Epidemiology of unintentional injury in a rural community, Tiruchirappalli District, Tamil Nadu, 2003

By

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(MAE-FETP Scholar 2002-2003)

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CERTIFICATION

This is to certify that this dissertation, entitled **'Epidemiology of unintentional injury in a rural community, South India'**, submitted by Dr. A. Mohan, in partial fulfillment of the requirements for the degree of Master of Applied Epidemiology, is the original work done by him and has not been submitted earlier, in part or whole, for any other (Publication or degree) purpose.

Date: 29.1.04

DIRECTOR

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Abbreviations

DALYs	Disability-adjusted life years
BHEL	Bharat Heavy Electricals Limited
CDC	Centers for Disease Control and Prevention
CI	Confidence Interval
DDHS	Deputy Director of Health Services
ESI	Employees' State Insurance
FETP	Field Epidemiology Training Programme
GDP	Gross Domestic Product
GGH	Government General Hospital
GNP	Gross National Product
HSC	Health sub-centre
ICD	International Classification of Diseases
ICD-9-CM	International Classification of Diseases, 9th revision, clinical modification
ICEICEI	International Classification of External Causes of Injuries
ICMR	Indian Council of Medical Research
ISM	Indigenous system medicine
MAE	Master of Applied Epidemiology
NIE	National Institute of Epidemiology
PHC	Primary Health Centre
RTA	Road traffic accident
SEA	South East Asia
SEAR	South East Asia Region
SEARO	South East Asia Regional Office
SES	Socio-Economic Score
WHO	World Health Organization

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Abstract

Background: Injury is an increasingly important health problem particularly in developing countries like India. Community-based studies are of paramount importance to develop preventive measures. Not many community-based studies have been done to assess the burden and nature of injury in India and the State of Tamil Nadu.

Objectives: Cross-sectional study was undertaken to estimate the incidence of unintentional injuries in a rural community and to describe nature of injuries and health seeking behavior.

Methods: A systematic random sample of households was selected from each of two selected Health sub-centres. All adult members were interviewed with a semi-structured questionnaire to collect information on unintentional injuries in a 30-day recall period. For children below 5 years, a responsible adult member (mostly mother or father) of the family was interviewed.

Results: Totally 2216 members were surveyed in 505 households. The overall incidence of unintentional injuries was 9.6 % [95% Confidence Interval (CI): 8.4, 10.9]. Incidence was lowest in 15-44 age-group and highest in 0-4 age-group (8.7% Vs 12.2%). The incidence was high in male than female (χ^2= 10.88; p=0.00004). All reported injuries were non-fatal in nature. The incidence of injuries that prevented the person from usual work was 5.5 % (95% CI: 4.6, 6.5) and that resulted in hospitalization was 0.9 % (95% CI: 0.6-1.4). The common types of injuries were minor injuries, falls, animal and insect bites and traffic injuries. The incidence of minor injuries was high (3.4%)compared to other types like falls (2.9%) and animal bite (1.6%). No injury was reported due to accidental poisoning and drowning.

Conclusions: Further studies (preferably prospective) using larger and more representative samples are needed to delineate the problem of unintentional injuries and their risk factors in rural Tamil Nadu.

1. Introduction

Globally, most countries are already facing the double burden of communicable and non-communicable diseases. Almost half of the disease burden in high-mortality regions of the world is now attributable to non-communicable diseases.[1] According to World Health Report 2003, injuries are described as one of the *'stealthy but rapidly evolving epidemics'*.

According to the Strategic Plan for Injury Prevention and Control in South-East Asia (SEA)[2], "in 2000 an estimated 5.1 million people died due to injuries worldwide, accounting for 10% of the deaths due to all causes. This burden of injuries is projected to increase in the next decades if the current trend continues. Most of these deaths will occur in developing countries, as the lifestyles of people are undergoing rapid changes due to urbanization, industrialization, mechanization, and migration. Injury is a major contributor of ill health and disability. Injuries can occur everywhere, at home, at work, at public places or during recreational and leisure time activities. It is estimated that more than a quarter of injury related deaths in the world occurred in the South-East Asia Region (SEAR) in 2000. Children saved today from nutritional and infectious diseases are killed and maimed by injuries in hundreds of thousands. In fact, road traffic injuries alone rank as the number one cause of burden of disease among children of 5 to 14 years, and number three cause among 15 to 29 years in 2000. This heavy burden at such an early age has long-term implications on the quality of life and economy of the nations". Road Traffic Accidents (RTA) is listed by World Health Organisation[1] (WHO) as one of the three growing threats to world next only to cardiovascular diseases and tobacco related diseases. Recent estimates indicate that more than 20 million people were killed or injured due to RTA each year. [1]

Since long, injuries have been considered synonymous with "accidents" assuming that occurrence of such events was sudden and caused by external factors and these factors were the uncontrollable acts of fate and luck. [3,4] So, injuries remained a neglected field of research in the past. However, in the last three to four decades in developed countries, many studies[4-7] have been

undertaken to identify the magnitude of the injury-related problem and based on these, appropriate safety measures, laws and regulations have been devised to prevent them. More recently,[4] the epidemiologists of developed countries have expanded their area of etiology of diseases to include injury and have contributed towards the understanding of causal relationships among risk factors, events and the outcomes of injury. In contrast, so far not much attention has been paid to injury awareness, prevention and control in the developing countries.

In developing countries, the morbidity and mortality due to injury[3-6] are higher than the developed countries. The RTAs, in particular, forms more than 85% of all deaths and 90% of disability adjusted life years (DALYs) lost. This may be attributable to limited access to healthcare, education and other developmental activities[2, 8] growth in number of motor vehicles and poor enforcement of safety regulations[6]. This burden on the poor due to this *"emerging epidemic"* of this century is, indeed, an unnecessary one that targeted preventive programmes can alleviate. In spite of this, very few studies were undertaken[4, 5] to identify and address the problem of injuries.

The RTAs and other serious injuries could be remembered for a long period of time because of its seriousness and longer duration of impact. Many studies have been undertaken on RTAs. Different sources of data are available for RTAs like police records, hospital admission records and to some extent the insurance records. This data has certain limitations with respect to completeness and factors associated to RTAs. Review of literature indicated that very few studies are available for other types of unintentional injuries especially of minor injuries, which are occurring within the households as well as in the day-to-day working conditions of people. People often tend to forget these types of injuries in a short period of time and the reference period for these studies has to be kept reasonably short. According to published studies,[9-14] unintentional is affecting approximately 10 to 20% of the population, many of them requiring hospitalization and also resulting in prevention from doing their usual daily activities. Hence, it is important to study these types of unintentional injuries periodically in the rural area. This study is done to assess the incidence of

unintentional injuries occurring within the household and outside the home at working places in rural area using a 30-day recall period. The recall period is based on studies done in some of the developing countries.

2. Rationale for study

The public health approach to injury prevention involves four key steps of an epidemiological approach to any health problem.[3] The first step is to determine the magnitude, scope, and characteristics of the problem. The second step is to identify the factors that increase the risk of injury or disability, and to determine which factors are potentially modifiable. The third step is to assess what measures can be taken to prevent the problem, by using the information acquired in the second step to design, pilot-test, and evaluate interventions. The final step is to implement the most promising interventions on a broad scale.

The preventive strategies developed in the high-income countries can be adapted to the low-income countries with appropriate modifications according to the local conditions.[9] In order to develop preventive strategy we need to understand the epidemiology of injuries. Injury can be broadly classified into intentional and unintentional injuries. These terms denote whether or not an injury was meant to harm the victim (Refer Appendix 1). In India, the studies undertaken [10-17] so far give an unclear picture on the required data for planning.

Injury data from hospital or institutions are highly biased, since not all people are reporting to Government health institutions and not all injuries are coming to the knowledge of the health institutions both private and government.

Hence, it is important to understand the epidemiology of the unintentional injuries. For this a community-based study is necessary.

Currently, the principal investigator as a part of the Field Epidemiology Training Programme (FETP) is placed at Tiruchirappalli district. This district is situated at the centre of Tamil Nadu. It is located 320 km to the South West of Chennai and 128 km North East of Madurai on the banks of the river Cauvery. It is one of the important industrial and pilgrimage centres. It is well connected by rail, road, and air with other cities and towns within and outside the State. Infact, three important National Highways (NH) [NH 45 (Between Tiruchirappalli to Chennai), NH 67(Between Nagapattinam and Mysore) and NH 197 (Between

Tiruchirappalli and Memesal)] run through Tiruchirappalli district. According to official statistics, [18] morbidity and mortality due to injury are on the increasing trend in Tamil Nadu (for instance, the number of accidents has increased from 44, 243 in 1997 to 62,707 in 2000).[18] Similarly, the number of vehicles also has increased. Urbanization, industrialization, mechanization, migration and widespread use of vehicles due to improving socio-economic conditions largely account for this increasing trend.

To the best of investigator's knowledge, no epidemiologic study on injury has been done till date in Tiruchirappalli district. Hence, this study is undertaken to estimate the incidence of unintentional injuries and to identify possible factors responsible for injuries. It is hoped that the findings could help in planning for further large-scale studies and in planning and implementing appropriate preventive strategies.

3. Objectives

- To estimate the incidence of unintentional injury in a rural community, in Tiruchirappalli district
- To describe the nature of injuries and their relationship to selected epidemiological variables
- To describe the health seeking pattern for the management of unintentional injuries

4.1 Introduction

The important asset of the society is human being. Therefore, the human beings need to be safeguarded from the ill effects of infectious, non-infectious diseases and injuries. This is important for them to assume optimal health and productivity. In recent days, it has been observed that injuries in all forms have assumed high proportion of total morbidity and mortality. Among these, unintentional injuries constitute an important and preventable component. Accident / injury now is on increase in many countries.[19] The numbers of injuries in terms of deaths, hospitalizations, disabilities and socio-economic losses are increasing from year to year. The social, economic and psychological hardships are unmeasured in any developing country and it is estimated that nearly 3% of Gross Domestic Product (GDP) is lost due to road traffic injuries alone. Correspondingly, the health system is not geared to handle this emerging problem in terms of prevention.[2,20] The situation is especially due to lack of professional and technical expertise, alongwith absence of policies and programmes. This has resulted in a huge burden on health care systems, which are already overburdened due to various deficiencies. The present review largely deals with unintentional injuries including RTAs, falls and other injuries.

4.2 Definitions and classification of unintentional Injury

Paramount to the epidemiology of any disease or phenomenon is the clear definition of the variables of interest. The definition of injury has been fraught with challenges and complexities. Importantly, injuries unlike diseases must be defined simultaneously by the causative event and by the resulting pathology. For example, bruising can occur in the absence of an injury event (e.g. in the case of sepsis or a bleeding disorder) and thus, taken alone, cannot be considered an injury. Similarly, there are many events, such as car crashes, which result in no pathology, even if 'victims' are bought to an emergency department for observation. Thus, the theoretical definition of injury must incorporate both cause and outcome. Equally challenging is the operational definition of injury, for example, which diagnoses, codes or combination of codes

from the International Classification of Diseases (ICD) [21-23] define injury. Hence, the definition and classification of injury is presented to interpret the comprehensive review of epidemiology of unintentional injury.

Unintentional Injury is defined[22] as any unintentional damage to the body resulting from acute exposure to thermal, mechanical, electrical, or chemical energy or from the absence of such essentials as oxygen.

Causes of injuries can be divided into the following broad categories as recommended by the new internationally accepted standard framework designed for presenting injury statistics [21-23] like cuts / pierce, drowning submersion, falls, fire/burn, firearms, machinery, motor vehicle traffic, pedal cyclist, pedestrians, overexertion, poisoning, struck by / against, and suffocation.

4.2.1 The International Classification of Disease (ICD) system[21]

Classification by external and internal causes of injuries is by two different codes, namely, N codes and E codes.

N codes refer to the nature of an injury and the part of the body injured. It does not explain how the injury occurred. Examples: concussion, fractured hip, burns.

E codes refer to the external cause of injury. It provides information on intentionality (self-inflicted, unintentional) and location where the injury took place (home, playground, swimming pool, etc.) Examples: motor vehicle crash, falls, poisoning.

Connecting the nature (N code) and external cause (E code) of injury is very important to design prevention strategies. Based on the above principles, injuries divided as shown in Table 1.

Table 1. The injury classification based on ICECI using ICD-9-CM codes*

Injury Classification	Codes
All Unintentional Injuries	E800-E869, E880-E929
Motor Vehicle Traffic	E810-E819 (.0-.9*)
Falls	E880.0-E886.9, E888
Pedal Cycle (Bicycle)	E800-E807 (.3*); E820-E825 (.6*); E826.1, E826.9;
Drowning/Submersion	E827-E829 (.1*)
Burns & Scalds	E830.0-E830.9, E832.0-E820.9, E910.0-E910.9
Poisoning	E890.0-E899, E924.0-E924.9; 940-949
Suffocation	E850.0-E869.9, 980.0-989.0
	E911-E913.9

* ICECI : International Classification of External Causes of Injuries; ICD-9-CM: International Classification of Diseases, 9th revision, clinical modification [21-23]

4.2.2 Injury classification by severity

According to the clinical severity, injuries are divided into fatal and non-fatal injuries. Again, the non -fatal injuries divided into grievous and minor injuries.

4.3 Injury as a disease[24]

Injury is a disease resulting from an interaction of agent, host and environment. Injury has long been considered an "accident". It has been seen from a medico-legal and criminal perspective and not as a public health problem. Once a person enters a health system for treatment of an injury, only then is it considered a health problem. [24]

Like communicable diseases, injury also needs the factors like agent (product) host (person), environment, physical and social and interaction among these factors are essential for injury to occur like any other diseases.

Injuries occur due to an acute transfer of energy between the human body and the environment around it. Therefore, injuries result from an interaction of the

agent, host and environment like any other disease (Figure 1). There are no basic scientific distinctions between injury and disease as shown in the Table 2.

Figure 1. Epidemiological triad in injury

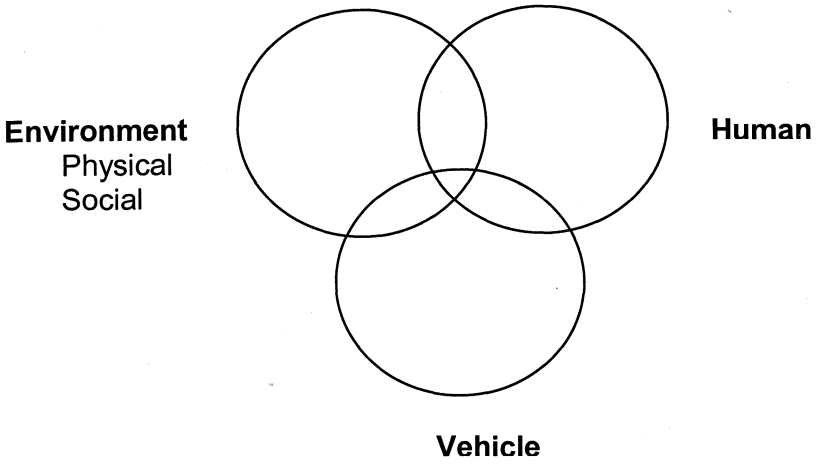


Table 2. Similarities between a communicable disease and injury*

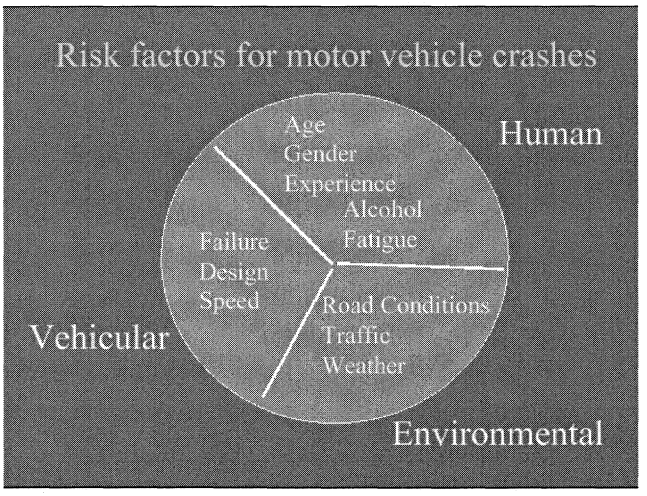
Pathological	Host	Agent	Vehicle/vector	Interaction
Malaria	Human	Parasite	Mosquito	Bite
Skull fracture	Human	Mechanical energy	Motor vehicle	Crash

* Reference: 24

4.4 Epidemiological models to analyze the epidemiology of injuries

The four factors that are involved in injury and the relations between them illustrated using RTA (Figure 2).

