ORIGINAL ARITICLE

Developing a precise questionnaire to elucidate risk factors and injury pattern in RTA victims

Singh RK[1], Gupta K[2], Kumar A[3], Singh GK[4], Verma V[5], Srivastava RN[6]

[1&2] PhD Scholar, [3] Associate Professor, [6] Professor, Deptt of Orthopaedics, KGMU, Lucknow, [4] Director, AIIMS, Patna, Bihar, [5] Assistant Professor, Dept. of Trauma and Emergency, AIIMS, Patna, Bihar.

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Address for Correspondence: Ravi Kant Singh, PhD Scholar, Deptt. of Orthopaedics, KGMU, Lucknow
E Mail ID: ravi_singhh@yahoo.com

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Abstract

Introduction: Road traffic injuries are a growing public health issue. Despite good numbers of traffic legislations/ law/bye-laws/ regulations/ policies at the national/ state level and various safety measures to prevent road accidents/ mishaps, awareness remains comparatively low in India. Till date no questionnaire has been suitably developed, standardized and positivised for determining association of causality with injury pattern and severity score. **Objective:** To design and develop a précised survey questionnaire determining association of causality with injury pattern along with severity score in RTA victims. **Methodology:** Till date no such study has been ventured which has observed the inter relationship of these factors resulting in a specific injury. Designed questionnaire was based on literature review, and updated several times to ensure the precision and agreement with the help of institutional trauma expert team. As a pilot study, 30 RTA victims admitted in trauma centre of KG Medical University were enrolled and designed questionnaire was tested for easiness and doubts. The results were thoroughly analyzed for item difficulty, precision and internal consistency. **Results**: A significant agreement of question pertaining to speed (k=0.99, CI=0.95), visibility (k=0.87), alcohol (k=0.65) in the questionnaire. Questions related to environment, driver, vehicle and road factors show a significant consistency ($p>0.05$) as cause of accidents. Test of agreements done by Kappa showed in variables having value more than 0.60 except few variables. **Discussion:** The designed questionnaire is precise, reasonably reliable in perfect agreement. This questionnaire should emerge a useful tool in determining the association of risk factors with injury pattern and severity.

Key Words

Road Traffic Accidents (RTA); Road Traffic Injuries (RTI); Causality; Injury Pattern; Severity Score

Introduction

World Health Injury Chart Book in 2002 reported Road Traffic Injury (RTI) as the major cause of death (approx. 1.26 million people). 90% deaths related to RTI occurred in low and middle-income countries (including India), contains 85% of the world's population (1), (2). More than fifty percent are young adults (aged 15-44 years) of which males being three times more than females (3). In the year 2000, injuries due to RTI was the 10th leading cause which could get elevated to 3rd position for death and Disability Adjusted Life Years lost in 2020. (1), (2), (4)

In India an accident takes place every minute and death at every 8 minutes with significant variations in different states (5) consuming 1% & 2% of the GDP. (3) These accidents are due to carelessness, thoughtlessness & overconfidence. A study by Mr. William Haddon stated "road traffic accidents are related to numerous problems which are required to be addressed separately". (6) A national programme interlinked with well-co-ordinated injury response system for injury management spectrum is required. (7) India is the fastest developing country after China and excelling in fields like education, industrialization and fashion, but it lags behind in good quality infrastructure, transportation and services. Due to large population this problem still has not been efficiently addressed in totality. (7) A study by Supriya Satish Patil et al. stated that RTI in 2-wheelers occupants was highest. (8) India experiences mixed type of road traffic patterns. Same road space is used by modern cars and buses, along with locally designed vehicles for public transport, scooters & motorcycles, bicycles, rickshaws & animal and human draw carts. These infrastructures have failed to fulfil the mobility and safety needs of traffic. (9)

Lucknow is one of the oldest cities in India which has witnessed sudden unplanned/ sub-planned rise in population during last couple of years leading to obvious resistance in the smooth flow of traffic. A survey in 2008 predicted the population of Lucknow to get doubled in 2013 leading to traffic congestions. (7)

Identification of RTI causing factors is required for making policies for prevention and reduction of severe injuries in Lucknow. Till date literature lacks a precise questionnaire for identification of the various factors responsible for a particular type of injury.

