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Disability to Admit as a Change of Life after a Road Crash: Estimates and Related Factors in Benin for Prevention

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Abstract

Background: Disability is an underestimated issue in public health, with road crashes as leading cause. In Africa, motorcyclists disproportionately bear the burden of road crash injuries, including disability. To contribute to decision-making for disability prevention, this study aims to determine the prevalence and factors associated with disability at 12 months among motorcyclists involved in road crashes in Benin. **Methods:** This is a prospective, cross-sectional, analytical study based on 12-month follow-up data from a cohort of road crash victims set up in five hospitals in Benin. Data were collected from November 2020 to January 2021. Sample used for this analysis size was 297 motorcyclists. Disability was assessed using the Washington Group on Disabilities Statistics question set. Logistic regression analysis was used to identify risk factors for disability in victims 12 months after the crash. **Results:** The prevalence of disability was 12.5% 95% CI (9.2 - 16.7). Disability occurrence was associated with being over 45 years old (OR = 3.1; 95% CI = 1.5 - 6.6), severity of initial injury (OR = 3.3; 95% CI = 1.5 - 7.3) and hospitalisation of the victim (OR = 6.9; 95% CI = 2.0 - 24). **Conclusion:** Age over 45 years, severity of initial injuries and hospitalisation of the victim were risk factors for the occurrence of disability among motorcyclists who were victims of road crashes in Benin. User awareness, law enforcement, holistic and early management of road crash victims could contribute to reducing the prevalence of disability among victims in Benin.

Keywords

Disability, Motorcyclists, Road Traffic Accident

1. Introduction

Disability has become an important issue in health care, but still insufficiently considered in public policies. According to the World Health Organization (WHO), disability is not linked to the individual but results from the interaction between a health problem and personal and environmental factors. It can be experienced very differently by each individual and therefore reflects an individual perception of capabilities [1] [2]. People with disabilities are exposed to social inequality and disability has a direct impact on development as it can increase the risk of poverty [2]. This requires targeted interventions to meet their specific needs, which may include disabled seating on public transport, access to public buildings, disabled-friendly pavements and traffic lights. Road crashes are one of the leading causes of injury and years of life lost due to disability worldwide and in sub-Saharan Africa [3]. Disability prevalence is estimated to be around 16% of the world's population [1] and related factors commonly identified for post-crash disabilities are factors such as age, sex, injury severity, injury location, and referral conditions [4] [5] [6] [7] [8]. In Africa, motorbikes are more exposed to crashes (28% of road crash deaths worldwide), due to their vulnerability and their importance in the transport and in the general population [9] [10] [11]. They represent about more 75% of road crashes victims in hospital in Benin [12]. Research on the disability consequences of road crashes is relevant for complementing mortality and morbidity data or for developing road safety policies. It is also useful for planning rehabilitation needs and monitoring the Sustainable Development Goals (SDGs) at the country level [13]. An estimation of the prevalence of disability and the identification of its related factors could help to have a better understanding of the specific needs of motorcyclists and contribute to the development of a better road safety policy. Therefore, this study aims to provide data on disabilities resulting from road traffic crashes by estimating its prevalence and associated factors 12 months after the crash among road traffic victims in Benin.

2. Materials and Methods

2.1. Setting and Type of Study

This is a cross-sectional study with an analytical focus, involving road crashes motorcyclists victims from a cohort set up in five hospitals in Benin in 2019 and followed up until 2021.

2.2. Data Source and Participants Selection

The TraumAR cohort was set up as part of the Multidisciplinary Research

Project for the Prevention of Road Traffic crashes (ReMPARt) in Benin [12]. Initial collection took place from July 2019 to January 2020 in five referral hospitals for the management of road traffic injuries in Benin. They were selected based on their annual number of admissions for road crashes and their status as referral centres for several other health facilities in the health system.