Figure 2. Risk factors for injuries



4.4.1 Public Health Model [24,25]

The classic public health model, which identifies the agent of injury, the host, and the environment, has emphasized removing harmful agents from or altering the physical environment (Table 3).

Table 3. Possible injury preventive strategies*

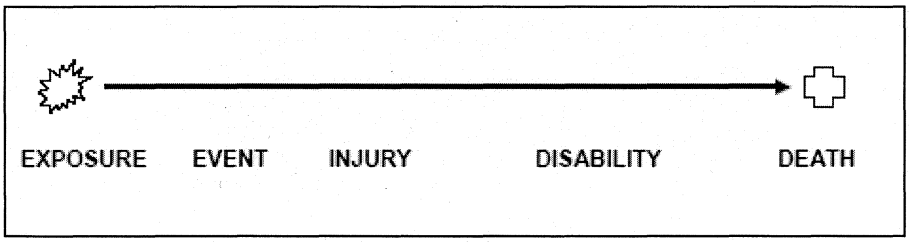
Factor	Possible prevention*
Host	Protect the rider with helmet
	Provide better physical therapy to help them to recover quickly
Agent	Lower speed limits to reduce the energy transfer
Vector	Ban production of the vehicle that speeds well
Environment	Reduce the smoothness, oiliness of road

*Refernce[25]

4.4.2 Injury spectrum

The injury spectrum[5, 25] is another useful model for analyzing the injuries. The injury spectrum is shown in figure 3. It maps an injury over time starting with the host's exposure to a hazard, followed by event through to the occurrence of the injury and finally the possible resultant disability and / or death.

Figure 3. Injury spectrum



Injuries are now recognized to have resulted from a complex interaction of sociological, psychological, physical and technological phenomena. This understanding of injuries helps us design safer products, environments, roads and traffic management systems. Injury can be prevented by reducing the probability of energy exchange between human beings and their surroundings. This is done by lowering the amount of energy available (e.g. speed limits), reducing the amount of energy transferred (e.g. cushioning provided by sand in playgrounds, use of helmets and seatbelts, cushioning impacts), and physical

separation of the energy source from human beings (e.g. insulation on electric wires). [24]

For every person killed, there are at least two others who suffer permanent brain damage. Death indicates only the tip of the iceberg. It is estimated that for each death, at least 30-45 injuries occur. [19,20,25]

4.4.3 Deficiency in public health model[24]

In numerous cases, the above two models proved to be an extremely effective approach. This strategy, however, is deficient in recognizing the relationship between psychosocial factors and injury. In all other aspects of public health, we do not depend solely on changing the behaviour of all concerned to control a disease. It will be difficult able to eliminate carelessness, absent-mindedness and even neglect in any day-to-day activity.

So, the combined behavioral and environmental approaches are recommended. Independent researchers need to evaluate the efficacy and cost effectiveness of multiple types of intervention strategies, including those that combine behavioral and environmental approaches.

4.5 Haddon Matrix

Haddon Matrix[25, 26] is a useful tool in helping to remember the array of potential strategies. Haddon matrix is a framework developed by Dr. William Haddon as a method to generate ideas about injury prevention that address the agent, host and, physical and social environments to have effects in the pre-event, event, and post-event phases of the injury process.

This planning tool is used to help identify the complete range of option for taking / choosing the strategy for control measures. Motor vehicle crashes are used to explain this matrix as follows. The matrix divides the time sequence of crash into three phases (pre-crash, crash and post-crash) and then considering the human, vehicular and environmental factors which can interact during each phase of crash. The result is a nine-cell matrix (Table 4), each cell of which offers opportunities for intervention to reduce motor vehicle injuries / any other injuries.

Table 4. The Haddon matrix used to identify the possible counter measures

	Human	Vehicle	Environment
Pre-event	Alcohol		night, rain
Event	No seat belt	no air bag	tree too close to road
Post-event			slow emergency response

4. 6 Unintentional injury as a public health problem

4.6.1 Injury mortality

An analysis of the leading causes of death shows that in most countries, irrespective of their level of development, accidents are among the top five leading causes of death. According to WHO's Global Burden of Disease estimates [3,7] accidents, as the cause of death as well as DALYs will dramatically rise in the next 20 years.

Globally, more than 5 million people die from injuries every year.[27, 28,] Injuries kill more people than HIV/AIDS and malaria combined. In 1998, of the estimated 5.8 million people who died from injuries, approximately 1.2 million died from road traffic collisions and 2.3 million died from violence, including 948,000 by suicide, 736,000 from homicide and 588,000 from war.[2] The rest died from other injury-related causes, including falls, drowning, burns and poisoning. Many more people survive their injuries, and live with a permanent disability.[27] In 2000, 10% of the deaths due to all causes [3] were due to injuries worldwide.

According to WHO report [29] total number of deaths (both the sexes) due injuries was 57, 64, 825 with a mortality rate of 97.9 per 100,000. The death rates in males and females were 128.6 and 66.7 per 100,000 population respectively.

The problem of injuries in South-East Asia Region, though enormous, remains largely unrecognized.[24] Even clear information on the number of deaths is not available due to problems of non-reporting and underreporting due to various reasons. WHO [2] estimates reveal that nearly 1.4 million people lost their lives due to injury during 2000. The ratio of deaths, hospital admissions, emergency

room registrations and hospital non-attending cases varies from 1:20-30:50-100 based on available epidemiological data. Nearly 100% of severe, 50-70% of moderate and 10-20% of mildly injured persons need short-term and long-term rehabilitation services. [2] The economic costs of injuries are profound, with road traffic injuries alone costing 1-3% of GDP across countries. The social costs and hidden impact of injuries in terms of loss of schooling, absence from work, loss of productivity and psychological trauma are significant, though not quantified.[2,45]

The percent of burden of injury in SEA countries [30] was 12.8 and the share of SEA in the injury burden (as percent of world burden) was 29.7. The death rate and DALYs lost due to injuries in India [4] was 3.4% and 142 respectively and for the unintentional injuries it was 2.2% and 98 respectively.[4]

Age and sex specific DALYs lost[4] was maximum in 5-14 age-group (22%) followed by 15-44 (9.1%). According to the WHO report [30,31] in India the injury and poisoning were the third leading cause of mortality next only to cardiac and respiratory diseases.

In Ghana, [32] where systematic studies have been done, the death rate was 83 per 100, 000 in urban and 53 per 100, 000 in the rural areas. The case fatality ratios due to RTA were 5.5 % and 2.3% respectively in the urban and rural areas.

In a hospital-based study, [33] 8% of mortality was attributable to injury of which 54% were due to RTA.

In Uganda[34] the leading cause for mortality was drowning (27%) followed by traffic (18%) and blunt injuries (15%) in rural areas whereas in urban the leading cause was road accident (46%).

Gordon[10] reported mortality rate due to unintentional injuries as 63 per 100, 000 population in rural India. The male mortality was 1.6 times higher than female.

In Andhra Pradesh[36], the mortality rate was 2.22% due to RTA in rural and other unintentional injuries was 4.99% whereas in urban mortality was high in RTA than falls.

In Tamil Nadu, the mortality rate due to accident and poisoning in 1999 was 2.9% of total deaths.[35]

4.6.2 Injury morbidity

Injuries, intentional and unintentional, are accounting for 16% of the global burden of disease in 1998.[3] Globally, injuries are responsible for one in six years lived with disability. The burden of unintentional injuries was as follows: RTA (12.2%), falls (18.7%), poison (1.1%), fires (5.8%), drowning (6.5%) and occupational (3.4%). [3,4]

The estimated DALYs lost due to injuries in the world[30] was 18,25,54, 000 and in SEA countries 5,42,36,000. The distribution of burden of injury (DALYs lost) [3,4,30,31] by cause among the unintentional injuries was as follows:

RTA	17.5%
Falls	12%
Drowning	7%
Fires	6%
Poisoning	5%

The percent of burden due to falls in SEA is 1.2, which forms 26.1% of the total burden of injury falls worldwide.[30]

Unintentional injuries in India were 86.6% of total reported injuries.[4] According to Andhra Pradash burden of injuries survey, [36] DALYs lost due to falls was 5.45% in rural and in urban DALYs lost due falls was 6.91%, fires 3.47% road accidents was 2.97%. The disability was high in falls both in rural and urban area in that state.[36]

According to Gordon,[10] injury rate was 11.6% (with 4% crippling) in Punjab. The injury rates were high in males between 0-14 years and highest in female in the age-group of 25-44. The leading causes for injury in this study was cutting and piercing instruments like knife and axe followed by cutting and piercing by sharp instruments like glass and sticks.

In another Indian study by Mohan[5] the injury rate was 15% due to RTA and 32% agricultural and all of serious in nature. The studies undertaken India and other developing countries are shown in table 5.

Table 5. Injury morbidity studies undertaken in India and developing countries

Country, Reference	Year	Morbidity
India (Rural)[10]	1962	Incidence: 116 per 1000
India (Rural)[13]	2000	Incidence: 186 per 1000
India (Urban)[12]	1996	121 per 1000
India (Rural)[14]	2002	Childhood injuries: 341.8 per 1000
India[11]	1983	Prevalence of traumatic amputations among males Rural: 24 per 100,000 Urban: 20 per 100,000
India (Hospital-based)[15]	2002	Traumatic brain injuries 240 per 1000
Chile[5]	1990	Incidence: 303 per 1000
Caracas, Venezuela[5]	1990	Incidence: 220 per 1000
Ghana [32]	1999	276 per 1000 (Both urban & rural)

4.7 Specific Injuries

4. 7.1. Minor injuries

Injury due to use of sharp instruments like knife, hand tool, blade, fall of objects like stone, hit by objects[5] and farm implements, thorn, blade, pencil and stick in rural area and finger nails, kitchen appliances and furniture in urban area [37] are common cause of non- fatal injuries in developing countries.

In Punjab, a study done by Gordon and co-workers[10] 44% of reported non-fatal injuries were due to use of above instruments. The corresponding injuries in Northeastern Ohio were 2.8%. These injuries often received little or no treatment resulting in disability and lose of time. According to the study done by Singh and colleagues[37] in Haryana (both urban and rural) minor injuries in school children per year were 2.9 % in rural and 2.1% in urban area; point prevalence was higher in urban area. First-aid training of teachers or the students was lacking in both the areas. Many of the injuries (41-46%) occurred during the school time. Fingers/hand or feet were affected most.

In study done USA[38], the cumulative one-year incidence of farm injuries for women was 5% based on the number of farmwomen injured. Lower extremities were the most frequently injured body parts. The leading external causes were contact with foreign object/substance, falls, and overdoing/lifting/hauling. Most injuries occurred in the summer or spring. Park H and colleagues[39] mentioned that the cumulative incidence of farm work-related injury during the one year was 10.5% (In the State of Iowa USA).

In another study by Leigh[57] the agricultural injuries constituted 14% of all ill health episode in India.

In Vietnam study [19] injuries / accidents in school and public places make up more than 10%. Proportion of children injured in school is higher than that of adult injured in production sites. Injured risk towards physical education (football, basketball, gymnastic) is triple that towards other subjects. Injury in sports which covers 15 -20% and has had tendency to increase during the 50 past years.

4.7.2 Falls

The importance and pattern of falls in a community depends on environment and age structure of the population, [5] Falls are a major cause of minor and severe injuries in developing countries. The common causes were fall from trees, fall on the ground while playing, slip in the bathroom, and falls from construction site. In

developed countries design features of home and furniture are often significant environmental factors in falls.[24]

Globally, according to the WHO report,[28] an estimated 283, 000 people died due to falls in 2000. A quarter of all fatal falls occurred in the high-income countries. Europe and the Western Pacific region combined account for nearly 60 % of the total number of falls-related deaths worldwide. Males in the low- and middle-income countries of Europe have by far the highest falls-related mortality rates worldwide. [5,9] In all regions of the world[7, 9] adults over the age of 70 years, particularly females, have significantly higher falls-related mortality rates than younger people.

The morbidity and mortality due to falls increases as age decreases. Further, both the extremities of age-groups are affected than any other age-groups.[24] Children account for the largest morbidity - almost 50% of the total number of DALYs lost globally to falls occur in children under 15 years of age.[9]

Falls are responsible for the largest number of hospital visits for non-fatal injuries especially for children and young adults, in many countries of the SEA Region[24]. As life expectancy increases in these countries, the incidence of hip and other fractures due to falls among the elderly are also assuming greater proportions. In India 18.7 percent of all type of injuries were due to fall.[4]

Older children fall from playground equipment, during play and recreational activities and during sports. Some studies undertaken in developing countries and India confirmed the risk factors.

According to the study by Kopjar B, [40] the incidence of falls-related injuries at home was 25 per 1,000. The incidence was higher among women than men (32 and 13 per 1,000 respectively). The ratio between falls to the same level and falls to lower levels was 2:1 in the age-group 65-79 year and 4:1 in the age-group over 80 years. The most common mechanisms causing injuries were as follows: loss of balance (46%), stumbling (19%) and sliding (12%). 60% of all patients sustained fractures (15 per 1,000). 50% of all patients were hospitalized.

Similarly the study done by Lord SR and colleagues [41], 66.1 percent of the subjects experienced no falls, 19.7 percent fell once and 14.2 percent fell on two or more occasions. . The most common causes of falls reported were trips, slips and loss of balance. Some (27%) suffered injuries as a result of a falls, and the proportion suffering injuries increased with age. Those who rated their health and balance as impaired, those with a limitation in activities of daily living, those receiving community services, those taking psychoactive drugs, and those taking four or more drugs had significantly more falls.

One study in India by Patel JC[42] identified that falls are common in elderly. They cause morbidly, mortality and financial hardship. Another study by Dolinis J [43] indicated that 28 percent reported having fallen at least once in the previous year. Independent risk factors for falling were: age; having left school at an early age; a worsening of vision in recent years; and histories of Parkinson's disease, fractured hip, glaucoma, stroke (including transient ischaemic attack), corns or bunions, or arthritis.