This study intends to develop a precise questionnaire for identification of risk factors in the causality of injury, mechanism and types of injury and its association with severity of trauma for Lucknow and suggest measures to prevent/reduce accidents.

Aims and Objectives

The aim of the present study is to develop a precise questionnaire for collecting information on causality and injury pattern for correlating it with injury severity score. The questionnaire should be able to assess the level of injury pattern among trauma victims for determining the association of risk factors with injury pattern alongwith severity score for RTA victims.

Methods

Relying upon the empirical method of research, the development and evaluation of the questionnaire was conducted during 2010 to 2011. After the ethical and conceptual approval from the research cell of King George Medical University, development of the questionnaire was undertaken first in English and then translated in Hindi. This included participation of a trauma expert team having experience in RTI. Informed consent was obtained from all participants. Answers in Hindi were translated back into English in order to ensure user friendliness, for understanding the accuracy of the meaning and intent of the questions. The questionnaire was pilot tested.

The development of questionnaire consisted of **four conjunctive** steps:

Step 1: To summarise the structure and extent of questionnaire: Literature was reviewed for defining the questions related to assessing RTA and its causality, injury pattern and injury severity score. (3–23) Trauma expert meetings and telephonic interviews were undertaken to get in-depth information.

Information gathered was decided to be arranged into four main sections of the questionnaire assessing knowledge about: [1] socio-economic profile [2] pre- hospital care [3] causality of RTA; and [4] outcome of injury.

Step 2: Development and precision of questionnaire items: A questionnaire was developed containing 46 items. We covered all the essential aspects of causality and injury pattern related questions to ensure content. A study by Menon et al in 2010 captured the information based on a questionnaire which accounts for causality of injury, pre-hospital care and outcome of injury variables for defining the injury pattern. However, literature still lacks factors responsible for types and severity of injury. Environmental 20 vehicle 21 and driver 22 related factors are required to be summarized separately. Trauma scores (AIS and ISS) are available for co-relating with the risk factors. An updated questionnaire was designed with all possible questions related to risk factors.

To ensure precision and agreement, questionnaire comprising 46 items was evaluated and re-evaluated many times for accuracy, appropriateness, and relevance by an expert panel. Knowledge items were arranged into three main types of answering options: yes/no/not known, multiple choices, and more/less different. These items were then re-evaluated. Experts selected the items for adequate coverage of the knowledge area, interpretability of the causality listed, and structure of the different questionnaire sections. A biostatistician was consulted to improve structure and layout.

After the first revision of the questionnaire, expert panel added 9 items related to average speed of vehicle, driver's distraction, average weight of vehicle and pre-hospital care. The second draft contained 55 items. It was tested for user friendliness and item ambiguity in a pre-pilot study. Each item of the questionnaire was discussed verbally and noted. The pre-pilot led to modification in the scaling of speed, angle of impact and addition of few items related to environmental 20, vehicles 21 and driver 22. After re-consultation with the experts, a third draft was finalized comprising 58 questions.

Step 3: Pilot study for further development and improvement of the questionnaire: A pilot study was conducted to assess the questionnaire for inter-observer reliability (*n*=30). All conscious patients of RTA reporting to trauma centre giving informed consent were included in the study. Questions were asked by three observers at different points of time at three different days with the gap of approximately 24 hours between each observation. Time taken to fill one form varied from 15 to 20 minutes. Data was analyzed using SPSS version 14.0. The results were analyzed quantitatively for item difficulty, internal consistency and qualitatively by looking at the respondent's comments on, e.g. the format of the questionnaire, the interpretability of the item, lack of important items, and time used for filling in the questionnaire. Internal consistency was measured using Cronbach's alpha. Results from the measures of item difficulty and internal consistency and comments from the evaluation of the questionnaire were all considered before commencing further changes. Fourth draft of the questionnaire was finalized as per Table 3. Between the third and fourth draft, 2 items (exact weight and speed of other vehicle) were modified by classifying it as light/low, moderate and heavy/high. Fourth draft contained 58 questions.

