

ORIGINAL ARTICLE

COMPARISON OF COMPUTERIZED AND MANUAL RATING OF PERMANENT PHYSICAL DISABILITY FROM MUSCULOSKELETAL INJURY, BLACK-LION HOSPITAL, ETHIOPIA

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ABSTRACT

Introduction: Whole Person Disability (WPD) evaluation is a difficult task done finally after treatment of an injured person. To avoid subjectivity, to exercise transparency and to calculate quickly, computer software applications are of potential use. Rating calculations shall be well reproducible and reliable.

Objective:

This study aims at comparing Permanent Physical Disability Rating using the software developed and doing it manually to award percentage WPD to applicants with Musculoskeletal (MSK) injury.

Methods:

Prospective study of all MSK injured applicants of permanent whole person disability evaluation was performed in Black-Lion Hospital (TASH) from Sept 2017-Sept 2019. Evaluation of Permanent Physical disability from injury was done after the time of Maximum Medical Improvement (MMI). A questionnaire, request letters, board letters, software database, and the Hospital's charts were used to gather information. Analyses and statistical testes were done.

Results: Only a fifth of the applicants were female. Majority of applicants came from Addis Ababa (219, 54.75%). Peak age group affected was 20-29 years (151, 37.75%). Road Traffic Crushes (256, 64%) & falls (57, 14.25%) caused most of the injuries. Mostly, law enforcement personnel requested the evaluation (155, 38.75%). Most, (260, 65%) were TASH patients and 102 (25.5%) of applications came from Private Hospitals in the Capital. Lower limb was the most injured region (258, 49.2%). Occurrences of multi-injury and poly-trauma respectively were (85, 20.8%) & 20(5%). There was only fair agreement (71%) between the two rating methods with Cohen's Kappa K=0.217.

Conclusions: Software based computerized WPD rating is better than manual method.

Keywords: Permanent Physical Disability, MSK injury, %WPD, WPI, MMI, Computerized Rating

INTRODUCTION

In Ethiopia, according to WHO estimate, around 18% of the country's population has some disability. W.H.O also defines disability as any restriction of ability to perform an activity in the manner or within the range considered normal for a human-being. It is a gap between what a person can do and he needs to do. American Medical Association (AMA) defines Disability, as a condition that interferes with individual's activities of daily living. Calculated disability-percentages are used to estimate the degree to which an individual's capacity to carry out daily activities are diminished (1). Such calculation has to be done carefully, comprehensively and in a transparent scientific way.

The two models of disability are the Medical and the Social models; Concept of Impairment vs. Disability derives from what is often referred to as the Social Model of Disability.

The Social Model is in opposition with the Medical Model of disability. This view states that a physically impaired person becomes disabled as a result of the society (2). These days, issues related to disability are crucial Human Rights agenda. Women with disabilities are discriminated against on two grounds: gender and disability, and often they have less access to essential services such as health care, education and vocational rehabilitation (3).

Changes in lifestyle, urbanization and socioeconomic developments in recent decades have caused changes in disease and disability patterns due to rise in incidence of non-communicable disease and injury among the youth in developing countries (4, 5). Globally, injury has become a recognized health problem with a steadily increasing trend.

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According to WHO and World Bank projections, injury is likely to account for 20% of the disease burden on the world population by 2020, with road traffic accidents (RTA) alone being the third leading cause (6-11). Recent increases in injury are observed. This is mainly due to explosive increases in Industrialization, Urbanization and motorization in countries like ours (12-17). Pattern of musculoskeletal disability differ from place to place and from time to time. Promoting Research and Empowering patients to participate in their care and implementing cost-effective preventive measures to improve prevention and treatment of disease is a priority in any health system (18-20).