Ho [44] mentioned many risk factors for falls. Among the risk factors studied, smokers were found to have an independent decreased risk of falls. Neither age nor sex was significantly associated with falls after adjusting for the other explanatory variables His findings differed from other findings that there was no difference in association between injury falls and age and sex.

In a community based Uganda study [34] falls were the second most common cause of severe injuries in both rural and urban areas affecting most often under 10 year children accounting to 33%. This may reflect the high-risk environment such as lack of proper sleeping, and play facilities.

4.7.3 Animal and insect bites[5]

Bites from animals and insects are an important public health problem in developing countries.[5] The customs of people and high risk environment might be reason for the high incidence of animal and insect bites in developing countries especially in rural areas.

The common types of animal bites are dog, snake, rat, and pig and cattle goring. The common type of insect bites are scorpion, centipede. The incidence of animal bites was 11 per 1000 with dog bite predominate in Ivory Coast rural study. In Nigeria 1% of hospital out patient department were of dog bite.

As per the WHO study[5], the reported rabies in India in 1978 was 20, 000 followed by Ethiopia with 412. The highest incidence of rabies was in India with 29.1 million populations followed by Ethiopia. In South Africa, the incidence was 0.1 per million in 1979.

4.7.4.1 Snakebites[5]

Snakebites are one of the important causes for death and the most neglected area in tropical medicine. Reason for the neglect might be due the fact that majority of bites were occurring in remote rural area, which were not reported. In Savanna (Nigeria) 10, 000 deaths occur annually and in northern Nigeria 1% of all death were due to snakebites. In Myanmar, deaths due to snakebite is seventh leading cause and in Bangladesh the leading of cause of death in women of childbearing age is snakebites.[5]

4.7.4.2 Insect bites

The scorpion stings are said to be more important than snakebites in large area of the world[5], such North Africa, parts of Brazil, and Mexico. The study[5] done in Libya during 1979, found incidence of 900 and 7 deaths / 100, 000 population. In Mexico, 1000-2000 deaths occur due to scorpion stings per year with an incidence of 3.8/10000 population per year was reported.

In India, though the burden of animal and insect bite is a public health problem there is hardly any evidence is available from either hospital or community based studies.

4.7.5 Poisoning

Poisoning is a major problem in developing and developed countries.[5, 7,9] More recent data shows that pesticides are the most common form of fatal poisoning in south Asian countries.[24] Poisoning is responsible for an estimated 315, 000 fatalities in world wide. [28] The mortality in European countries is high (21.5 per 100, 000) [5,9] when compared to SEA countries like India where the mortality is 7 per 100, 000 population.

SEA region is responsible for 26% of total mortality due to poisoning. Both the SEA and European region combinely accounts for > 50 % of mortality due to poisoning.[5,9] An estimated 82, 000 fatalities in countries of the SEA Region has been reported.[24] The most common agents responsible for poisoning are pesticides, kerosene, prescription drugs and household chemicals. Pesticides are widely used in many countries where agriculture is an important part of the economy. Reports from India, Indonesia, Sri Lanka and Thailand indicate that common availability and use of toxic pesticides is responsible for intentional and unintentional morbidity and mortality.

In Sri Lanka, pesticides are one of the main agents used in attempted suicide in rural areas.[24] Paraquat intoxication is known to cause irreversible damage in patients. Many countries also report accidental ingestion of kerosene as a leading cause of poisoning, especially among children. A study from Thailand revealed that 54 per cent of cases of poisoning among pre-school children involved therapeutic drugs. [24]

In all regions males are more affected than female. [5,9] The mortality rate is high in 45-69 age-group (60%). The overall poisoning mortality among male in Europe is 3 times higher than the rate in either sex in any region.

In India, the burden of injury due to poisoning was1.1%. [4] In other developing countries it was 2.3%. The distribution of mortality between male and female due to poisoning in developing countries was 3% each whereas in developed countries it was 7.4 and 6% respectively.[4]

4.7.6 Road Traffic Accidents

According to WHO Director General's report [45] RTAs is the ninth leading cause of all death worldwide. The DALYs due to RTA will jump from the 9th position to 3rd rank by the year 2020. Death from road injuries accounts for 2.2% of the global mortality. This RTA kills more people than Malaria and put tens of thousands of people in hospitals. In the year 2000, 1.26 million [28,3] people died as result of road crash.

In low and middle-income countries road crash victims occupy upto 10% of all hospital beds. In fact, 90% of all RTAs occur in these countries. Of the 1.26 million annual deaths 35% are from SEA which include India 24% from the western pacific including China, 13% in Africa, 11% in America, 10% from Europe which includes Russia and 7% from Eastern Mediterranean including Pakistan.[45]

The human suffering from the victim's of RTA and their households is incalculable. Their death and disability have serious implications for victims, their households and their dependents: reduction in quality of life, suffering and poverty. In strict economic terms, the cost associated with surgery, prolonged hospitalization and the long term rehabilitation of victims, injuries, in addition to their lost productivity cost, represent tens of billions of dollars each year[28, 45,] The burden on the health system compromises prospect for development. The countries with problem of tuberculosis, malaria, AIDS, find it very difficult to manage the RTA. [45]

According to the World Health Report 2003,[1] "RTA is one of the three growing threats to world next only to cardiovascular diseases and tobacco related diseases. The burden of RTA injury falls mostly on the developing countries because of rapid increase in the number of vehicle. This hidden epidemic receives little attention at the national and international level. The epidemic of road transport, still in its early stage, accounts for 90% of DALYs lost in developing countries. In 2020, it will be the third leading cause of DALYs lost. It

is expected to increase in 2020 by 92% in China and 147% in India and 80% in other developing countries"

In India, the reported morbidity / mortality as per WHO SEA Regional Office reports[46] due to road traffic injuries were 3, 30, 000 and number of deaths were 80,000.

In Vietnam, as per the study done by Mooren, [20] every day 30 young people were killed in road crash. For every person killed, there are at least two others who suffer permanent brain damage. Death indicates only the tip of the iceberg. It is estimated that for each death, at least 30-45 injuries occur. The burden of RTA is even more disproportionate when vehicle ownership is considered.

Developing countries own only 40 % of world's motor vehicle, whereas, it accounts for 86% of road fatalities. Africa owns only 3% of vehicle but accounts for 3% of road deaths[20]. According to WHO, Ethiopia has the highest rate of fatalities per vehicle, i.e. nearly 200 per 100000 vehicles. The trend data shows that the total number of persons killed in road crashes in the developing countries continues to increase, whereas in motorized countries, there has been decreasing trend over the last 15 years. For example, in Asia-Pacific, it is 40%, Africa by 26%, whereas in motorized countries, it is only 10%.[20]

According to World Bank Report[22], the cost of road trauma averages between 1-3% of GDP, whereas in Thailand, it is reported as 3% of GDP. WHO puts the GDP at 5-6%.

In the less than 45 years age-group, 67% of all RTAs occur, whereas only 10% of RTA occurs in retired and above age-group. The aggregate economic effect of this is that accidents mains and kills more of the very people required to build the economy and tackle poverty at its roots. This means RTA are one of the factors contributing to the cycle of poverty, which needs to be broken[1, 20]

In a population-based urban study conducted in India[12] the results showed that the incidence of RTA was16 per 1000. The relative risk of males to females for

traffic injuries was 3.04 and the relative risk of traffic injuries among male for consuming alcohol was 2.26. The incidence was high in urban slum and is a priority problem. In another hospital based study at Chennai [17] by the same author indicated that 35% of the patients who were attending the causality department were due to RTA and 47% of that cases occurred in the age-group of 21-40 and males were affected more than female. Similarly, the study in Ghana also [32] showed that the major type of injuries in urban were transport related. In that study they found that both rural and urban combined, 73% of RTA injuries involved commercial vehicle.

In Uganda a hospital-based study[33] indicated that 50% of the injuries were due to RTA and majority of the affected in RTA were students. This was contrary to Ghana[32] studies where it was the adult male population.

In another Ghana study[47] the transport related injuries in urban was 16% and 10% in rural area. The most common transport related mechanisms were either to passenger involved or pedestrian struck by the vehicle in urban and in rural area it was the bicycle crash.

In another Uganda study[34] RTA was next only to drowning with 18% in rural area and in the urban area RTA was the leading cause of injuries similar to what was reported in the Ghana study. In both the settings males were injured more than females.

4.7.7 Drowning

Drowning accounts for loss of many young lives[5]. In 2000, an estimated 4,50,000 people drowned, making it the second leading cause of unintentional injury death globally after road traffic injuries.[5,9, 28] These figures are an under-estimate of all drowning deaths, since they exclude drowning due to floods (cataclysm), boating and water transport. Almost 97% of all drowning deaths occurred in low- and middle-income countries. The Western Pacific and South East Asia regions account for 60% of the mortality and DALYs. Males in Africa and in the Western Pacific have the highest drowning-related mortality rates

worldwide. However, children under 5 years of age have the highest drowning mortality rates worldwide. Over half of the global mortality and 60% of the total number of DALYs lost due to drowning occurs among children aged between 0 and 14 years.[3] A death caused by drowning is the second most important category in the developing countries.[4] Ponds, rivulets, irrigation canals and open wells represent the danger of drowning for young children.

During 2000, injuries accounted for over 9% of total global mortality[48]. Of these injury-related deaths, 8% were from unintentional drowning. Of these unintentional drowning deaths, 97% occurred in low-and middle-income countries.[48] Drowning death rates in Africa are more than eight times higher than those of the United States and Australia[48].

Both the United States and Australia have higher drowning mortality rates among indigenous populations compared with white mortality rates. The rate of submersion resulting in hospitalization is approximately double the mortality rates from drowning in both countries

Local studies and reports from the countries of the SEA Region indicate that drowning is also one of the causes of deaths and injury in the Region.[24] Bangladesh and Maldives have identified drowning as the most common cause of accidental deaths.[5]

In Asia, deaths due to drowning was responsible for 48% in male and 44% in female of unintentional injuries.[5] In India drowning was noted as one of the three methods for of suicide. According to Government report, 1976, accidental loss of life accounts for 23% of deaths from injury with an annual rate of 4/100000.

As per one Indian study[4] the burden of drowning was 8.5% in India, 13.2% in China, 7,5% in developing countries and 4% in developed countries. Similarly in developing countries the burden is 10.2% in male and 10.3% in female, where as in developed countries it was 9.2% and 8.5% respectively

A study conducted In Uganda [34] in rural setup, identified that the leading cause of fatal injuries was drowning (27%).

4.7.9 Fires and Burns

Burn is one of the leading causes of death. Female is the most vulnerable group.[5] Globally some 238, 000 deaths occurred worldwide due to burns.[28] Half of the total number of DALYs lost due to burns were among 0-15 year age-group. [5] The incidence increases with age increases, attain maximum at 15 and begin to decline after 15 years. A study by Gumber [4] showed that the burden of injury due to burns was 4.3% in developed countries 4,1% in developing countries, and 5.8% in India[4]. The mortality due to burns between male and female was 2.1 and 3% in developing countries, 1.9 and 3% in developed countries.

An estimated two-thirds of the global burden of burn mortality among females was from South-East Asia[24] and an estimated 1,28,000 persons died of burn injuries in 2000. This burden accounts for more than half of the global burden of fire related burns. In fact, two-thirds of the global burden of fire-related burns among females [5,24] was estimated to have occurred in South-East Asia. Burns often rank as another major source of morbidity and mortality after traffic injuries, falls and drowning. The majority of burns occur at home.

The impact of burns, especially severe ones, is worse in the SEA Region compared to that in high-income countries because of infections and lack of adequate physiotherapy.[24] Therefore, prevention and adequate treatment of burns must be an important part of injury control activities

A study in Indian citifies showed that 15-45% of all deaths in hospitals[5] were due to burns. Another Indian study in Allahabad, India among Government employee households showed that burns were the second largest cause of any injuries at home. A study at Punjab rural area by Gordon[10] showed a mortality rate of 14 per 100, 000 population due to burns.

4.8 Identified risk factors for injuries

Risk factors for injuries may vary from one country to another and the risk group may not be same. For example the pedestrian death rate in Reo de Janeiro was about four times that of Baltimore.[5]

4.8.1 Personal characteristics

4.8.1.1 Age and sex

Age and sex are important risk factors for many injuries and will vary within the specified injuries.[5.] In developed countries, the highest rates of serious injuries occur in elderly particularly in women. Gordon and colleagues[10] indicated that injury mortality was high among elderly in developing countries also. Little data by age and sex are available, particularly in least developed countries.[5] As much as 50% of all deaths in the age-group 10 - 24 years are due to injury.[49]

Injuries are not random events; they occur in patterns that are predictable[3, 4,24] They are based on the age and sex of the individual, the time of day and the season of the year. For example, infants are more likely to drown in bathtubs than older children, males are at higher risk for injuries than females and bicycle-related and other injuries increase during the spring and summer.

4.8.1.2 Alcohol

It is risk factors for many injuries. The importance of alcohol and other drugs in relation to injuries has been described in developing countries. Wyatt [5] found that in Papua New Guinea, 40% of those who died in RTA were related to alcohol and one study by Sathiyasekaran in India also had history of alcohol related to injuries[17] but no other studies were found documenting the role of alcohol in other injuries.[5]

4.8.1.3. Other risk factors

Other factors related to injury include poverty, residence in rural area and race. These factors have all been shown to be major factors in causing injuries in

industrialized countries[24,49] but few studies were available in developing countries. Poverty may be risk factors but evidence is not available in developing countries. One study in Brazil [5] using the educational status of head of households as proxy for socio-economic status showed that in households with low education the injuries in children 2.9 times was high than highly educated households.

According to Gumber [4] certain risk factors specific for Indian conditions in addition to sex, age, include marital status, socio-economic status including education whether covered under Employees' State Insurance (ESI) or other health insurance scheme, type of state, season, whether the village is located in an urbanized zone, and whether the urban patient is resident of a town/city.

4.8.2 Physical factors

Factors like visual acuity, Vitamin A deficiency and epilepsy are playing important role in causing injuries.[5]

4.8.3 Environmental risk factors

The people's customs and high-risk environment must be reason for the high incidence of animal and insect bites in developing countries especially in rural areas. This has been observed in the case of animal and insect bites. [5]

4.9 Consequences of injuries

4.9.1 Premature death and disability

An analysis of the leading causes of death shows that in most countries, irrespective of their level of development, accidents are among the top five leading causes of death. [29,50]

In addition to causing premature death, injuries are a significant cause for disability or time lost for normal activities and permanent crippling.[3] Around the world, almost 16, 000 people die from injuries every day and for every person who dies of injuries, several thousand injured persons survive, but many of them

are left with permanent disabling sequelae. Although mortality is a cardinal indicator of the magnitude of injuries as a worldwide health problem, it is important to emphasize that for each death from injury there are many more injuries that result in hospitalization, treatment in emergency departments, treatment by general practitioners or other health personnel, or no treatment at all. In many cases these injuries cause permanent disability. Disability-adjusted life years (DALYs) take account of this issue by combining the number of years of life lost from premature death with the loss of health from disability among persons with nonfatal injuries[3]. One DALY is 1 lost year of healthy life.