Result

The item analyses from the pilot study on 30 patients for the third draft showed 100% agreement for socio-economic profile (Table

2). Cronbach's alpha values range from 0 to 1, and a score of 0.7 or higher is generally acceptable. (Table 2). Cronbach's alpha varied from 0.99 in the section for speed and 1 for the distance and no. of passenger (Table 1). Measuring validity through Kappa statistics, the value is 1 for the sections 1 and 2 (socio-economic profile and pre hospital care) having 18 items shows 100% agreements. Spearman Correlation coefficient for continuous variables is also significant. For section 3 and section 4 the value of kappa is more than 0.60 except for few variables. The value of Kappa in section 3 having 0.29, 0.37, 0.47 (shows fair agreement), this fair agreements can be improved by asking one question many times and looking for concordance in the answer. The overall Cronbach's alpha for all variables is more than 0.99 show high strength of variables. The test retest reliability of the questionnaire was significant within all sections. The interclass correlation coefficient for 3rd sections (3 items i.e. speed, distance travelled and numbers of passenger in vehicle) was 0.99 to 1.

Discussion

In the present study, special attention was given to the development, precision, and testing of a causality and injury pattern through questionnaire focusing on socioeconomic profile, pre hospital care, causality, injury pattern, type and severity of injury, vital signs of trauma victims.

During the development process of the questionnaire, priorities were given to contents related to RTA. Moreover, the all sections with specific items will also make the questionnaire more user friendly for other purposes.

In the current study, considerable strive was injected to ensure precision and contents. This was done both by taping and analyzing the discussion of all items and answers in the prepilot study, asking the respondents in the pilot study to comment on the content and design of the questionnaire.

The sample size of the pilot study was 30 patients and test retest was also done on 30 patients. The reliability coefficient increases as the number of respondents and number of items increase. Separating the knowledge items of the questionnaire into smaller sections may have had an impact on the test results both for the internal consistency and the test retest reliability of the questionnaire. A questionnaire was designed at ICMR for defining the pattern of injuries due to RTA in New Delhi. Our questionnaire can also prove to be an update to an above questionnaire defining many additional factor such as driver related, environment related, vehicle related and road related etc. However there is still a need for designing a questionnaire which could address validity with precision.

Conclusion

This designed questionnaire was précised to assess causality, severity type of injury and its pattern. The questionnaire has reasonable content, precision, reasonably reliable in perfect agreement with the objectives. This questionnaire can be a useful tool for determining the association of causality with injury pattern alongwith severity score for RTA victims.

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Tables

TABLE - 1: TEST FOR AGREEMENT BETWEEN THREE OBSERVERS FOR THE THIRD DRAFT

Observer	Mean ± sd	Intra-class correlation coefficient (95%CI)	Cronbach's alpha
Speed			
1	34.33±21.49	0.95 (0.61-0.98)	0.99
2	41.87±22.63		
3	41.83±22.15		
Distance			
1	26.18±70.34	1.00	1.00
2	26.33±70.30		
3	26.63±70.38		
No. of passengers			
1	2.60±2.90	1.00	1.00
2	2.60±2.90		
3	2.60±2.90		