National Surveys are crucial to identify magnitude and pattern of different major causes of physical disability in a country: E.g. Injuries from traffic, construction, machines, chemicals radiation, natural disaster and conflicts. This helps to introduce planned interventions and gives an insight to policy makers. In Ethiopia, injury is a major health problem accounting for more than a quarter of all surgical admissions, deaths or disabilities (21-23). In the past decade, Sub Saharan Africa reported to have 42% increases in the road fatalities and road traffic accidents are the commonest causes of trauma in urban Ethiopia with 199 fatalities per 10,000 registered vehicles per year. Traffic injuries in Ethiopia account for the deaths of 37.28 persons per 100,000. This is 2.8% of the total deaths in the country, placing Ethiopia 12th in the world. (24-25).

One way to evaluate the final outcome of a treatment is to assess the remaining disability at the end of treatment. Hence, this study could additionally give an insight to the acceptability of the different MSK injury treatments offered to the WPD applicants when they were patients.

METHODS

Setting: This is prospective study, part of a multi thematic national project funded by Ethiopian Ministry of Innovation & Technology (MiNT). Addis Ababa University, College of Health Sciences, School of Medicine, Department of Orthopedics, Disability Rating Board, Black-Lion Hospital.

Participants: Applications for MSK permanent disability were received by our Hospital from all over Ethiopia. Most ratings are done at MMI, which is 1 year after injury and we included only those. The following were the other inclusion criteria: Every eligible applicant that came for routine permanent physical disability evaluation by the Orthopaedic board of TASH and awarded a written percentage WPD in the period Sept 2017-Sept 2019. .

After the manual rating was done on Thursday board meetings of 3-5 Orthopaedic consultant experienced in disability rating, computerized re-rating, using same injury variables and structures was done using the software developed by the project in the Department. Both percentages were recorded separately. Discrepancies were settled at board's discussion. We addressed only permanent physical MSK disability, other forms of disabilities like mental and sensory disability were not included.

Sampling: All applicants with awarded percentage WPD were taken. If percent is not given, they are not.

Measures: Data on socio-demographic variables, causes of injury, who requested the evaluation, anatomic region affected, and details of final percentage disability awarded was collected.

How do Orthopaedic boards perform permanent MSK disability rating? This is an experienced group of 3-5 highly senior Orthopaedic staff surgeons who have been rating physical disabilities for over three decades. The permanent whole person disability evaluation was done after the time of (Maximal Medical Improvement) MMI, which is after 12 Months post-surgery or post-injury. Referred applicants from all over the country were also evaluated. After clinical and imaging evaluation, manual rating was done and percentage WPD was given to the applicant in a printed, stamped formal letter. Every patient's percentage WPD was re-rated using a computer software developed by the project. Discrepancies and combined ratings in poly and multi-trauma were discussed with the board. Additional information was gathered directly from the consenting patients, board letters, request letters, software database, and the Hospital's charts as well.

The Disability Rating Computer Software: This is an Ethiopian Software developed by our project funded and inaugurated by Ministry of Innovation and Technology (M In T). It rates and awards percentage physical disability related to the lower limb (L.L) or the whole person (WPD). The software will soon be used nationally.

Ethical approval: Ethical clearance was secured from our College's IRB.

Statistical analysis: The data were collected using epidata version 3.1 and analyzed with SPSS version 12. Descriptive analysis and statistical agreement testes were done. A P-value of less than .05 at CI 95% was considered statistically significant.

RESULTS

Most applicants in this study were men (317, 79.25%). The age range was 1-82 years making age average 33 years. Patients came from all regions of Ethiopia, Addis Ababa- the capital contributing for more than half (219, 54.75 %). The other socio-demographic characteristics of the applicants are presented on **Table 1**. Treatment place for most (260, 65%) was Black-lion Hospital (TASH) and the remaining (140, 35%) WPD evaluation applications were filed for patients we never treated or followed at all. Of these, 102 (25.5%) of applications came from Private Hospitals in the Capital and the remaining requests came from other government & private Hospitals scattered all over Ethiopia.

Fig 1 shows only 8 (2%) requests were personal applications. The predominant (256, 64%) cause of Permanent physical MSK disability was Road Traffic Crash (RTC). **Figure-2** presents the remaining major causes of physical disability from injury we identified: Falls from height, construction or while walking (57, 14.25%); machine injuries (40, 10%), assaults with bullets, stone or stick (21, 5.25%) and injury from falling heavy object (18, 4.5%) were the major causes.