The RTA forms 22% of burden of injuries of DALYs lost followed by falls (11%), drowning (7%), fires (6%)poisoning (5%)among the unintentional injuries

According to WHO's Global Burden of Disease estimates, accidents as the cause of death and disability adjusted life years (DALY) will dramatically rise in the next 20 years.[1,3,50]

4.9.2 Cost of medical care and loss of productivity

The cost of medical care and loss of productivity due to injuries of all kinds globally, resulting from violence is almost US$ 500 billion annually [50] Globally 3% of GDP is lost due to road traffic injuries alone. In United States[49] an annual cost due to injury is of $210 billion to the nation. Injury caused the loss of thousands billion US dollars (accounting for 5% -6 % Gross National Product [GNP], 1993). [3,49]

4.9.3 Psychological problem

The consequences of accidents and violence extend far beyond physical injury. They include profound psychological implications for their victims [45,50]
The impact of socio-economic loss to individuals, households, society and infrastructure is very high.

4.10 Preventive strategy

Decreasing the burden of injuries is among the main challenges for public health in the next century—injuries are preventable, and many effective strategies are available. Public health officials must gain a better understanding of the magnitude and characteristics of the problem, contribute to the development and evaluation of injury prevention programs, and develop the best possible pre hospital and hospital care and rehabilitation for injured persons [51]

According to Centers for Disease Control and Prevention, "Injury is probably the most under recognized major public health problem facing the nation today, and the study of injury presents unparalleled opportunities for realizing significant savings in both financial and human terms—all in return for a relatively modest investment."[51] While most countries have recognized the high burden of morbidity and mortality resulting from injuries, it is only recently that injuries have been recognized as a public health problem in many countries around the world.[49]

Injuries are not random events.[3,4] They are preventable[24]. The use of seat belts; child car seats; helmets; designated drivers; flame-resistant clothing; smoke detectors; fencing around areas of water; and separate, locked storage of firearms and ammunition are among the measures that have contributed to decreasing injuries.

Prevention strategies need not be expensive.[24] Some strategies that have proven to be cost-effective in high-income countries can be adapted in low and middle-income countries. Examples include passing and enforcing seat belt and motorcycle helmet laws, and promoting safety equipment such as protective eyewear for certain types of jobs. For violence-related injuries, examples include mentoring programs for youth at risk of violence, school policies which favor non-violence, and home visitation by community social activists.

New strategies are also being devised in low and middle-income countries. These include the design and manufacture of motorcycle helmets appropriate to

warm climates, the painting of bicycles in highly visible colors and the production of safer stoves and fuels.

4.11 Injury predictable and preventable

Just as the occurrence of an injury requires the interaction of several factors, preventing one may require a mixture of countermeasures or interventions.[24] Injuries are predictable events and, as such, provide an opportunity to design interventions at many points prior to, during, and after the event to reduce the risk or severity of injury. Using the available science of injury control, we can begin to identify effective strategies for specific injury problems

According to WHO- SEARO, "Injuries have causes -- they do not simply befall us from fate or bad luck. To prevent injuries it is necessary to have information about the factors that contribute to their occurrence. With this information we may understand the options for prevention. Effective injury prevention requires a multifaceted, multidisciplinary approach[24]"

WHO recognizes that injuries cannot be effectively addressed by one sector alone. [24] With the public health sector acting as a convenor, experts from the fields of medicine, education, transportation, sociology, criminology, justice, urban planning and communications can play a crucial role in creating safe and healthy communities. This requires a commitment at the international, national and community levels to document the problem; craft, test and evaluate comprehensive solutions; and disseminate lessons learned.

Deaths and disabilities due to injuries have declined markedly in countries where such prevention efforts are established. A host of strategies at the individual, family and community levels have also shown promise in reducing violence-related injuries. These include substance abuse programmes, family counseling and school-based violence prevention initiatives. Prevention efforts need to go global. There is urgent need to adapt lessons learned to local realities to develop appropriate, cost-effective measures.[9]

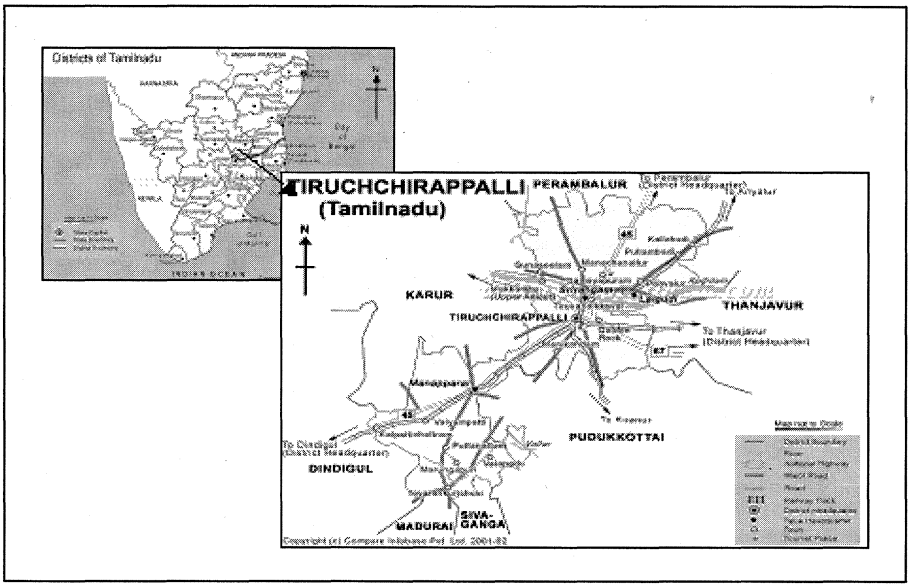
5.1 Study Design

A cross-sectional survey of all individuals in a selected sample of households using a reference period of 30 day preceding the date of interview was carried out.

5.2 Study setting

Tiruchirappalli district is situated at the centre of Tamil Nadu State India (Figure 4). Its boundaries are Thanjavur in the east, Karur in the west, and Namakkal in the north and Pudukottai in the south. It is located 320 km to the southwest of Chennai and 128 km north east of Madurai on the banks of the river Cauvery. The area is mostly plain and the river Cauvery flows through the city and is the source of water for domestic and irrigation purposes. It is one of the important industrial and pilgrimage centres. The economy of the district is essentially agrarian in nature. The setting up of a public sector undertaking industry Bharat Heavy Electricals Limited (BHEL) at Tiruverambur provided a base for industrial expansion.

Figure 4. Map of Tiruchirappalli District



Tiruchirappalli District has 49 primary health Centres (PHC) and 304 Health sub-centres (HSCs) spreading over 14 Blocks in the rural areas. Its population is about 25 lakhs including around 8 lakhs living in urban areas

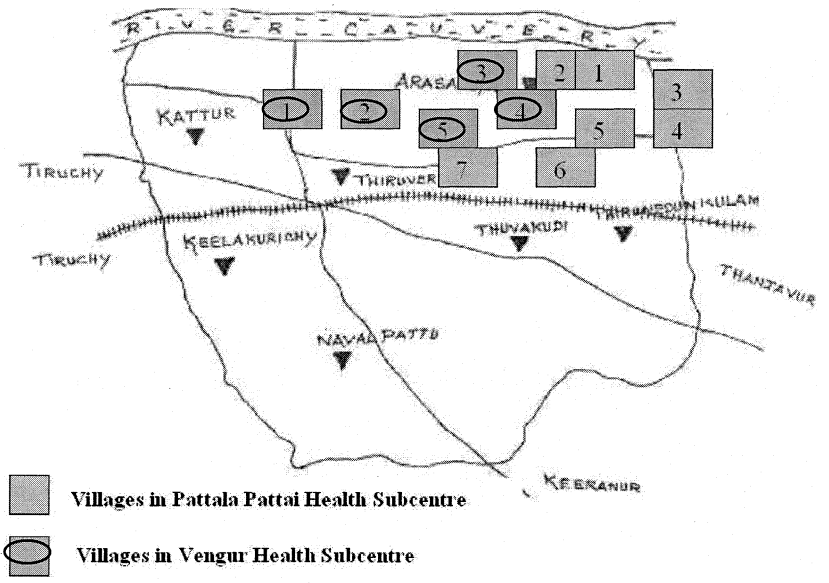
For operational convenience, Tiruverambur block, which is located 14 km East of Tiruchirappalli town, was selected. One rural PHC namely, Arasankudi (with a population of 30,000) was selected as a convenient sample from this block (Figure 5). This PHC represents one of the typical rural[60] (Appendix 1) PHCs in the block, situated 12 km away from national highway of Nagai-Gudalur-Mysore.

5.3 Study area

This Arasankudi PHC has five HSCs with a total population of 28,364. The present study was conducted in two randomly selected HSCs. The selected HSCs were Vengur and Pattala Pattai. These 2 HSCs have 12 villages. Arasankudi, Kiliyur, Krisnasamudram, Kotrapatti, Vengur, Pattala Pattai, are the main villages in the study area.

Arasankudi, the main village in the PHC area is located on the backyard of the famous dam Grand Anicut built on the river Cauvery. It is 12 Km away from Tiruverambur and 25 Km away from Tiruchirappalli city. River Cauvery is flowing just 1 km away from the Arasankudi village.

Figure 5. Location of study area, Tiruchirappalli District, Tamil Nadu



The study areas are well connected with neighboring villages and the district capital by village and highways roads. The river cauvery's tributaries are the main lifelines for irrigation for the entire PHC area. These areas are having small and large canals, ponds and lakes for irrigation fed by river cauvery and rainwater.

The people are mainly farmers who grow crops like paddy during season and pulses during off-season. The economy of the entire PHC area depends on the flow of water in the river Cauvery. For the past 2 years the agriculture activities and economy of this area is very much affected because of scanty and limited flow of water in the river Cauvery.

All but one of the 12 villages in the two selected HSCs have village road and link road connected to highways. In one village the approach road to high ways is not available. Except this village, all the other villages have Public transport facilities. All the villages are provided with electricity, protected water supply and primary schools. Sanitary facilities are not available. The available health facilities are the PHC at Arasankudi and HSCs at Vengur and Pattala Pattai. Few private allopathic, alternative and indigenous system medicine practitioners (ISM) are available

5.4 Sample Size

The required sample size is based on the assumption that incidence of unintentional (both fatal and non-fatal) injuries in the community would be around 15%. Alpha error was set at 5%. The required sample size for a relative precision of 10% would be,

$$\text{Sample size} = \frac{1.96^2 \times \textit{prevalence}\ \%\,(100 - \textit{prevalence}\ \%)}{\textit{precision}\ \%^2}$$

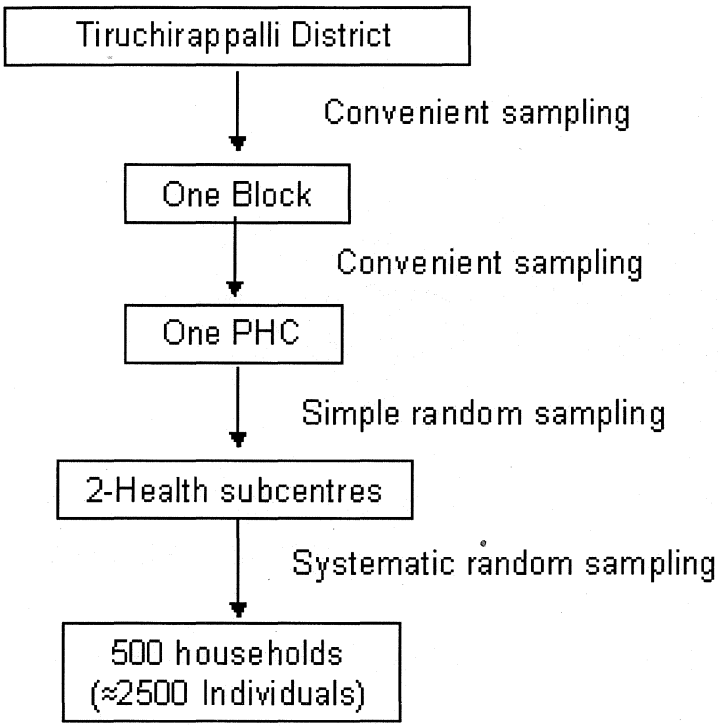
$$= \frac{1.96^2 \times 15 \times 85}{(1.5)^2} = 2177$$

Total sample size required would be approximately 2500 (after allowing for a little over 10% refusals and non-response). A sample of 500 households could be needed assuming that each household will have an average of 5 members.

5.5 Sampling strategy

Since the five HSCs under the Arasankudi PHC were similar in population size, two HSCs were selected by simple random sampling. An equal number of households were selected from each of the selected HSCs by systematic random sampling procedure (Figure 6).

Figure 6. Sampling method for selection of households



5.6 Selection and definition of variables

Operational definitions used in this study are given in Appendix 1.The Classification of injuries is based on the international classification of external causes for disease (ICD-9) for unintentional injuries.[21, 22,23]

5.7 Study Team

A two-member team was constituted, which included,

1. The MAE- FETP Scholar as a principal investigator
2. One helper (female health workers or Anganwadi Workers as per availability)

5.8 Study instruments

A semi-structured questionnaire was designed to interview the family members. Questionnaire is given as Appendix 2. The questionnaire has 2 parts: Form-A and Forms B –1 to B -7.

1. Specially designed, pre-tested and coded form for the household (Form-A)

Form-A included baseline data of the individual family and family members socio-demographic and economic characteristics, ownership of vehicle, injury related information, nature of injury, total numbers injured, total episode in the family.

2. A specially designed, pre-tested and coded form for different types of unintentional injuries (Form B –1 to B 7)

Forms B-1 to B-7 were used for each episode of injury in the family separately according to the type of injuries. The data collected include the details of date of occurrence of injury, time of occurrence injury, place of occurrence, what was the individual doing at the time of injury, brief description of the incident, parts of the body affected, type of injury, nature of wound, condition of the individual at the time of injury, treatment seeking behaviour, whether hospitalized or not, how many days, prevented from doing usual work, how many days.

5.9 Data collection procedures

The details regarding number of households in the HSCs were collected from the PHC registers. Since our sample size was 250 households from each of the selected HSCs, the total available households in the entire HSC were divided by 250, which turned out to be 4 in one HSC and 4.6 in another HSC. To have uniformity, it was decided to collect information from every 4^{th} houses in both HSCs. The households available in all villages in each HSC were numbered continuously as per the geographical contiguity of the village and every 4^{th} was selected by systematic random sampling procedure.

After selecting the first village namely East Vilankulam (of Pattala Pattai HSC), first 4 households were selected from the list and from the 4 households one was selected randomly by using the number available in rupee note which turned out to be 4. Hence, the first household for the study for all 12 villages was 4^{th} one and the 2^{nd} house was 8^{th} one. Like this, every fourth house was selected in all 12 villages available in the 2 HSC areas.

All the individuals present during the time of visit to the households were interviewed by the principal investigator himself. In the cases of children under 5 years, absence of an individual at the time of visit, or fatal accident, the data was collected from a responsible adult member of the family. All unintentional injuries-minor/major and fatal/non-fatal which occurred anywhere for the resident of study area during a 30-day reference period immediately preceding the date of interview was included. The injuries recorded were all of unintentional injuries like RTAs, falls, animal and insect bites, burns, accidental poisoning, accidental drowning, side effects of drugs, injuries resulting from surgical and medical complications and other minor injuries including occupational related injuries. The questionnaire was verbally administered in local language (i.e., Tamil).

