22,23] and therefore would be an important contributor to quality of life after stroke [35]. In addition, a significant association has been found between driving and community reintegration in stroke patients [15]. The stroke survivors in this study who had returned to driving had better motor function and community reintegration and this could have positively impacted their quality of life.

This study is the first to compare motor function, community reintegration and quality of life in stroke survivors with pre-stroke driving history in our community. However, non-probing of the immediate post-stroke clinical parameters such as extent of the lesion is an important limitation to the findings of this study. The outcome of the study should also be interpreted with caution because of the small sample size.

Conclusion

Stroke survivors with pre-stroke driving who returned to driving (returners) after stroke had better motor function, community reintegration and quality of life compared to their counterparts who had not returned to driving (non-returners). The better motor function observed in stroke survivors who returned to driving suggests that motor function either plays a role in return to driving or is possibly improved by it. The findings of this study further affirm return to driving as an indicator or part of attributes of community reintegration and improve quality of life after stroke.

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