Table-2 depicts the Anatomical regions injured and the complexity as well. Most injuries (303, 74.2%) were isolated. Multiple injuries accounted for 85 (20.8%) of the applications and 20 (5%) applicants had poly-trauma. Eight poly-trauma claimants also had multiple injury. Lower extremity region remains the most injured region in WPD claimants (258, 49.2%) while upper limb was injured in (178, 34%) of applicants. Pelvis and Acetabulum injury was encountered in 48 (9.2%) of the assessments.

Figure-3 portrays the agreement in awarded WPD percentage using both rating methods: computerized and manual. Both methods agreed and awarded same percentage (within + 2% the WPD) in 284 (71%) of the evaluations. This is only a fair agreement with Cohen's Kappa statistical coefficient = 0.34. The Chi-square statistic is 4.79 with P-value .029. This difference between the two rating methods is statistically significant at $p < .05$.

Table 1: Socio-demographic characteristics of WPD evaluation applicants with MSK injury. Sept 2017 - Sept 2019, Black-lion Hospital (TASH), Ethiopia

Variable		Frequency (N=400)	Percentage (%)
Sex of patients	Male	317	79.25%
	Female	83	20.75
Age Categories of the Applicants	<10 Years	10	2.5%
	10-19	22	5.5
	20-29	151	37.75
	30-39	79	19.75
	40-49	67	16.75
	50-59	27	6.75
	60-69	15	3.75
	70-79	5	1.25
	>80 Years	1	0.25
	Addis Ababa	219	54.75%
Address: (Administrative Regions/Cities in Ethiopia)	Oromia	95	23.75
	Amhara	58	14.5
	SNNPR	15	3.75
	Tigray	5	1.25
	Afar	3	0.75
	Somali	1	0.25
	Dire Dawa	1	0.25
	Harari	1	0.25
	Benshangul-Gumiz	1	0.25
	Gambella	1	0.25

Table 2: Anatomical region & multiplicity of MSK injury in applicants of WPD evaluation and rating. Sept 2017 - Sept 2019, Black-lion Hospital (TASH), Ethiopia

Variable		Frequency	Percentage (%)
Multiplicity of Injury *(N=408)	Isolated Fracture	303	74.2%
	Multiple Fractures	85	20.8%
	Poly-Trauma	20	5%
Anatomical MSK region/s Injured (N=520 Regions)	Lower Limb	258	49.2%
	Upper Limb	13	34%
	Pelvis & Acetabulum	8	9.2%
	Shoulder Griddle	6	4.6%
	Spine	5	1.7%
	Rib Cage	4	1.3%

*N.B. Eight poly-trauma applicants also had multiple injuries.

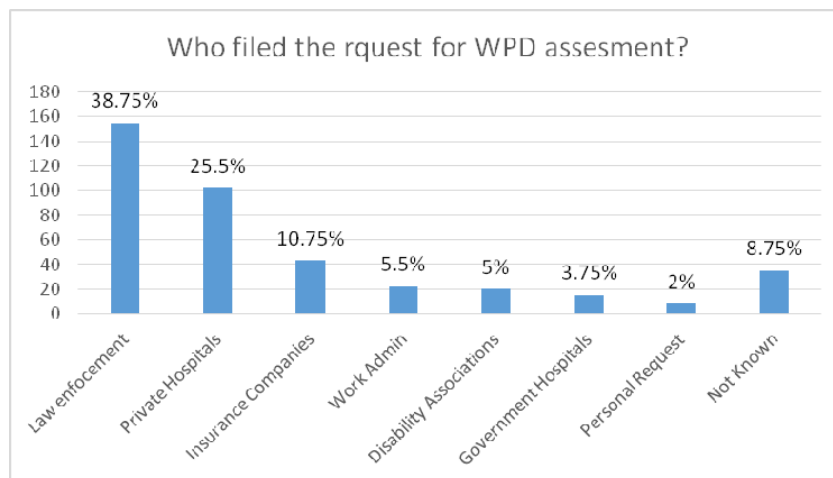


Figure 1: Distribution of who requested WPD evaluation of applicants with MSK injury. Sept 2017 - Sept 2019, Black-lion Hospital (TASH), Ethiopia