From the selected household, general information regarding all the available household members, age sex, educational status, occupation, owning vehicle/house and met with any injury were collected in Form - A. If there was any history of injury in any of the household members, the detailed information

regarding injury were collected in Forms B-1 to B-7 separately for each member of the family and for each episode of injury.

5.10 Standardization of data collection

The data collection was standardized by undertaking a pilot study involving 39 households in a nearby village with similar socio-economic characteristics. The data collected were checked daily for its clarity, accuracy, and completion and coding. This was later entered into computer on a regular basis.

5.11 Data Collection period

The data collection has been done between August to November 2003

5.12 Reference period and date of interview

The reference recall period was 30-day immediately preceding the date of interview. So, the date of interview extended from August to October. The reference period was shifting from August to October (shifting reference period) since it was decided to stick to the recall period for 30-day preceding the date of interview. This reference and recall period was based on two assumptions:

1. There is no seasonal variation
2. There is no unusual occurrence of any activities (festivals or any calamity) in this area during that period

The 30-day recall period is based on the two reports of Ghana studies. [32,52] According to these studies, data on more serious injuries are less complete in developing countries. Hence, surveys are needed to evaluate not only the less serious injuries but also the more serious ones. For these more serious injuries, longer recall periods would be more appropriate. The more serious injuries are less common and a longer recall period would capture more of such cases for analysis. Moreover, the memory recall decay will be minimal for these serous injuries and longer recall period would lead to minimal bias in estimated rates. This has been discussed at length during the meetings of International Collaborative Effort on Injury Statistics, 2003.[53, 54]

For the estimation of non-fatal injury rate (including lesser as well as more severe non-fatal injuries), for the countries of similar environments, shorter recall period has been advocated. In other words, the minor injury rate was estimated from the most recent month of recall time and a major injury rate was estimated from one year recall period.

5.13 Data entry and analysis

The collected data for all the individuals were entered in Epi Info 6.04 d. The data was analysed by baseline characteristics of study population and incidence of unintentional injuries by different types and severity.The estimate was reported with their 95% confidence intervals. Chi square tests (Yates corrected) were used as test of significance and 'p' value of less than 0.05 was considered statistically significant.

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6.1 Study Population

The population of the study area is around 9,012 with 2,159 households spreading over 12 villages in two HSCs. By systematic random sampling procedure, every 4th house was selected. Among the 550 selected households, 502 households with a population of 2216 could be contacted and data collected (Table 6). The response rate was 91.3%.

Table 6. Distribution of study population, Tiruchirappalli, Tamil Nadu, 2003

Name of the Health sub centre	Number of villages	Number of households	Population	Number of households surveyed	Population surveyed
Pattala	7	1028	4254	229	1010
Pattai					
Vengur	5	1175	4758	273	1206
Total	12	2203	9012	502	2216

The distribution of study population by villages is provided in Appendix 3.

6.1.1 Profile of non-respondents

Out of 550 households, 502 households were surveyed and the remaining 48 households could not be contacted because the houses were found locked at two visits. The information gathered from the neighboring households indicated that none were residing in 10 households. The remaining households were having the population of 168 with less than 15-year population 48 and above 15-year population 120. The age distribution of non-respondents was closely similar to that of respondents (Table 7).

Table 7. Distribution of non-respondents in the study population, Tiruchirappalli, Tamil Nadu, 2003

Age-group (in years)	Respondent			Non-Respondent		
	Male	Female	Total	Male	Female	Total
<15	301	310	611 (27.6)	22	26	48 (28.5)
≥ 15	777	828	1605 (72.4)	56	64	120 (71.4)
Total	1078 (45.6)	1138 (53.4)	2216 (100)	78	90	168 (100)

6.1.2 Proxy respondents

Data on injury were collected from all available household members present at the time of survey. The information for the children and others who were not present at the time of interview was [(n=50) among the injured] collected from other members of the households. Among the proxy respondents, 181 were for the under 5 years, 210 for 5-14 and 217 for the above 15 age-group.

6. 2 Demographic characteristics of study population

6.2.1 Age and sex distribution

Among the surveyed population, 1078 (48.6%) were males and 1138 (51.4%) were females. The age of the population ranged from 1-90 years (Median: 27 years) [Table 8]

Table 8. Distribution of the study population by age and sex, Tiruchirappalli, Tamil Nadu, 2003

Age-group	Male n (%)	Female n (%)	Total n (%)
0-4	76 (7.0)	105 (9.2)	181 (8.2)
5-14	225 (20.9)	205 (18.0)	430 (19.4)
15-44	552 (51.2)	583 (51.2)	1135 (51.2)
45-59	149 (13.8)	176(15.5)	325 (14.7)
60 & above	76 (7.0)	69 (6.0)	145 (6.5)
Total	1078 (48.6)	1138 (51.4)	2216

The sex ratio for Tiruchirappalli district was 1000 (1000 female /1000male) and the percent of widow was around 10% and this could be reason for high percent of female in this study area. The reason for the high percent of widow was not investigated.

6. 3 Socio-economic characteristics of the study Population

6.3.1 Type of houses

In the study population, 46% were living in well-built houses including mansion and 19 % were living in huts (Table 9)

Table 9. Type of houses in the study area, Tiruchirappalli, Tamil Nadu, 2003

Type of house	n (%)
Hut	419 (19)
Kutcha	283 (13)
Mixed	488 (22)
Pucca	814 (37)
Mansion	214 (9)

6.3.2 Educational status

The educational status of the study population is given in table 10. The proportion of illiterate accounted for highest (27%) followed by primary level 24% and the middle level 20%. Among the adults, (15 years and above) slightly lower percent (25%) was illiterate. slightly higher percent (8.6%) had college/professional education. Proportion of illiterates was more than double among females as compared to males in the 15 and above age-group. Proportion of male in the college/ professional education was more than double compared to female.

Table 10. Educational status of the study population by age and sex, Tiruchirappalli, Tamil Nadu 2003

Education	0-14 years (n=611)			15 and above (n=1605)			Overall
	Male n (%)	Female n (%)	Both n (%)	Male n (%)	Female n (%)	Both n (%)	
Illiterate	86 (28.5)	108 (34.8)	194 (31.0)	120 (15.4)	281 (33.9)	401 (25.0)	595 (26.8)
Primary	131 (43.5)	119 (38.4)	250 (40.0)	133 (17.0)	149 (17.9)	282 (17.5)	532 (24.0)
Middle School	63 (20.9)	57 (18.4)	121 (20.0)	165 (21.2)	160 (19.3)	325 (20.0)	445 (20.0)
High School	21 6.9)	26 (8.4)	46 (9.0)	200 (25.7)	120 (14.5)	320 (20.0)	367(16.6)
Higher Secondary	0	0	0	62 (8.0)	76 (9.1)	138 (8.5)	138 (6.2)
College	0	0	0	69 (9.0)	28 (3.4)	97 (6.0)	97 (4.4)
Post Graduate / Professional	0	0	0	28 (3.6)	14 (1.7)	42 (2.6)	42 (1.9)
Total	301	310	611	777	828	1605	2216

6.3.3 Occupational status

The different occupations that the people were engaged in are shown in table 11. Forty eight percent of the population was not gainfully employed. Out of 1066 not gainfully employed people 635 were children and students.

Table 11. Occupational status of the study population, Tiruchirappalli, Tamil Nadu, 2003

Type of Occupation	n (%)
Not gainfully Employed	1066 (48.0)
Unskilled Laborers	805 (36.0)
Skilled Laborers	161 (7.3)
Small Business	59 (2.7)
Independent profession	1 (0.04)
Cultivator	87 (4.0)
Service	37 (1.7)

635/1066 were children and students

6.3.4 Socio- economic status

Socio-economic score (SES) was constructed using variables like caste, education, occupation and type of house [Appendix 4] The minimum and maximum scores were 3 and 21. SES was used to divide the study population into three socio-economic groups. The lowest one-third being low, middle one-third being medium and the highest one-third being high socio-economic group. The percent of low, medium and high socio-economic groups were 36%, 40% and 24% respectively.

6. 4 Incidence of unintentional injuries

Totally 213 individuals reported unintentional injuries in the study population for the 30-day recall period immediately preceding the date of interview. Among the injured, 10 persons reported more than one episode of unintentional injury. Thus totally 223 episodes of injury occurred in the study population. All reported injuries were non-fatal in nature.

The overall incidence of unintentional injuries in the studied rural population was 9.6 % [95% Confidence Interval (CI): 8.4, 10.9].

The incidence of unintentional injuries was 10.4 % (95% CI: 8.6, 12.7) in Pattala Pattai and 8.9 % (95% CI: 7.4,10.7) in Vengur HSCs (Table 12). The village wise incidence of injuries was similar for all the villages surveyed.

Table 12. Incidence of unintentional injuries by Health sub-centre, Tiruchirappalli, Tamil Nadu, 2003

Health subcentre	Total Injured	Incidence (%) (95 % CI)
Pattala Pattai	105	10.4 (8.6,12.5)
Vengur	108	8.9 (7.4,10.7)

The incidence of injuries among different castes, education, occupation and other individual socio-economic variables did not show any significant difference.

6.4.1 Incidence of unintentional injuries by age and sex

In the total sample among the different age-groups, the incidence of unintentional injuries was lowest in 15-44 age- group (8.7%) and highest in 0-4 age-group (12.2%). The difference in the incidence among different age-groups and sex were not statistically significant (χ^2=2.14; p=0.71) (Table 13)

Table 13. Incidence (%) of unintentional injuries by age and sex, Tiruchirappalli, Tamil Nadu, 2003

Age -group	Male n (%)	Female n (%)	Total n (%)
0-4	14 (18.4)	8 (7.6)	22 (12.2)
5-14	28 (12.4)	17 (8.3)	45 (10.5)
15-44	60 (10.9)	39 (6.7)	99 (8.7)
45-59	16 (10.7)	17(9.7)	33 (10.2)
60 +	9 (11.8)	5 (7.2)	14 (9.7)
Overall	127(11.8)	86 (7.6)	213 (9.6)

The overall incidence of unintentional injuries among males was 11.8% (95% CI: 9.95, 13.9) and among females 7.6% (95% CI: 5.9, 8.9). The incidence of unintentional injuries among male was higher than among female (χ^2= 10.88; p=0.00004). The incidence in females compared to males was constantly lower in all age-groups.

6.4.2 Incidence of unintentional injury by socio-economic status

The incidence of unintentional injury by different socio-economic groups is shown in table 14. The difference in the distribution of unintentional injuries among various socioeconomic groups was found statistically significant. (χ^2=6.21;p=0.05). Age and sex stratified analysis did not show any significant difference.

Table 14. Incidence of unintentional injury by socio-economic status, Tiruchirappalli, Tamil Nadu, 2003

Socio-economic group	Incidence of Injury n (%)
Low	72 (9.2)
Medium	101 (11.3)
High	40 (7.4)

6.5 Incidence of unintentional injuries by type

The incidence for the different types of injuries is given in Table 15. The incidence of minor injuries was high (3.4%)compared to other types like falls (2.9%) and animal bite (1.6%). The proportional incidence was highest for minor injuries followed by falls, animal and insect bites, RTA and burns (Table 16).

Table 15. Incidence (%) of various types of unintentional injury by sex, Tiruchirappalli, Tamil Nadu, 2003

Type of Injuries	Number injured	Incidence (%)		
		Overall	Male	Female
		% (95% CI)*	n (%)	n (%)
Road traffic accidents	22	1.0 (0.7, 1.6)	12 (11.1)	10 (8.8)
Falls	65	2.9 (2.3, 3.7)	41(38.0)	24 (21.0)
Animal and insect bites	35	1.6 (1.1, 2.2)	17(15.8)	18 (15.8)
Burns	15	0.7 (0.4, 1.1)	3 (2.8)	12 (10.5)
Minor Injuries	76	3.4 (2.7, 4.3)	54 (50.0)	22 (19.3)
Overall	213	9.6 (8.4, 10.9)	127 (117.8)	86 (75.6)

* 95% Confidence Interval

Table 16. Proportional incidence (%) of various types of unintentional injury, Tiruchirappalli, Tamil Nadu, 2003

Type of Injuries	Number (%) injured	Male n (%)	Female n (%)
Road traffic accidents	22 (10)	12 (9.4)	10 (11.6)
Falls	65 (30)	41 (32.3)	24 (27.9)
Animal and insect bites	35 (17)	17 (13.4)	18 (20.9)
Burns	15 (7)	3 (2.4)	12 (14.0)
Minor Injuries	76 (36)	54 (42.5)	22 (25.6)
Overall	213 (100)	127 (100)	86 (100)

6.5.1 Incidence of type of unintentional injuries by age and sex

Nearly a third of the male were injured due to falls whereas more female were affected due to burns than male. Minor injuries were more in male than female. (Table 16).

Among the different type of injuries, injury falls and minor injuries were high (Table 17) and RTA was low in male when compared to female. Similarly the age-specific incidence showed that falls was highest among 0-4 age-group (144 per 1000) followed by minor injuries in 45-59 age- group (60 per 1000). (Table 17)

Table 17. Incidence (per 1000 population) of type of unintentional injuries among males, Tiruchirappalli, Tamil Nadu, 2003

Type of Injuries	Age-group				
	0-4	5-14	15-44	45-59	60 +
Road traffic accidents	0	9	11	13	13
Falls	144	71	18	13	39
Animal and insect bites	0	9	18	20	26
Burns	0	4	4	0	0
Minor Injuries	39	31	58	60	39
Total	184	124	108	107	118

Among females, the incidence of falls was high (48 / 1000) in 5-14 age-group and low in RTAs (5 / 1000) in 15-59 age- group and in 60 and above age-group (0/1000) (Table 18).

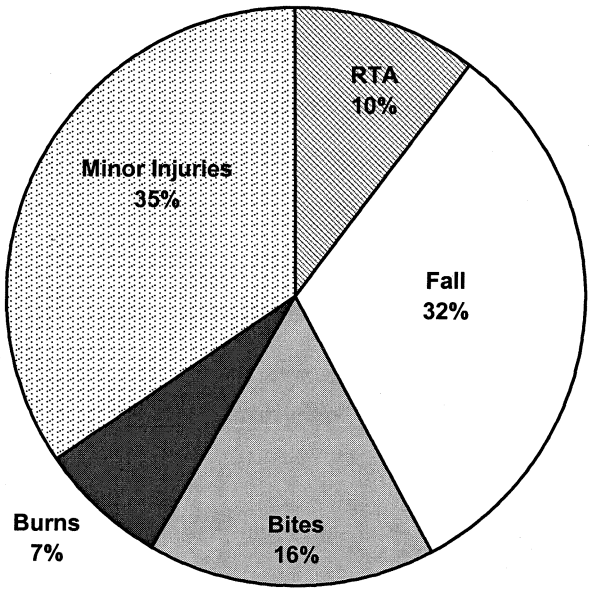
Table 18. Incidence (per 1000 population) of type of unintentional injuries among females, Tiruchirappalli, Tamil Nadu, 2003

Type of Injuries	Age-group				
	0-4	5-14	15-44	45-59	60 +
Road traffic accidents	10	24	5	5	0
Falls	28	48	7	22	43
Animal and insect bites	0	0	21	28	14
Burns	19	0	17	0	0
Minor Injuries	19	10	17	40	14
Total	76	83	67	97	70

6.6 Description of type of unintentional injuries

The various types of unintentional injuries reported from the study area are shown in figure 7. The highest percent of injuries were minor injuries (35%) and the lowest were burns.