After the baseline collection, two other data collections were conducted to complete the follow-up data of the TraumAR cohort. The baseline collection was led from July 2019 to January 2020 and consisted in a questionnaire directly addressed to inpatients. This was followed by exploitation of their medical records. The collection of the 6-month follow-up was carried out by questionnaire administered via a phone call interview and took place from May to June 2020. It collected data on the short-term consequences of the crash. The second follow-up point took place approximately 12 months after the crash, from November 2020 to January 2021. All eligible subjects (alive at the time of collection, giving consent for follow-up, residing in the southern zone of Benin) received a clinical examination and face-to-face administration of various specific tools related to the evaluation of health status: 1) physical or functional (disability, pain, health status), 2) psychological (anxiety, depression, post-traumatic stress disorder). Quality of life, return to work and the negative impact of the crash on income and family were also assessed. The present study considers baseline and 12-month follow-up data including disability assessment data.

The population was represented by the motorcyclists involved in crashes in the TraumAR cohort followed at 12 months. Inclusion criteria for this study were: consent for 12-month follow-up in the cohort, availability of all information on the variables studied, and being at least 18 years of age. The sampling was exhaustive with a sample size of 297 motorcyclists.

2.3. Disability Assessment Tools and Study Variables

Variables were collected at baseline and 12-month follow-up by trained interviewers through structured interviews using pre-tested questionnaires.

The dependent variable was disability by road crash dichotomized into two modalities "yes and no". It was assessed using the short tool of the Washington Group on Disabilities Statistics [14]. This tool is based on the WHO's International Classification of Functioning, Disability and Health Status (ICF) and is the result of a process validated by scientists, clinicians and people with disabilities. It considers the interactions between the person with a disability and the effect of their interactions with their environment. Hence, emphasis is placed on the patient's own subjective perception of his or her ability to do or to not do.

It explores the following six impairment areas through the following questions [14]:

1) Vision: "Do you have difficulty seeing, even if you wear glasses?"

2) Hearing: "Do you have difficulty hearing, even if you use a hearing aid?"

3) Mobility: "Do you have difficulty walking or climbing stairs?"

4) Memory: "Do you have difficulty remembering or concentrating?"

5) Personal care: "Do you have any difficulties taking care of yourself (for example) washing, dressing?"

6) Communication: "Using your usual (native) language, do you have any difficulties in communicating, e.g. in understanding or making yourself understood?"

The possible answers are presented on a scale of 1 to 4, according to the level of difficulty for each item:

1 = No difficulty,

2 = Yes—some difficulty,

3 = Yes—a lot of difficulty,

4 = Impossible to do at all.

A victim is diagnosed with a disability if he or she answers "Yes—a lot of difficulty" or "Cannot do it at all" to any of the 6 questions in the tool.

The independent variables were: 1) socio-demographic factors and history: age, gender, marital status, Chronic disease history, road crash history; 2) behavioural factors: helmet use, fatigue/drowsiness during the crash, use of psychoactive substances (doping drugs, use of sleeping pills, alcohol use, tobacco use), speeding during the crash and distraction during the crash; 3) clinical factors: injury severity, injury location (head/neck, upper limb, thorax/abdomen, lower limb) and hospitalization; 4) road features and crash circumstances: type of road (national interstate road, rural track, national road, alley), pavement condition (good, poor, under construction), visibility (acceptable, good, poor), time of day (00 - 06 h, 07 - 19 h, 20 - 24 h), reason for travel (private, work related), 5) referral and care conditions: means (ambulance, motorbike, private vehicle), referral time (less than one hour, more than one hour), health worker status (surgeon, general practitioner, medical student, nurse). Hospitalization is defined as the victim's stay in hospital for at least 24 hours. Injury severity was assessed with AIS scale with M-AIS equal or above 3 defining severe injury [15]. The psychoactive substance use was self-reported with questions related to recent consumption prior the crash. Questions were adapted from Alcohol, Smoking and Substance Involvement Screening (ASSIST) Test tool of WHO [16].