TABLE - 2 TEST FOR AGREEMENT BETWEEN OBSERVER 1, 2 AND 3 FOR THE THIRD DRAFT

Variables	Kappa for agreement		
	1 vs 2	1 vs 3	2 vs 3
Consciousness	0.83 (p<0.0001)	0.90 (p<0.0001)	****0.74 (p<0.0001)
Pre-hospital care	1.00	1.00	1.00
Head facing forward	0.81 (p<0.0001)	0.81 (p<0.0001)	0.81 (p<0.0001)
Vehicle travelling*	0.92 (p<0.01)	0.90 (p<0.01)	0.98 (p<0.01)
Vehicle stopped at time of accident	****0.73 (p<0.01)	****0.73 (p<0.01)	****0.73 (p<0.01)
Use of helmet	1.00	1.00	1.00
Using seat belt	1.00	1.00	1.00
Use of mobile	1.00	1.00	1.00
Having driving license	1.00	1.00	1.00
Visibility	0.87 (p<0.0001)	**0.29 (p=0.02)	**0.37 (p=0.01)
Fog	1.00	1.00	1.00
Lighting	****0.78 (p<0.0001)	****0.78 (p<0.0001)	1.00
Rain	1.00	1.00	1.00
Taken Alcohol	****0.65 (p<0.0001)	1.00	****0.65 (p<0.0001)
Stress	1.00	1.00	1.00
Hurry during driving	***0.47 (p=0.002)	***0.47 (p=0.002)	1.00
Habit of driving	1.00	1.00	1.00
Animal on road	1.00	1.00	1.00
Pre-existing chronic conditions			
CA	1.00	1.00	1.00
COPD	1.00	1.00	1.00
Hypertension	1.00	1.00	1.00
Renal disease	1.00	1.00	1.00
Diabetes	1.00	1.00	1.00
Malignancy	1.00	1.00	1.00
Metastasis	1.00	1.00	1.00
Road conditions*	0.99 (p<0.01)	0.98 (p<0.01)	0.99 (p<0.01)
Place of accidents	0.91 (p<0.0001)	0.94 (p<0.0001)	0.91 (p<0.0001)
Position of passenger*	0.93 (p<0.01)	0.93 (p<0.01)	0.93 (p<0.01)
Weight of vehicle	1.00	1.00	1.00
Run-over by the vehicle	1.00	1.00	1.00
Skidding of vehicle	0.83 (p<0.0001)	0.92 (p<0.0001)	0.91 (p<0.0001)

Death during driving	1.00	1.00	1.00
Moving in wrong direction	****0.71 (p<0.0001)	0.87 (p<0.0001)	0.84 (p<0.0001)
Thrown up in air during accident	1.00	1.00	1.00
Weight of other vehicle	1.00	1.00	1.00

*Spearman Correlation coefficient; **Kappa shows fair agreement (0.21– 0.40),*** Kappa shows Moderate agreement (0.21– 0.40), **** Kappa shows Substantial agreement (0.61–0.80)

Five respondents had difficulty in recollecting and reporting the approximate speed and angle of impact. The information provided by them is an eye-opener about the lack of safety measures that are undertaken during travelling. (21, 22, 23)

4th draft

Table 1 and table 2 show Kappa and Spearman Correlation coefficient. For all sections together, the correlation coefficient was 0.99 and 1. All correlations were significant for each section in the questionnaire (p<0.01) and for all sections together (p<0.001). After the retest, a total overview of the questionnaire was made by the expert panel. This resulted in few changes, and the final questionnaire consisted of 58 questions.

TABLE - 3: FINAL QUESTIONNAIRE

	1. NAME: - ---------- 2. DATE: ---------- 3. ID NO:----	
SOCIO-ECONOMIC PROFILE		
	4. CONTACT NO.:---------- 5. ADDRESS:	
	6. AGE GROUP:	
	7. SEX: -1. Male 2. Female 3. Others	
	8. RELIGION: - 1. Hindu 2. Muslim 3. Sikh 4. Others	
	9. EDUCATIONAL LEVEL: - 1. Illiterate 2. Primary 3. Middle 4. Matriculate 5. Intermediate 6. Graduate 7. PG/Professional	
	10. NATIONALITY: - 1. Indian 2. NRI	
	11. MARITAL STATUS: - 1. Married 2. Unmarried 3. Widow/divorce	
	12. OCCUPATION: - 1. Sedentary 2. Manual 3. Businessman 4. Housewife 5. Student 6. Retired/not working 7. Labourer 8. Others 9. Not Applicable	
	13. MONTHLY INCOME:	
PRE -HOSPITAL CARE		
	14. ANY PRE- HOSPITAL CARE: 1. Yes 2. No 3. Not known	
	15. TIME IN SEEKING PRE-HOSPITAL CARE:	
	16. WHERE WAS THE FIRST AID GIVEN: - 1. At accident site 2. Nearby govt. hospital 3. Nearby pvt hospital/clinic 4. Others	
	17. MODE OF TRANSPORT: 1. Govt. Ambulance 2. Pvt. Ambulance 3. Pvt. Vehicle 4. Own Vehicle. 5. Police Van 6. Others	
	18. WHO GAVE THE FIRST AID: - 1. Health worker 2. Doctor 3. Nurse 4. Police 5. Public 6. Not known	
CAUSALITY OF RTA		
	19. DATE OF ACCIDENT ---------- 20. DATE OF ADMISSION:----------	
	21. TIME OF ACCIDENT: 22. TIME OF ADMISSION	
	23. HOLIDAY: 1. Public holiday 2.School holiday 3. No Holiday	
	DAY OF ACCIDENT:----------	
	25. ACCIDENT LOCATION: 1. National highway 2. State highway 3. Major road 4. Street 5. Junction's 6. Cross road	
	26. WHERE WERE YOU: 1. Motorcyclist 2. HMV Driver (bus, truck etc) 3. Pedal Cyclist 4. LMV Driver (car, jeep, van, tractor etc) 5. Pillion rider 6. Passenger 7. Pedestrian 8. Others 9. Not known	
	27. STRUCK FROM: 1. Front 2. Behind 3. Right side 4. Left side 5. Auto parked 6. Not known	