Figure 7. Distribution of unintentional injuries by type, Tiruchirappalli, Tamil Nadu, 2003



6.6.1 Road Traffic Accidents (n=22)

Out of 213 persons who reported injuries, 22 were due to RTAs and they formed 10.3% of the total injured persons. All injuries due to RTA were non-fatal in nature in this study. Among those injured in RTA, 13 (56%) were males and remaining females.

The overall incidence of RTA was 1.03% (95% CI: 0.7-1.6). The place of occurrence varied from streets to National Highways. Among the 22 persons injured in RTA, 16 (72%) were prevented from doing usual work (the duration ranging from 1 to 25 days) and 9 (40%) persons were hospitalized for 2 to 21 days. The place of occurrence of RTA varied from country roads (n=9), state highways (n=9) and national highways (n=4). The nature of activities they were doing at the time of RTA were walking on the road, driving vehicles (like riding

bicycle, motorcycle and bullock cart), pillion riding (cycle, motorcycle) and as passengers traveling in vehicles such as lorry, bullock cart and shared auto rickshaw (n=3). The maximum number of RTAs occurred around 17 hrs (n=5).

6.6.2 Falls (n=65)

The overall incidence of unintentional injuries due to falls was 2.9 % (95% CI: 2.3, 3.7). Sixty three percent (n=41) of them were males. Within the different age-groups, 5-14 age-group was affected more than any other group in both males and females. The different activities they were involved during the onset of injuries varied from playing 43 (66%), sleeping and work related activities (each 12%) and other household and leisure activities. The number of persons prevented due to injuries from usual activities was 16 (25%). Among the injured due to falls, 2 persons were hospitalized. The site of fall was mainly on the ground 58(89%), and the nature of fall from a height was 12%. Maximum number of falls occurred in the mid-afternoon (n=16).

6.6.3 Animal and insect bites (n=35)

The incidence of animal and insect bite was 1.6 %. Among them, 51% were females and 49% were males. Among the different age-groups, 15-44 was more affected (63%) followed by 45-59 years (22%). The animals / insects that bit the victims were: scorpion (48%), dog (17%), and other animals like centipedes, rat, snake and unknown animal (8.5% each). Within the house 45% of the animal /insect bites occurred and the remaining outside the house. Outcome of the animal and insect bites were that 71% were prevented from usual activities and 14% were hospitalized. In this study, all the animal and insect bites were non-fatal in nature. In 63% of the animal and insect bites, the lower limbs were affected. The highest frequency of occurrence of animal and insect bites at various time were 7.30 hrs (n=3), 13.30 hrs (n=3), 19.30 hrs (n=4), and 23.30 hrs (n=4).

6.6.4 Poisoning and drowning

During the 1-month recall period, neither accidental poisoning nor drowning was reported.

6.6.5 Other minor injuries (n=78)

The reported unintentional injuries due to minor injuries were 78 (incidence of 3.3%). Majority of the injuries occurred among males (72%). Among the different age-groups, 65% were in 15-44 groups. All the minor injuries were non-fatal and in 40% of the cases, were prevented from usual activities. In 4% of the cases, the victims had to be hospitalized. Around 64% of the minor injuries were occupational in nature. The instruments, which caused the unintentional injuries, were: knife, wood, stone, bricks, spade, crowbar etc. Maximum number of minor injuries occurred at 12.30 and 14.30 hrs (n=16 each).

6.6.6 Occupational injuries (n=77)

The incidence of occupation related injuries were 34 per 1000 population (n=77). It constituted 36% of all reported unintentional injuries. Majority (64%) of the occupational injuries were minor injuries in nature. The other types of injuries related to occupation included RTA, falls, animal and insect bites, fires and burns. Among the occupational injuries, 77% (n=59) were prevented from their usual work and 8% were hospitalized.

6.7 Top four causes of unintentional injuries in different age-group

Table 19 shows the relative position of type of unintentional injuries in different age-groups. The proportion of injury falls was high in less than 15 years whereas in 15 and above age- group it was minor injuries. Among those aged 60 years and above the top most was falls. It is interesting to note that among 15-44 age-group, RTA was not ranked among first four ranks.

Table 19. Top four causes of injuries, Tiruchirappalli, Tamil Nadu, 2003

Age-group	Number injured n (%)	Top four causes n(%)	Number injured n (%)
0-4	22 (10.3)	Falls	14 (63.7)
		Minor Injuries	5 (22.7)
		Burns	2 (9.0)
		Road Traffic Accidents	1 (4.5)
5-14	45 (21.13)	Falls	25 (55.6)
		Minor injuries	9 (20.0)
		Road Traffic Accidents	8 (17.8)
		Animal and insect bites	2 (4.4)
15-44	99 (46.5)	Minor injuries	42 (42.4)
		Animal and insect bites	22 (22.2)
		Road Traffic Accidents	14 (14.1)
		Burns	12 (12.1)
45-59	33 (15.5)	Minor injuries	16 (48.9)
		Animal and insect bites	8 (24.2)
		Falls	6 (18.2)
		Road Traffic Accidents	3 (9.1)
60 +	14 (6.6)	Falls	6 (42.9)
		Minor injuries	4 (28.6)
		Animal and insect bites	3 (21.4)
		Road Traffic Accidents	1(7.1)

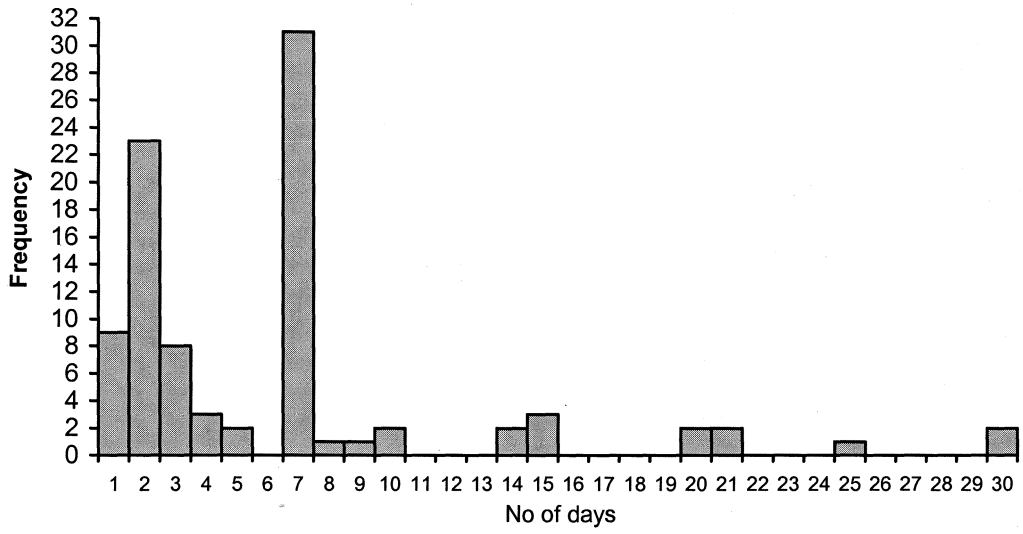
6.8 Outcome of unintentional Injuries

The outcome of unintentional injuries is presented as injuries that prevented the individual from usual work and those needed / resulted in hospitalization.

6.8.1 Prevented from usual work

Out of 213 injured persons, 121 (57%) were prevented from their usual work. Thus, incidence of unintentional injury that prevented the individuals from usual work was 5.5 % (95% CI: 4.6-6.5). The number of days prevented from usual work ranged from 1 to 30 days (Figure 8).

Figure 8. Distribution of days prevented from usual work due to unintentional injuries, Tiruchirappalli, Tamil Nadu, 2003



6.8.1. 1 Types of injury that prevented injured from usual work

The different types injuries that prevented the usual daily work are shown in table 20. The highest percent was in minor injuries and lowest in burns. Among the injured, males were prevented more from usual work than females and similarly in different age-group males were prevented more from usual work than females (Table 21). The proportion prevented from usual work was higher among those who sustained injuries outside the home than within the households (Table 22).

Table 20. Distribution of unintentional injuries that prevented the injured from usual work, Tiruchirappalli, Tamil Nadu, 2003

Type of injuries	Number (%) prevented from usual work
Road traffic accidents	16 (13.0)
Falls	25 (20.6)
Animal and insect bites	31 (26.0)
Burns	2 (1.6)
Minor injuries	48 (40.0)
Total	121 (100)

Table 21. Distribution of unintentional injuries that prevented the usual work by age and sex, Tiruchirappalli, Tamil Nadu, 2003

Type	<15 years			15 &above		
	Male	Female	Total	Male	Female	Total
Road Traffic accidents	1	3	4	7	4	11
Falls	5	2	7	9	9	18
Animal and insect bites	2	0	2	13	16	29
Burns	0	0	0	0	2	2
Minor injuries	2	2	4	34	10	44
Total	10 (58.8)	7 (41.2)	17 (58.8)	63 (74.0)	41 (67.0)	104 (49.0)

Table 22. Distribution of unintentional injuries that prevented the usual work by place of occurrence, Tiruchirappalli, Tamil Nadu, 2003

Place of occurrence of injury	Number of injured persons	Prevented from usual work n (%)
Within the house	50	26 (52.0)
Out side the house	163	95 (58.3)
Total	213	121

6.8.1.2 Hospitalization due to unintentional injuries

Among the injured persons, 20(9.3%) were admitted in hospitals for treatment (Table 23). The incidence of injury resulting in hospitalization was 0.9 per 100 population (95% CI: 0.6-1.4). The number of days of hospitalization ranged from 2 to 20 days (Figure 9). The various causes for hospitalization are shown in tables 18. The hospitalization was high among those who were injured in a RTA. Similarly, in different age-groups, males were hospitalized more than females in both the age-groups (<15 and ≥15 years).

Table 23. Hospitalization due to unintentional Injuries (n=20), Tiruchirappalli, Tamil Nadu, 2003

Type of Injuries	Total number of injured	No. (%) admitted in hospitals
Road Traffic Accidents	22	9 (40)
Falls	65	2 (3)
Animal and insect bites	35	5 (14)
Burns	15	0 (0)
Minor Injuries	76	4 (5)
Total	213	20 (9.3)

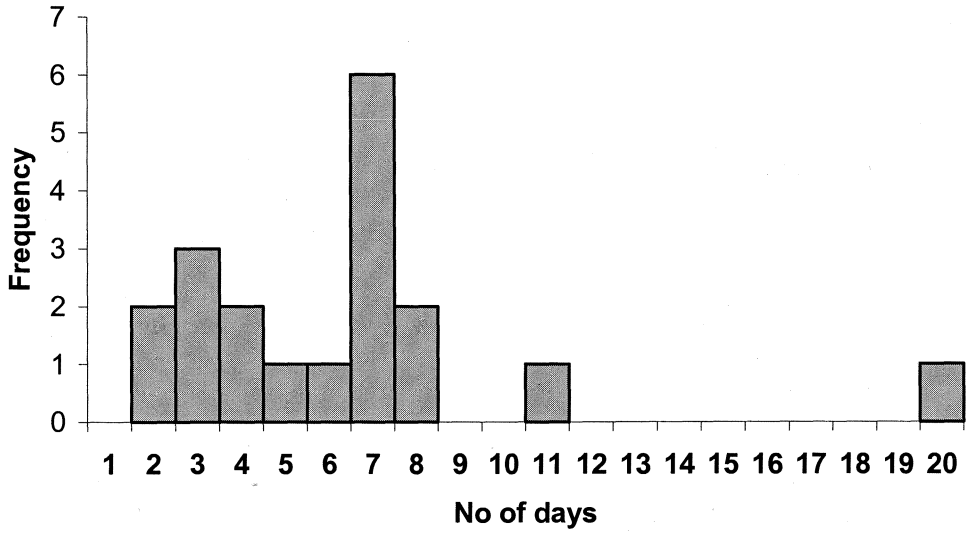
Among those hospitalized due to injury, 85% had treatment in private nursing homes and hospitals including the indigenous system medicine and 15% were hospitalized in district and other government general hospitals (GGH) (Table 24).

Table 24. Distribution hospitalization by different hospitals, Tiruchirappalli, Tamil Nadu, 2003

Type of injury	Type of Hospital*					
	Private	Government			ISM	Total
		HSC	PHC	GGH		
Road traffic accidents	6	0	0	2	1	9
Falls	1	0	0	0	1	2
Animal and insect bites	1	0	0	1	3	5
Burns	0	0	0	0	0	0
Minor injuries	3	0	0	0	1	4
Total	11	0	0	3	6	20

*HSC = Health subcentres; PHC = Primary Health Centre; GGH = Government General Hospital; ISM = Indigenous System of Medicine

Figure 9. Distribution of days of hospitalization due to unintentional injuries, Tiruchirappalli, Tamil Nadu, 2003



6.9 Type of unintentional injuries by place of occurrence

Approximately 24 % (n=50) of the reported injuries occurred within the household environment and the remaining 76% (n=163) occurred outside the houses. The type of injuries as per site of occurrence is shown in table 25. The common sites were the workplace, schools, streets, state highways and national highways.

Table 25. Place of occurrence of various types of unintentional injuries, Tiruchirappalli, Tamil Nadu, 2003

Type of Injury	Within the house n (%)	Outside the house n (%)	Total
Road traffic accidents	0	22 (14)	22
Falls	9 (18)	56 (31)	65
Animal and insect bites	16 (32)	19 (12)	35
Burns	10 (20)	5 (3)	15
Minor Injuries	15 (30)	61 (37)	76
Total	50	163	213

6.9.1 Household injuries (n=50)

The proportion of injuries that occurred within the household was 23%. The commonest type of injuries were animal/insect bites (32%), minor injuries (30%). The other types of injuries observed were burns (20%) and falls (18%). The age and sex distribution of injuries within the houses are given in table 26. The highest number of injuries was among the 15 and above age-group (n=41) and 65% of them occurred among females.

Table 26. Distribution of household unintentional injuries by age and sex, Tiruchirappalli, Tamil Nadu, 2003

Type	<15 years			15 and above		
	Male	Female	Total	Male	Female	Total
Road Traffic Accidents	0	0	0	0	0	0
Falls	1	0	1	4	4	8
Animal and insect Bites	0	0	0	6	10	16
Burns	1	2	3	1	6	7
Minor injuries	3	2	5	3	7	10
Total	5	4	9	14	27	41

6.9.1. 1 Preventable injuries that occurred within the households

The number of unintentional injuries that occurred within the house was 50. Among them, preventable injuries were 82% (n=41). The commonest preventable injuries were burns that occurred while cooking (n=7), falls within the house (n=4), animal and insect bites while sleeping in the house (n=9), minor injuries while doing some household activities like cutting vegetables, cutting wood and thorn (n=8), milking the animals (n=2) and cleaning the houses (n=8).