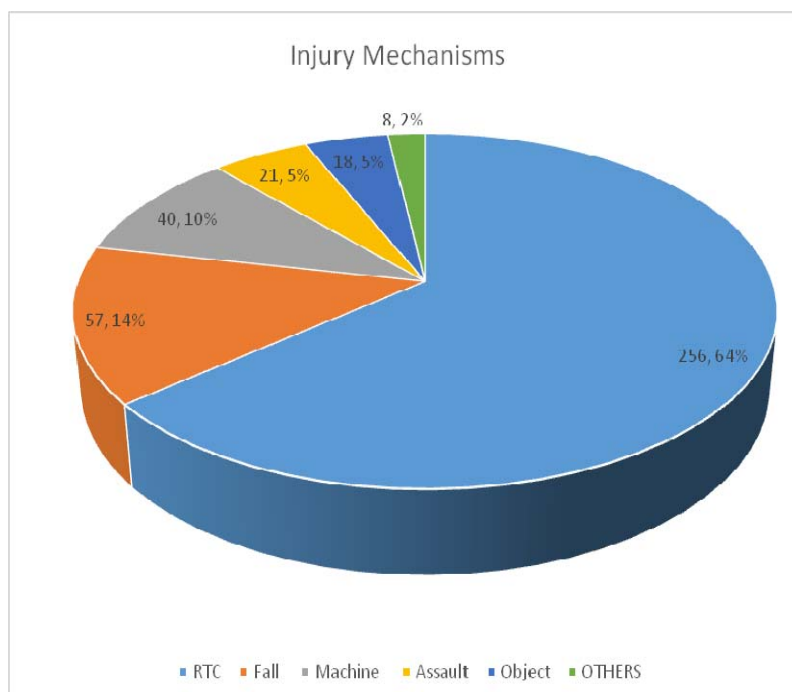


Figure 2: Distribution of causes of injury of applicants of WPD evaluation from MSK injury. Sept 2017 - Sept 2019, Black-lion Hospital (TASH), Ethiopia

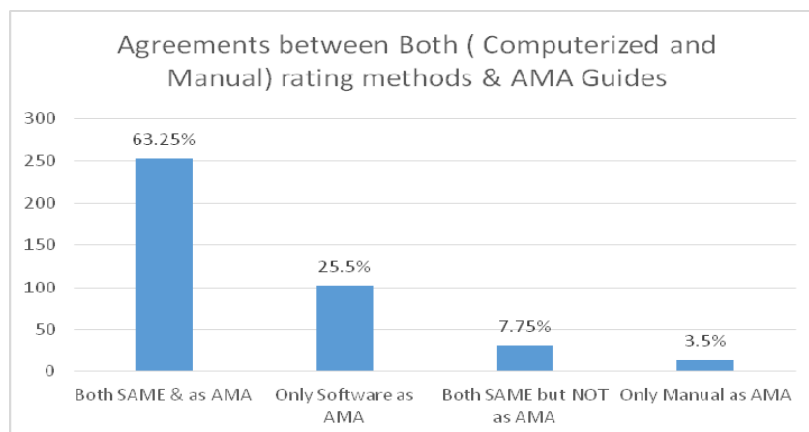


Figure 3: Agreements between WPD Percentages awarded for applicants of MSK injury rated using both manually and with the software developed and compared to American Medical Association (AMA) guides. Sept 2017 - Sept 2019, Black-lion Hospital (TASH), Ethiopia

DISCUSSION

Documented Permanent MSK WPD evaluation and rating in injured Ethiopian civilians started in 1988 (24). Until recently, the orthopaedic Department at AAU, CHS, SOM, in Black-lion Hospital was the only centre to do such impairment ratings in Ethiopia, receiving applications from all over the country.