2.4. Data Processing and Analysis

The data were processed and analyzed using Stata 15 software. Categorical variables were presented using absolute and relative frequencies. Comparison of proportions was performed using chi-square and Fisher tests. Logistic regression analysis was used. A difference was considered statistically significant at a p-value ≤ 0.05. Risk factors for disability in motorcyclists, 12 months after the crash were assessed by deriving Odds Ratios (OR) followed by their 95% confidence intervals (95% CI). In the simple logistic regression analysis, each covariate was examined for inclusion in the multiple regression model based on a threshold $p < 0.2$. The multiple regression used a top-down stepwise strategy. Variables with a p-value greater than 0.05 were gradually removed from the

model. The final results were presented as the adjusted Odd Ratio (ORa) followed by the 95% confidence interval. The collinearity test was performed. Similarly, the Hosmer-Lemeshow goodness-of-fit and final model specification tests were performed.

2.5. Ethical Statement

The study protocol was validated by the ethical committee of the University of Parakou under number 0182/CLERB-UP/P/SP/R/SA. Only patients who gave a written consent were included in the study. Victims were free to withdraw their participation at any time and were therefore removed from the study without prejudice. A briefing note providing additional information about the study was given to each participant. Authorizations for data collection were signed by the heads of the centers participating in the study.

3. Results

3.1. Prevalence of Disability

Among this sample of 297 motorcyclists followed-up at 12 months, the prevalence of disability was 12.5% 95% CI (9.2 - 16.7). The most common types of disability were walking difficulties (76%), memory difficulties (43%) and self-care difficulties (30%).

3.2. Descriptive Statistics

As far as socio demographic features are concerned, the motorcyclists followed up at 12 months were aged between 30 and 44 years (44.8%), mostly male (91.2%), married or engaged (83.2%). On behavioral aspects, most of motorcyclists declared wearing a helmet (90.9%), 11.8% were under the influence of fatigue/drowsiness during the crash. Speeding was self-reported by 13.1% of the victims and 14.8% declared that they were distracted at the time of the crash.

The injuries were severe in 16.2% of cases. More than half of the motorcyclists got injuries to their lower limbs (56.6%). For road features and crash circumstances, crashes occurred mostly on alleys (67.3%) followed by crashes on national roads (17.2%). The daytime between 07:00 and 19:00 recorded more crashes than the rest of the day (61.3%). These road crashes often occurred in good visibility conditions (72.7%) and on roads in good pavement condition (83.5%). The ambulance was the most common means of referral for victims (40.1%), with hospital admissions often taking more than one hour (72.7%).

3.3. Factors Associated to Disability

In univariate analysis, using simple logistic regression, Table 1 shows that the risk of disability at 12 months was higher in subjects over 45 years of age compared to subjects aged 18 - 44 years (OR: 4.1; 95% CI: 1.4 - 11.4; $p = 0.003$). The risk of disability occurrence was also higher in severely injured (OR: 4.7; 95% CI: 2.2 - 9.9; $p < 0.001$) or hospitalized (OR: 8.6; 95% CI: 2.6 - 28.6; $p < 0.001$) patients

compared to non-severely injured and non-hospitalized patients respectively. Similarly, Table 2 shows that compared to crashes on alleys, motorcyclists had a

Table 1. Univariate analysis for disability at 12 months among motorcyclists involved in road crashes in the TraumAR cohort, n = 297.