6.9.2 Injuries that occurred outside the home

The commonest type of injuries that occurred outside the home was occupational. The incidence of occupational injuries was 34 per 1000 population. Occupational injuries (n=77) constituted 36% of all reported unintentional injuries (Figure 3). The type of injuries that occurred outside the home included RTA (13.5%), falls (34 %), animal and insect bites (13%) burns and fires and minor injuries 39% (n=163) (Table 27). The age and sex distribution of injuries are given table 22. The number of injuries in 15 and above age-group was high (n= 65) when compared to other age-group (<15 years). The proportion was higher among males than females.

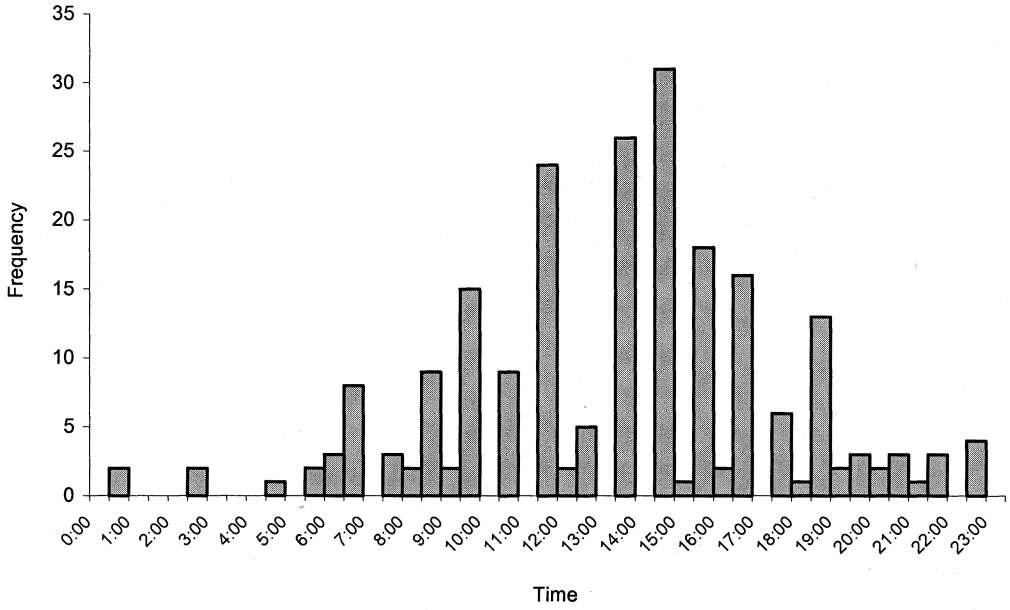
Table 27. Distribution of number of injuries that occurred outside the home by age and sex, Tiruchirappalli, Tamil Nadu, 2003

Type	<15 years			15 and above		
	Male	Female	Total	Male	Female	Total
Road Traffic Accidents	2	6	8	10	4	14
Falls	25	13	36	11	7	18
Animal and insect bites	2	0	2	9	8	17
Burns	0	0	0	1	4	5
Minor injuries	7	2	9	41	11	52
Total	36	21	57	72	34	106

6.10 Time of occurrence injuries

The time of occurrence of unintentional injury is described for the total number of episodes reported (n=223). The time of occurrence of injuries ranged from 1 a.m in early morning unto 23 hrs in the night. The maximum number of injuries occurred during the daytime between 6 hrs to 18 hrs. The highest number injuries occurred at 15 hrs (n=31) (Figure 10).

Figure 10. Time distribution of unintentional injuries*, Tiruchirappalli, Tamil Nadu, 2003

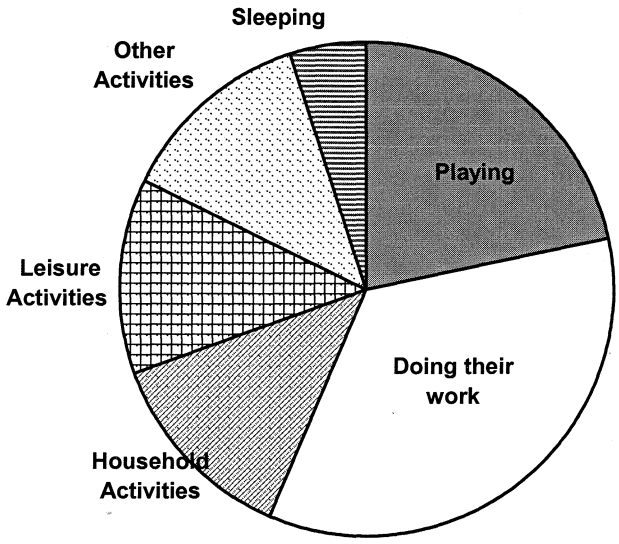


* presented for total number of injury episodes reported (n=223)

6.11 Nature of work done at the time of injury

At the time of occurrence of unintentional injuries, 36% of the injured were working at their work environment (agricultural field, factory and other work places). Twenty two percent was injured while playing either in school or in the streets and 13% of them were doing household activities. About 5% of the people were injured while sleeping in the night (Figure 11). The injuries that occurred while sleeping were animal and insect bites and falls. The other activities carried out at the time of injuries were animal rearing, milking, and returning from schools and work places.

Figure 11. Nature of activities performed at the time occurrence of injuries, Tiruchirappalli, Tamil Nadu, 2003



6.12 The nature of wound and the parts of the body affected due to injuries

The main parts affected due injuries were the forearms including wrist and the legs below the knee. The most frequent type of wound was open wound or laceration (70%) followed by superficial wound (20%).

6.13 Treatment seeking behaviour

Among the injured persons, 194 (91%) had treatment and 19 (9%) did not have any type of treatment. The different institutions where they had treatment vary from home to district hospitals (Table 28). Among those who got treated (n=194), about 43% had self-treatment within their household and 30% went to private practitioners. Approximately 14% approached the government institutions like HSCs, PHCs and GGHs. Around 10% of the injured were treated as in-patient in various hospitals. Among the different types of injuries, all those who met with RTA and animal and insect bites had treatment.

Table 28. Distribution of unintentional injuries by place of treatment, Tiruchirappalli, Tamil Nadu, 2003

Type of injury	Type of Hospital					
	Self	Private	Government**			ISM
			HSC	PHC	GGH	
Road traffic accidents	2	11	0	5	3	1
Falls	31	17	3	3	0	4
Animal and insect bites	4	9	0	3	0	19
Burns	13	1	0	0	0	0
Minor injuries	30	21	2	9	0	3
Total	80 (42.6%)	59 (30.0%)	5 (2.5%)	20 (10.0%)	3 (1.7%)	27 (13.7%)

**HSC = Health Subcentres; PHC = Primary Health Centre; GGH = Government General Hospital; ISM = Indigenous System of Medicine

6.14 Health facilities available in the study area

There are two HSCs with trained multi- purpose health workers and one primary health centre (PHC) located in the study area (Table 29). The block PHC with in-patient facilities is situated 15 – 20 km away from the study areas. In addition, 10-15 indigenous system of medicine practitioners and two allopathic doctors are available. The available facilities (including the Block PHC) can provide first- aid and follow- up care to the injured individual. In-patient facilities and ambulance services are not available in the study area. The working time for the PHC Is between 8 hrs to 17 hrs. The nearest referral hospital is the medical college hospital situated 15 –25 km away from the study areas.

Table 29. Available health facilities in the study area, Tiruchirappalli, Tamil Nadu, 2003

Facilities	Availability
Hospital	One Primary Health Centre and two Health subcentres
Private doctors	3 allopathic doctors 10 Indigenous system of medicine practitioners
Ambulance services	Not available

Incidence of unintentional injuries

The overall incidence of unintentional injures in the study area was 9.6% indicating that injury is a problem of public heath concern in this area. However, the incidence is lower than the expected level based on results of similar population based studies conducted in India and elsewhere.[10-17,32] The main occupation of this region is agriculture, which was very much affected for the past few years. This year also, the agricultural activities came to standstill during the study period (August to October) due to non-availability of water in the river, which is the main source of livelihood in this area. Further, alternative employment opportunities are lacking in this area. These might be one of the reasons for low incidence reported in this study.

In India, very few community-based studies were undertaken on injuries.[10-17] Most of these were either urban or hospital- based studies except the study done by Gordon and colleagues[10] in rural Punjab. The Punjab study was conducted more than 40 years ago and at that time the infrastructure and mechanized transport facilities were not so developed. So, the estimates of that study are not comparable with the present study.

Epidemiological studies based on interview data are likely to underestimate the rates because of under reporting. [55] However, underestimate is likely to be low in this study because principal investigator interviewed the people personally. The rural people, in general, were very co-operative in giving information. The recall-period is sufficiently shorter to avoid bias associated with longer periods of recall.[32,52,54]

Of the 550 households in the study sample, 10 were unoccupied and another 38 occupied houses were found locked on two visits. The age and sex distribution of household members from whom the data on injuries could not be collected, was closely similar to the members of 502 households from whom the data on injuries was collected. Hence, it is unlikely that the estimate of injuries obtained in this study is affected by non-response.

The injury data presented here were only of unintentional type. Even though the investigator came across intentional injuries during the survey, the details were not recorded because of time constraints and other problems in elucidating the details of injury. Moreover, the main objective of this study was to estimate the incidence of unintentional injuries and their nature on a pilot-scale to plan future surveys on larger and more representative samples for developing preventive strategies.

Incidence of injuries by age and sex

The incidence of injuries was more in male than female. This was consistently seen in all ages. This could be due to the fact that males were usually engaged in outdoor activities including traveling in motor vehicles. So, in any type of injuries that occurs outside the home males are likely to be at higher risk than females. This incidence difference by gender was consistent with most of the community-based studies and hospital based also. [3,5,10-17,32,] and inconsistent with Malaysian study where household injuries were common than injuries occurring outside.[56] The overall incidence of unintentional injuries in different age-groups indicated that it was highest in 15-44 age-group and also similar in both the sexes. Next was the 5-14 age-group in male and whereas in female it was in both 5-15 and 45-59 age-groups. This age distribution was consistent with other studies like Ghana and Uganda and Indian studies. [3,5,10-17,32,34]

Pattern of unintentional injuries

In this rural population of predominantly agricultural workers, despite the current low agricultural activities, the leading contributor to disability was due to agricultural and other occupational injuries. These findings were consistent with other studies.[32, 34] A high rate of morbidity due agricultural injuries has also been reported by community-based surveys in India.[7,10,11, 16, 57]

Minor injuries due to occupational and other household activities were the commonest type of injuries. The common causes for the minor injuries were due to stone or pot or heavy article falling on the limbs, falling down while playing,

Struck by object while walking, cutting or piercing while doing household and occupational activities like cutting vegetables with knife, digging the mud with spade, crowbar, cutting the wood, etc. The incidence of minor injuries was 3.3%, which was comparable with other similar studies.[32, 34] The minor injuries formed 36% of reported unintentional injuries in the total injuries during the 30-day recall period of which majority were due to occupational activities. This finding of high percent of injury due to agricultural activities was consistent with study by James [57].

The second common type of injuries in this area was injuries due to falls. This finding is consistent with other studies.[32,34,58] Falls have been reported as responsible for the largest number of hospital visits for non-fatal injuries, especially for children and young adults.[22,32] The most common causes of falls reported in the study sample were slips and loss of balance, falls from trees, children falling from ground while playing, older people slipped in the bath room, falls among construction, and agricultural workers. These findings are consistent with other studies.[22,24,32,34,42] The proportion of injuries due to falls was 30 per cent, which is similar to findings from a hospital-based study.[20] As discussed by Kobusingye and co-workers,[34] injuries in children and old people might reflect the high risk due to environmental factors like lack of play facilities, inadequate supervision of parents over their children, uneven street surfaces and village roads and inadequate bathing facilities. The proportion of injuries due to falls was pronounced in children and old age people. This is in agreement with findings from Ghana[32] and other studies[34]. The high incidence of injuries due to falls reported by studies from Western countries in young adults is not seen in the present study and in studies from other developing countries as well. So, the injury prevention activities of high-income countries need to be modified according to our needs.[9]

Animal and insect bites were the third important cause of injuries in this rural setup. It is an important public health problem like in other developing countries [5]The incidence of animal and insect bites were comparable with other studies.[5]The type of injuries seen in any given area are usually a product of the prevailing environment as well as the habits and customs of the people. Animal

and insect bite are typical of rural problem because of the high risk environmental factors like bushy environment, poorly illuminated surroundings, huts and kutcha houses and living nearer or close to agricultural fields, which favour animals and insect to live/hide. The widespread custom of keeping dogs as pets and allowing the street stray dogs to wander freely without routine immunization makes dog bite second only to insect bites.

Females and males were almost equally affected by animal and insect bites. The most common type of insect bite was scorpion, as observed in other studies.[2] Among the different age-groups, 15 and above age-group was affected more than the younger age-groups (90% vs. 10%). The reason for high incidence of animal and insect bites in adults, especially in females might be due to their involvement in household activities like cleaning the houses, sweeping the houses, clearing the dust, cub web, wastes within and outside the houses, white washing, clearing the bushes outside the house, and gathering of firewood in the field. People seek treatment more readily for bite injuries because of pain, severity of injuries and fear and belief about the adverse consequences of Animal and insect bites. Preventive strategies need to be planned and implemented as per the needs of the community like elimination of stray dogs, improving the bushy environment and better illumination and provision of facilities at the primary health centres for managing the animal and insect bites.

RTAs were the fourth leading cause for injuries. The burden of RTA was next only to minor injuries, falls and animal and insect bites. This finding is in sharp contrast to other community–based studies where RTA was the commonest cause of injuries [12,17,32,47] except the Uganda study[34] where other injuries were more common than RTA in rural areas. The relatively low incidence of RTA in the present study was probably because of the remoteness of the selected rural area from national highways as well as lack of use of private vehicles for travel to nearby urban areas. For traveling within the village and to the nearby villages the commonest mode of transport next to buses were the cycles. Therefore, the commonest risk factors for RTA in this area was cyclist and cycle related and pedestrian. This finding is consistent with both Uganda[34] and Ghana studies.[32.]

The other risk factors for RTA in developing countries like alcohol, poor driving skill, poor road design and maintenance, poor road worthy condition of vehicle were not assessed by this study. More than 50% of RTA reported in this area were due to cycle related injuries followed by passengers traveling in transports shared auto, lorry and cart. The transport related injuries were more in private vehicles like cycle, shared auto, lorry and cart than public vehicle, which was similar to findings from Ghana.[32,34]

The other injuries that were less common but nonetheless important, were due to burns. In this study the incidence of burns was 0.7% and the estimates of injury due to burns were the last category (lowest incidence). This finding is similar to Ghana study.[32] Most of the injuries due to burns were of low severity (less than 5% involving only exposed part of skin and the body surface). Females were more affected than male. This finding is comparable with other studies [2,5,7,22,24.] The majority of injuries were due to household activities like cooking with fires; open cooking, making coffee, boiling water and handling hot vessels. The other risk factors were poorly ventilated or and non-availability of separate kitchen and unsupervised play of less than 5-year-old children within the house environment. In high-income countries, burn prevention has given emphasis to house fires and scalds.[32.] This may not be applicable to rural areas in developing countries since risk factors differ from developed countries.

In this study, no injury was reported due to accidental poisoning and drowning which was not consistent with other studies.[17, 32,33,34] It is hypothesized that even though the study area is having plenty of ponds, lakes, river branches (the main river is hardly 1 km away from the main village) the water availability in these sources were meager or almost dry. This might be one of the reasons for no case of drowning being reported.