	28. STRUCK WITH: 1. 2 Wheeler mobike 2. 3 Wheeler tempos 3. 4 Wheeler 5. Tonga 6. 6 Wheeler 7. Rickshaw 8. Bicycle 9. Stationary object 10. Tractor 11. Overturned 12. Animal 13. Tree 14. Not known	
	29. ANGLE OF IMPACT	
	30. SKETCH DIAGRAM OF ACCIDENTS:	
	31. SPEED OF VEHICLE (km/hr):	
	32. DID YOU LOSE CONSIOUSNESS (BLACK OUT) UPON IMPACT: 1. Yes 2. No 3. Don't know 4. NA	
	33. WAS YOUR HEAD FACING STRAIGHT FORWARD AT THE TIME OF ACCIDENT:- 1. Yes 2. No 3. Don't know	
	34. VEHICLE WAS TRAVELLING, WAS IT: 1. Slowing 2. Gaining speed 3. Steady speed 4. Stopped 5. NA	
	35. WAS VEHICLE STOPPED AT THE TIME: 1. Yes 2. No 3. Fall down 4. NA	
	36. WHILE DRIVING.	
	37. Use of helmet: 1. Helmet with screen 2. Open helmet 3. Helmet with chin guard 4.Helmet without chin guard 5. Without Helmet 6. NA	
	37.1. Reason of without helmet: 1. For short distance 2. In a hurry 3. Forgotten 4. Not a habit 5. Others 6. NA	
	37.2. Using helmet belt 1. Yes 2. No 3. Don't know 4. NA	
	37.3. Using seat belt: 1. Yes 2. No 3. Don't know 4.NA If no, then why?	
	37.4Using mobile /Head Phone 1. Yes 2. No 3. Don't know	
	37.5 Having license 1. Learning 2. Permanent 3. Not valid 4. None 5. NA If no, then why	
	37.6. OTHER VARIABLES	
	38 Visibility: 1. Adequate 2. Inadequate 3. Don't know	
	38.1 Fog: 1. Yes 2. No 3. Don't know	
	38.2 Lighting: 1. Adequate 2. Inadequate 3. Don't know	
	38.3 Rainfall: 1. Yes 2. No 3. Don't know	
	38.4 Taken alcohol/hypnotic drug: 1. Yes 2. No 3. Don't known If yes, then how many hours before accident & how much quantity?	
	38.5 Stress/ fatigue 1. Yes 2. No 3. Don't know	
	38.6 Distance travelled:-	
	38.7 In a hurry: 1. Yes 2. No 3. Don't know	
	38.8 Habit of driving in years (approx.)	
	38.9 Animal on road during driving: 1. Yes 2. No 3. Don't know	
	38.10 PRE-EXISTING CHRONIC CONDITIONS:	
	39. Coronary artery disease: Previously not diagnosed but present 1 Previously diagnosed but not on Tt 2 Previously diagnosed & on Tt 3 Absent 4	
	39.1 Chronic Obstructive Pulmonary Disease: Previously not diagnosed but present 1 Previously diagnosed but not on Tt 2 Previously diagnosed & on Tt 3 Absent 4	
	39.2 Hypertension: Previously not diagnosed but present 1 Previously diagnosed but not on Tt 2 Previously diagnosed & on Tt 3 Absent 4	
	39.3 Renal disease : Previously not diagnosed but present 1 Previously diagnosed but not on Tt 2	