Variables	n (%)	Disability (N = 37) n (%)	Crude OR	95% CI	p-value
Socio-demographic factors					
Age (years)					0.003
18 - 29	75 (25.2)	05 (6.7)	1		
30 - 44	133 (44.8)	16 (9.0)	1.4	0.5 - 4.1	
45 years and more	89 (30.0)	20 (22.5)	4.1	1.4 - 11.4	
Gender					0.441
Male	271 (91.2)	35 (12.9)	1.8	0.4 - 7.9	
Female	26 (8.8)	02 (7.7)	1		
Marital status					0.295
Single	50 (16.8)	04 (8.00)	1		
Married or engaged	247 (83.2)	33 (13.36)	1.8	0.6 - 5.3	
History of chronic disease					0.280
Yes	69 (23.2)	06 (8.7)	0.6	0.2 - 1.5	
No	228 (71.8)	31 (13.6)	1		
History of road crash					0.394
Yes	107 (36.0)	11 (10.3)	0.7	0.3 - 1.5	
No	190 (64.0)	26 (13.7)	1		
Behavioural factors					
Helmet use					0.697
Yes	270 (90.9)	33 (12.2)	0.8	0.3 - 2.5	
No	27 (9.1)	04 (14.8)	1		
Fatigue/drowsiness					0.150
Yes	35 (11.8)	07 (20.0)	1.9	0.8 - 4.8	
No	262 (88.2)	30 (11.5)	1		
Use of doping drugs					0.196
Yes	18 (6.1)	04 (22.2)	2.1	0.7 - 6.9	
No	279 (93.9)	33 (11.8)	1		
Use of sleeping pills					
Yes	12 (4.0)	01 (8.3)	0.6	0.1 - 5.0	0.659
No	285 (96.0)	36 (12.6)	1		
Alcohol use					0.367

Continued

Yes	223 (75.1)	30 (13.5)	1.5	0.6 - 3.6	
No	74 (24.9)	07 (9.5)	1		
Tobacco use					0.575
Yes	25 (8.4)	04 (16.0)	1.4	0.4 - 4.3	
No	272 (91.6)	33 (12.1)	1		
Speeding during the crash					0.334
Yes	39 (13.1)	03 (7.7)	0.5	0.2 - 1.9	
No	258 (86.9)	34 (13.2)	1		
Distraction during the crash					0.812
Yes	44 (14.8)	05 (11.4)	0.9	0.3 - 2.4	
No	253 (85.2)	32 (12.7)	1		

Table 2. Univariate analysis for disability at 12 months among motorcyclists involved in road crashes in the TraumAR cohort, n = 297.

Variables	n (%)	Disability (N = 37) n (%)	Crude OR	95% CI	p-value
Clinical factors					
Injury severity					<0.001
Yes	48 (16.2)	15 (31.3)	4.7	2.2 - 9.9	
No	249 (83.8)	22 (8.8)	1		
Injury location					0.226
Head/neck	68 (22.9)	06 (8.8)	1		
Upper limb	57 (19.2)	04 (7.0)	0.8	0.2 - 2.9	
Thorax/abdomen	4 (1.3)	01 (25.0)	3.4	0.3 - 38.5	
Lower limb	168 (56.6)	26 (15.5)	1.9	0.7 - 4.8	
Hospitalization					<0.001
Yes	182 (61.3)	34 (18.7)	8.6	2.6 - 28.6	
No	115 (38.7)	03 (2.6)	1		
Road features and crash circumstances					
Type of road					0.009
National interstate road	34 (11.5)	08 (23.5)	3.5	1.4 - 9.1	
Rural track	12 (4.0)	02 (16.7)	2.3	0.5 - 11.4	
National road	51 (17.2)	11 (21.6)	3.2	1.4 - 7.2	
Alley	200 (67.3)	16 (8.0)	1		
Pavement condition					0.529
Good	248 (83.5)	33 (13.1)	2.0	0.6 - 6.8	
Poor	42 (14.1)	03 (7.1)	1		