Most applicants in this study were men (317, 79.25%) and this can be explained by the fact that higher number of males are injured by the main causes of injury in Ethiopia (26). Men may also have a better access to law enforcement and insurances. The age range was 1-82 years, showing us disability affects all age groups. The highly affected was a younger age group 20-29 years. Over 80% the affected applicants were from working age group revealing that the impact of disability on economically active group is enormous. This is similar to other studies where Road Traffic Crash (RTC) is disproportionally higher major cause of physical permanent disability (27, 28).

Applicants came from all regions of Ethiopia, Addis Ababa- the capital contributing for more than half (219, 54.75 %). This finding suggests that WPD evaluation and rating services have to be established in many Hospitals across Ethiopia. After proper training of the staff, such service can be started and could save time and money of the applicants travelling to the Capital from all corners of the country.

Higher body decision has to be made to authorize selected/specific Hospitals who could evaluate disability and award WPD. The developed software makes such practices much easier. It is better if the patient is evaluated for WPD in the Hospital where he/she was treated and all medical documents including imaging are available. Most of the referral documents are incomplete. In line of this, we also found that even though the treatment place for most (260, 65%) applicants was Black-lion Hospital (TASH),

the remaining (140, 35%) WPD evaluation applications were filed for patients we never treated or followed at all. Huge number of referrals! Of these, 102 (25.5%) of applications came from Private Hospitals in the Capital and the remaining requests came from other government & private Hospitals scattered all over Ethiopia. With proper training and authorization, all these Hospitals could be capable of physical disability rating in the injured. Only 8 (2%) requests were personal applications as such applications are discouraged. There has to be a reason and official request by a letter to award WPD. These written requests mainly come from law enforcement, insurance or work place administration.

The predominant (256, 64%) cause of permanent physical MSK disability was Road Traffic Crash (RTC). Like RTC, the other main causes of injury we saw were also preventable: Falls from height, construction or while walking (57, 14.25%); machine injuries (40, 10%), assaults with bullets, stone or stick (21, 5.25%) and injury from falling heavy object (18, 4.5%). This remained the same for many years in our Hospital (24). In Ethiopia, population survey showed that 73.4% of RTC victims spend from a week to half a year off their regular activities. (26)

Most injuries (303, 74.2%) were isolated major bone fractures. This could be explained by the fact that our Hospital is the highest tertiary referral Hospital in Ethiopia mainly receiving difficult injuries. Multiple injuries accounted for 85 (20.8%) of the applications and 20 (5%) applicants had poly-trauma. Eight poly-trauma claimants also had multiple injury. Lower extremity region remains the most injured region in WPD claimants (258, 49.2%) while upper limb was injured in (178, 34%) of applicants. Considering the fact that most applicants were RTC victims, this is consistent with other studies and international data (24, 29).

Pelvis and Acetabulum injury was encountered in 48 (9.2%) of the assessments. This proportion has increased from previous observations. The possible explanations could be due to the fact that heavy trucks in Ethiopia are leading to high-speed deeper bone (Like Pelvis-Acetabulum) fractures or it could be due to the fact that in recent years, in our Department pelvis & Acetabulum surgeries are performed routinely (30). The WPD percentages awarded for pelvic fractures are usually lesser percentages.

The agreement in awarded WPD percentage using both rating methods: computerized and manual. Both methods agreed and awarded same percentage (within + 2% the WPD) in 284 (71%) of the evaluations. This is only a fair agreement with Cohen's Kappa statistical coefficient = 0.34. The Chi-square statistic is 4.79 with P-value .029. This difference between the two rating methods is statistically significant at $p < .05$.

Conclusion

There was statistically significant difference between the computerized and manual WPD rating. The agreement between the two rating methods was only fair (71%).

The software based computerized rating we developed was quicker, transparent, objective, reliable, reproducible and better in agreement with international guides and standards.

Recommendation

The software developed is highly recommended for use in WPD rating and can be used all over Ethiopia.

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Competing interests

There are no any competing interests.

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