	Previously diagnosed & on Tt 3 Absent 4	
	39.4 Malignancy: Previously not diagnosed but present 1 Previously diagnosed but not on Tt 2 Previously diagnosed & on Tt 3 Absent 4	
	39.5 ROAD CONDITION: 1. Plane 2. Slippery 3. Pot holed 4. Kharanja 5. Under construction 6. Dust 7. Sand 8. Poor condition	
	40. NUMBER OF PASSENGERS:	
	41. POSITION OF PASSENGERS: 1. Front side passenger 2. Mid right 3. Mid middle 4.mid left 5. Side passenger 6. Vehicle occupant 7. Rear right 8. Rear left 9. Rear middle 10. Back Passenger	
	42. WEIGHT OF VEHICLE: 1. Heavy vehicle 2. Light vehicle 3.NA	
	43. ARE YOU RUNOVER BY THE VEHICLE: 1. Yes 2.No 3. Don't know	
	44. SKIDDING OF VEHICLE: 1. Yes (It's Cause?) 2. No 3. Don't know 4. NA	
	45. DEATH OF ANYONE IN/ON WHICH YOU ARE TRAVELLING: 1. Yes 2. No 3. Don't know 4. NA	
	46. ARE YOU MOVING/TRAVELLING IN WRONG DIRECTION: 1. Yes 2. No 3. Don't know	
	47. WAS IT YOU HITED BY ANOTHER VEHICLE, THROWN UP IN AIR & FALL DOWN: 1. Yes 2. No 3. Don't know 4. NA	
	48. NATURE OF INJURY IS DUE TO: 1. Primary Impact 2. Secondary Impact	
	49. WEIGHT OF OTHER VEHICLE: 1. Heavy vehicle 2. Light vehicle 3. NA	
	50. WAS THE OTHER VEHICLE STOPPED AT THE TIME: 1. Yes 2.No 3. Don't know 4. NA	
	51. MECHANICAL FAULT: 1. Yes 2. No 3. Don't know 4. NA	
	52. DO YOU FOLLOW TRAFFIC RULES: 1. Always 2. Most of times 3. Never	
	53. DO YOU KNOW ABOUT TRAFFIC RULES: 1. Little much 2. Yes 3. No	
	54. SPEED OF OTHER VEHICLE (Km/hr):- 1. LOW 2.MEDIUM 3. HIGH 4. STOPED 5. DONT KNOW 4. NA	
OUTCOME OF INJURY		
	55. NATURE OF INJURY: - 1. Blunt 2. Penetrating 3. Cut/Open 4. Multiple 5. Fracture 6. Sprain 7. Hematoma	
	56. INJURY SEVERITY SCORE:-	
	57. GLASS GOW COMA SCORE: For brain injury victims Severe, with GCS ≤ 8, Moderate, GCS 9 – 12, Minor, GCS ≥ 13 The GCS is scored between 3 and 15, 3 being the worst, and 15 the best. It is composed of three parameters: Best Eye Response, Best Verbal Response, and Best Motor Response, as given below: Best Eye Response. (4) No eye opening. Eye opening to pain. Eye opening to verbal command.	

Region	AIS Code	AIS Score	Square Top 3	
Head & Neck				
Face				
Chest				
Abdominal & Pelvic Content				
Extremities				
External				
			ISS Score=	NISS Score=

E=	V=	M=	Total Score=

	Eyes open spontaneously. Best Verbal Response. (5) No verbal response Incomprehensible sounds. Inappropriate words. Confused Orientated Best Motor Response. (6) No motor response. Extension to pain. Flexion to pain. Withdrawal from pain. Localising pain. Obeys Commands.	
	58. OTHER VITAL SIGNS: - 1. Respiratory Rate ------ 2. Heart Beat------ 3. Blood Pressure----------	