Continued

Under construction	7 (2.4)	01 (14.3)	2.2	0.2 - 24.4	
Visibility					0.300
Acceptable	39 (13.1)	07 (18.0)	1.1	0.3 - 3.5	
Good	216 (72.7)	23 (10.7)	0.6	0.2 - 1.5	
Poor		42 (14.2)	07 (18.0)	1	
Time of day					
00 - 06 h	26 (8.7)	04 (15.4)	1		0.806
07 - 19 h	182 (61.3)	21 (11.5)	0.7	0.2 - 2.3	
20 - 24 h	89 (30.0)	12 (13.5)	0.9	0.3 - 2.9	
Reason for travel					0.458
Private	176 (59.3)	24 (13.6)	1		
Work related	121 (40.7)	13 (10.7)	0.8	0.4 - 1.6	
Referral and care conditions					
Referral means					0.001
Ambulance	119 (40.1)	25 (21.0)	5.5	2.0 - 14.9	
Motorbike	108 (36.3)	05 (4.6)	1		
Private vehicle	70 (23.6)	07 (10.0)	2.3	0.7 - 7.5	
Referral time					0.251
Less than one hour	81 (27.3)	13 (16.1)	1		
More than one hour	216 (72.7)	24 (11.1)	0.7	0.3 - 1.4	
Health worker status					0.599
Surgeon	66 (22.2)	05 (7.6)	1		
General practitioner	92 (31.0)	13 (14.1)	2.0	0.7 - 5.9	
Medical student	21 (7.1)	03 (14.3)	2.0	0.4 - 9.3	
Nurse	118 (39.7)	16 (13.6)	1.9	0.7 - 5.5	

higher risk of disability at 12 months in crashes on national interstate road (OR: 3.5; 95% CI: 1.4 - 9.1; p = 0.009) or national roads (OR: 3.2; 95% CI: 1.4 - 7.2; p = 0.009). In addition, victims referred by ambulance were more likely to develop a disability than those referred by motorbike (OR: 5.5; 95% CI: 2.0 - 14.9; p = 0.001).

In the final model, by multiple logistic regression, adjusted for other variables, age over 45 years (OR: 3.3; 95% CI: 1.1 - 9.9; p = 0.029), severity of initial injury (OR: 3.2; 95% CI: 1.5 - 7.2; p = 0.004) and victim hospitalization (OR: 6.9; 95% CI: 2.0 - 24.0; p = 0.002) were the risk factors for the occurrence of disability 12 months after the crash among motorcyclists of the cohort (Table 3).

The Hosmer-Lemeshow goodness-of-fit test and the specification test performed show that the final model is adequate and specific. Moreover, there is no

Table 3. Risk factors for disability at 12 months among motorcyclists involved in road crashes in the TraumAR cohort: final model.

Variables	Adjusted OR	95% CI	p-value
Age (years)			0.029
18 - 29	1		
30 - 44	1.0	0.3 - 3.2	
45 years and more	3.3	1.1 - 9.9	
Injury severity			0.004
No	1		
Yes	3.2	1.5 - 7.2	
Hospitalization			0.002
No	1		
Yes	6.9	2.0 - 24.0	

collinearity between the variables studied.

4. Discussion

Our study suggests that active male adults are more exposed to disabilities resulting from road traffic crashes. This profile is consistent with the common profile of most literature review studies, regardless of the context [7] [17] [18] [19] [20] [21]. This predominance of young males among road crash victims can be explained in Beninese settings by the fact that these young men (more than women or older people) engage in activities that require a lot of travel with most of the time risky behaviors such as speeding, non-compliance with traffic regulations, use of psychoactive substances and other driving habits that are more risky in traffic (passing between several vehicles, risky overtaking, aggressive driving in search of thrills). The assumption, entirely plausible in the Beninese context, is confirmed by recent work in China, in which male drivers were found to be more likely to take extreme risks while driving, explaining their preponderance among the victims [22]. Setting up policies to prevent accidents and consequently post-accident disability must therefore integrate this profile as being particularly high-risk and more vulnerable to the phenomenon.

The prevalence of disability in the present study was 12.5%. The main types of disability observed were walking difficulties (75%), memory difficulties (43%) and body care difficulties (30%). Regarding disability prevalence, there are very large variations depending on the context (close to 15% in Africa, around 30 - 50% Iran and Brazil) and the comparison remains difficult and not necessarily relevant [4] [19] [23] [24] [25] [26]. Indeed, integrating differences between contexts, used assessment tools, patient's specific clinical profiles, follow-up times, defining outcomes, and data sources as well as evaluation times makes it difficult to have proper objective comparisons [25] [26]. For example, regarding

assessment tools, the United Nations Washington Group on Disability Statistics questionnaire used in this study is internationally recommended for the assessment of disability in general. It explores the main types of disability according to the recommendations of the International Classification of Disability, Functioning and Health (ICF), taking into account the interaction of disabled people with their environments by proposing an exploration on the six (06) functions with a self-report of the patient. This self-reporting which remains for its part subjective can be discussed, as well as the definition of the six functions or the levels of scale used and these reservations justify the exploration through other tools like the WHODAS, developed by WHO [27], or Barthel Index, which is a 10-item tool that assesses disability on a scale of 0 to 20 [28]. Furthermore, the results of the studies could differ according to the data sources as in population studies offers precise data [24] and that hospital surveys suffer from selection bias and may be an issue for representativeness. Thus, according to what is recommended, it is necessary to standardize methodological approaches and tools [26].

As far as type of disability is concerned, the disability is more related to mobility with a focus on walking difficulties (76%) in this study and likewise in reviews [8] [29]. Lower body injuries are the most common, and some authors have established a greater risk of disability in patients with lower extremity injuries [27]. Also, when motor function is affected, the person is more reliant on others than on other functions. The self-reporting of the tool might influence the diagnosis.

Age was the first associated factor with disability plausible due to the great fragility of older peoples. They got a longer recovery process than younger people who have more resistant bodies. Our findings fit those of the literature review [4] [8] [24].

No other socio-demographic variables were associated with the risk of disability in this study whereas sex was linked in other studies [4], as well as the level of education and incomes [6] [8]. Variations in populations, sampling and the availability of some variables that have not been studied account for the differences. On the one hand, wider-scale explorations are necessary to better investigate the problem, but the need for standardization of approaches recommended by some authors is confirmed here [26].

In this study, the severity of the initial injury and the hospitalization of the patient were also factors that influenced the occurrence of disability as logical consequences. Similar findings have been made in studies where the length of hospital stay and injury severity were risk factors for post-crash disability [5] [27] [28] [29] at 6 and 12 months after a road crash. This result also explains the other paradoxal findings related to the fact that ambulance transport to the hospital was significantly associated with disability. Although this variable is not significant in the final model, it can be explained regarding the fact that most serious injuries are transported by ambulance, which usually takes a long time to reach the site of the accident. The quality of pre-hospital care on site can help reduce

the initial severity of the injuries (whose evaluation, recall, is done in the context of the first reception and management structure) and probably the length of hospitalization. In fact, improving the quality of pre-hospital care is a relevant and potentially effective area of intervention to be considered in implementing strategies to prevent disabilities after road crashes [19].

Besides, due to the link with technological evolution and the impacts on individual and family life with significant socio-economic consequences, disability is thus a problem of public health for which, a better knowledge of the extent and the identification of the associated factors will allow to better target the most relevant interventions.

This study has some limitations due to the restriction of the 12-month follow-up to patients living in the south of the country. The health barrier put in place during the pandemic period at COVID-19 did not allow for the inclusion of all initial collection sites, some of which were located in the northern part of the country. However, this did not significantly influence the quality of the data as few patients were recruited in hospitals in this area. In order to limit the number of missing data, eligible victims were sufficiently reassured about the measures taken to prevent contamination by COVID-19 in the collection hospitals. This may have improved the adherence of victims. In addition, they were informed that the data collected is not part of any legal proceedings relating to their crash. Nevertheless, some behavioral or clinical variables could not be collected from certain victims, which explain the missing data. In addition, some bias could have been introduced into the study due to the likely false answers given by the victims for certain non-verifiable behavioral variables.

5. Conclusion

Age over 45 years, severity of initial injury and hospitalization of the victim were risk factors for the occurrence of disability in the motorcyclist victims. Campaigns against road crashes (awareness raising and enforcement of the road safety law), holistic and early management of seriously injured people over 45 years of age, could contribute to reducing the prevalence of disability among victims in Benin.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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