Non-reporting of accidental poisoning in this study may be due to lesser agricultural activities during the study period and negligible usage of fertilizers and insecticides.

Consequences of injuries

The three important consequences of injuries considered were death, disability and hospitalization.

This study allows some conclusion to be drawn about which mechanism contributed more significantly to the societal burden of injuries in the study area. The proportion of disability in this study due to unintentional injuries was similar to other studies.[17,32,34,57] Among males, minor injuries [including agricultural related injuries] were the single largest contributor to disability whereas among females it was due to animal and insect bites. Falls contributed to disability equally in both the sexes. RTAs ranked fourth in disability contribution. In all the four types of injuries, 15 and above age-groups were disabled more due to injuries suggesting a significant impact on economy as well [1,20,24,]

In this study all reported injuries were non-fatal in nature, which was contrary to other studies.[10,11,17, 32,34] One of the reasons was that because of want of time the investigator failed to contact the local police station to verify the veracity of absence of fatal injuries.

Hospitalisation is considered as one of the important outcomes of injuries indicating severity of injuries. The rate of hospitalization observed in this study was comparable with other studies.[32,34] The rate of hospitalization depends on so many factors like type and severity of injuries, age, and vehicles involved in the RTA, socio-economic conditions and availability of emergency and trauma care services. In addition to above-mentioned factors, the type of hospital approached for injury treatment depends on the availability and accessibility of services and people's confidence in services offered at Government / private hospitals. The longer the stay in the hospital the more is the severity of injuries. The number of days hospitalized varied from 2-20 days which is a great burden to the individual, by way of financial burden of cost of treatment and loss of wages, as well as psychological sufferings.

The hospitalization was higher for RTA (45%) than any other injuries. Infact, it is higher than Ghana study findings.[32] Similarly, the number of days hospitalized

was highest in RTA than other injuries indicating the severity of RTA. The type of hospitals utilized for treatment was mainly private and indigenous hospitals, which is contrary to the Malaysian study[56] where majority favored treatment in government hospitals. In an Indian study, also the hospitalization was more in Government sectors rather than in private sectors.[4]

Health seeking behaviour

Majority of the injured had treatment either in the home or in hospitals. These findings were consistent with other studies. [4,56] Like hospitalization, majority approached the private sector for out patient treatment, which is consistent with one study[4] and inconsistent with other study.[56] The reason may be the ready availability of services when needed, nearness of facilities to their residence and people's greater faith in quality of services in private sectors.

Strengths and limitations of the study

Strengths

- This study sheds light on burden of unintentional injuries in a rural community.
- It used a community sample and included injury episodes of all causes (excluding intentional injuries), all ages, all body parts, place of occurrence and prevention from usual work and hospitalization.
- The purpose of the study was explained to the participants and the questions were put in simple local dialect clearly. The participants had no apparent motive to distort or hide any fact about injuries or other data sought.
- The study is undertaken at the time when Government of India is going to implement the integrated disease surveillance programme (IDSP) in a big way throughout India. The findings may help the planner to impress upon the political leaders about the importance of surveillance of non-communicable diseases and injuries.

Limitations

- The study is based on relatively small purposively selected sample limiting its external validity.
- The parents were the reporting source for their children. So it is possible that they were not aware of minor injuries like falls or may underestimate the importance of giving information regarding minor injuries and falls.
- The study mostly relied on the information given by the affected persons and proxy respondent. The reliability and veracity of their answers on the events of injuries were not verified with records. There is always a tendency to underestimate some of the events such as minor injuries and falls during household activities as they think that these are not important to disclose because of low priority given to minor injuries.
- In some cases, despite being injured, they continued to work in the field as well as in house hold activities because of socioeconomic condition and cultural practice (cooking by female despite injured). This may have resulted in the underestimate of disability or severity of injuries
- The cross-sectional nature of this study limits the causal interpretation of risk factors and types of injuries. It is necessary to undertake longitudinal follow up in that area. The above-mentioned factors along with the reported low agricultural activities suggest that the study may have unintentional injury incidence underestimated.

Despite the above-mentioned limitations, this study allows useful conclusions to be drawn, which may be useful for developing a preventive programmes.

Summary and conclusions

In the process of economic development and modernization, there is a phenomenal increase in injury events due to a greater interaction of host with environment and agents of mechanical, electrical, thermal or chemical energy. Intentionally or not, injury has so far lacked public awareness and is under-recognised as a serious public health problem in both developed and developing countries. This study is essentially a pilot study. There is a need to carry out larger studies in the same place and other similar areas stratified by potential contributing factors like distance from national high ways, location of industries and nature and density of vehicular traffic.

Recommendations

The reported incidence of minor injuries, falls and animal and insect bite in this community are very common. The recommendations to reduce the incidence of injury are provided under three different sections namely, the individual, community and the health system

Individual

- Use of appropriate foot wears need to encouraged in these population
- Education regarding first aids and other preventive activities need to be included in the school curriculum

Health system

- Health system should incorporate injuries into their surveillance system
- Ambulance services need to be provided for transporting the injured to hospital
- Studies of working conditions in the workplace (both in the organized and unorganized sector) need to be done to plan for appropriate preventive measures.

Community level

- Community education needs to be given for providing basic first aid and other emergency measures in the case of minor injuries

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Appendix 1: Operational definitions used in the study

1.1 Definition of Injury

An injury is a bodily lesion at the organic level, resulting from acute exposure to energy (mechanical, thermal, electrical, chemical, or radiant) in amounts that exceed the threshold of physiologic tolerance. In some cases (e.g., in drowning, strangulation, or freezing), the injury results from an insufficiency of a vital element.

1.2 Classification of injuries

The external causes of injuries are often categorized as unintentional or intentional.

Unintentional

Traffic injuries, fire-related injuries, falls, drowning, and Poisonings are classified as unintentional injuries

Intentional

Injuries due to assaults, self-inflicted violence, and war are classified as intentional injuries

1.3 Type of injuries

Road Traffic Accidents: A traffic injury is any vehicle injury occurring on a public highway (i.e. originating on, terminating on, or involving a vehicle partially on the highway).

Falls: A falls is an event, which results in a person coming to rest inadvertently on the ground or floor or other lower level. Within the WHO database falls-related deaths and non-fatal injuries exclude those due to assault and intentional self-harm. Falls from animals, burning buildings and transport vehicles, and falls into fire, water and machinery are also excluded

Animal and insect Bite[59]

Animal and insect bites are defined under two different categories, namely dog and other bites.

from other animal bites

Other bite / sting: Injury from a poisonous or non-poisonous bite or sting through the skin, other than a dog bite. This category includes human bite, cat bite, snake or lizard bite, insect bite, stings from coral or jellyfish, or bites and stings by other plants and animals.

Drowning: Drowning is the process of experiencing respiratory impairment from submersion/immersion in liquid. Drowning outcomes are classified as death, morbidity and no morbidity. Agreed terminology is essential to describe the problem and to allow effective comparisons of drowning trends. Thus, this definition of drowning adopted by the 2002 World Congress on Drowning should be widely used

Fires and burns : Burn or thermal injuries occur when hot liquids (scalds), hot solids (contact burns) or flames (flame burns) destroy some or all of the different layers of cells, which form the human skin. For traditional reasons, skin injuries due to ultraviolet radiation or radioactivity, electricity and chemicals, as well as respiratory damage resulting from smoke inhalation, are considered as burns, poisonings

Other minor injuries: (This classification is intended for the purpose of the present study; It is not mentioned in ICECI) Injuries classified as "other minor injuries" include injuries from cutting and piercing injuries, by use of sharp instruments like knife, hand tool, crowbar, blade, fall of objects like stone, bricks, metal, hit by objects, farm implements, thorn, finger nails, kitchen appliances and furniture, occupational related, household activities related injuries, leisure activities related injuries, adverse effects to medication, as well as a miscellaneous group and other unintentional injuries not specified in other groups

Hospitalization

Number of days the person is hospitalized/ admitted in a hospital due to injuries for treatment.

Disability/prevented from usual work

A **disability** is something, which has a serious, and lasting effect on a person's ability to do everyday tasks like looking after them self or doing a job of work.

1.5 Definitions for selected Socio-economic variables:

1.5. 1 Type of house:

Hut: usually one room-construction of mud walls with a thatched roof.
Kutcha: construction with more than one room with mud walls and a thatched roof.
Mixed: A house, which has one or two of the following. Cement or mortar used for plastering of wall of floor with the tiled roof.
Pucca: One which is built with a foundation, using stone or bricks with mortar and cement and having a concrete or stone laid roof or tiled roof.
Mansion: A large house containing more than 5 rooms (excluding kitchen and roof)

1.5.2 Occupation:

Presently not gainfully employed:
Housewife, Household work, Retired, Student, Preschool, Unemployed

Labour unskilled / Agricultural:
Those who are engaged by others on wages. Usually they get wages on daily basis and maintain their households with wages. e.g., Landless labourer,

watchman

Skilled labourer:

Include artisans who follow their caste. Occupations like tailor, blacksmith, goldsmith, carpenter, washer man, potter, barber, electrician, dhobi, shepherd, basket weaving, masonry, mechanic, driver and beedi workers can be included.

Small business:

Traders who maintain petty shops and are engaged in small business and trade activities.

Independent profession:

High-prestige but low income jobs; includes persons who are in employment not carrying high social status. In this will be included the "class IV employees" and village level workers.

Traditional birth attendant, peon, ayah, attender, balwadi teacher, community nutrition worker and temple priest.

Land owner/ Cultivator owner / Cultivator tenant:

Landowner:

A person who owns land and cultivates it himself. In addition, may hire other people to work on.

Cultivator owner:

A person who owns land and cultivates it himself. In addition, may hire other people to work on his land.

Cultivator tenant:

The land is leased from someone else and he cultivates it. He may also hire other people to work.

The highest social status is for professions like medical, legal and engineering professions and for employment involving administrative responsibilities. In this category, people like headmasters; officers in government (police, armed forces) and other employment (business man, factory owner), supervisory personnel etc will be included.

1.6 Definition of Urban / Rural areas[60]

Urban area

The definition for urban area as per Census of India ,2001 is as follows:

All places with a municipal corporation, municipalities, cantonment board or notified town area committee

All other places that satisfied the following criteria

a) A minimum population of 5000

b) At least 75% of males working should be engaged in non-agricultural pursuits

c) A density of population of at least 400/square km

All places notified under law such as municipal corporations, town Panchayats and cantonment boards, have been treated as urban units irrespective of satisfaction of the demographic criteria. Further, in the case of other local bodies namely, village Panchayats, demographics criteria were strictly applied and those village Panchayats which satisfied the demographic criteria were declared as urban units

Rural Area

All other places, which do not form part o any urban unit, have been treated as rural areas.

Appendix 2 Questionnaires used in the study

Epidemiology of injury in a rural community, South India

Form-A

1. HSC Code ☐ **2.**village Code ☐

(Please put ✓ mark wherever appropriate)

3.Household ID ☐ **4.Religion**[1] ☐ **5.Caste** [2] ☐

6.Type of the House[3] ☐ **7.Ownership of the house**[4] ☐

8.Sociodemographic, injury related information: Name of Head of the family----------

Person ID	Age (In years)	Sex (1.Male 2.Female)	Educationa l status [5]	Occupation[6]	Marital Status (1.Married 2.Unmarried)	Owning vehicle (1.Yes 2.No)	Met with any injury in past 1month 1.Yes2.No[7]	If yes, Nature ofinjury[8] (TYPE)	How many times? (Frequency and type)

	Male	Female	Total		Male	Female	Total		Male	Female	Total
9.Total number				10.Total Numbers Injured				11.Total episode in the family			

1. Religion 1.Hindu 2 .Muslim 3.Christian 4.Others; **2.Caste** 1. S.C 2. S.T 3.B.C. 4.M.B.C. 5.F.C **3.Type of house**; 1.Hut 2.Kutcha 3.Mixed 4.Pucca 5.Mansion; **4.Ownership of house** 1.Rented 2.Own. **5.Education** 1.No education 2. Primary (1-5) 3.middle (6-8) 4.High school (9-10) 5.Higher secondary (11-12) 6.College/Tech 7.Professional/Postgraduate **6.Occupation** 0.Presently not gainfully employed 1=Labour unskilled 2.Labour skilled 3. Small business 4.Indepent profession 5.Cultivator owner / tenent 6. Services Govt/ Private 7. **Nature of injury** 1.RTA 2.Fall 3.Bite 4.Drowning 5.Fires & Burns 6.Poisoning 7 Minor injuries 8 Others

[7] If yes go to survey form b

1.Was the injury traffic related or not1.1.Yes ☐ 2.no ☐ **Person ID** ☐

2. If yes go to form B-1 I f no go to form b-2

(Please put ✓ mark wherever appropriate)

Form –B 1

Road Traffic Accidents

1 Date of occurrence of injury; Month ☐ Date ☐ **2.**Time of occurrence injury ☐

3.Place of occurrence 1.School ☐ 2.Village Road ☐ 3.High ways ☐ 4.National Highways ☐ .5.others ☐

4,What was the victim doing at the time of injury 1.Walking ☐ 2.Travelling in vehicle ☐

5. What was the victim doing in or on the motor vehicle; 1.Driver ☐ 2. Pillion ☐ 3.Passenger ☐

6.What type of vehicle the victim riding in ? 1.Cycle ☐ 2.Two wheeler. ☐ 3.Car. ☐ 4.bus ☐ 5.Lorry ☐ 6.Bullock Cart ☐

7. Brief Description of the incident

8. **Parts of the body Affected;** 1.head&neck ☐ **2.**LUL ☐ 3.RUL ☐ 4.RLL ☐ 5.LLL ☐ 6.Trunk ☐ 7.abdomen ☐ 8Wrist&hand ☐ 9.Ankle&foot ☐ 10. Others ☐

9.Does the injury is related to occupation of the victim.1.yes ☐ 2.No ☐

10.Type of injury 1.Fatal ☐ 2.Non-fatal ☐

11.Type of injury1 1 Superficial wound ☐ 2. Open wound ☐ 3.Dislocation ☐ 4.Fracture ☐ 5.Injury to nerve &vessels ☐ 6.Crushing injuries ☐ 7.Injury to internal organ ☐ 8.Tramatic amputation ☐ 9.Other unspecified injuries

12.Condition of the individual at the time of injury

A.Consumed alcohol 1.Yes ☐ 2.No ☐ B.Wearing a helmet 1. Yes ☐ 2.No ☐ 3. Not applicable ☐

1. Treatment taken or not 1.Yes ☐ 2.No ☐

2. Where 1.Self ☐ 2.Private ☐ .3.Govt ☐ 4.Others ☐

3. If Govt. where 1Subcentre ☐ 2.PHC. ☐ 3.G.H ☐

4.Referred or directly gone for treatment 1.Referred ☐ 2. Self referral ☐

14.Disability;

a. Have you been Prevented from doing usual daily routine work 1,Yes ☐ 2.No ☐

b. If yes how many days /weeks

c. Have you been confined to Bed 1,Yes ☐ 2.No ☐

d. If yes how many days /weeks ☐

[1] Superficial woundinclude a, Abrasion b.Contusion2.open wound includes Cut, Laceration, Puncture wound, Penetrating wound &Animal bite

Form –B-2

Other injuries

1. **Date of occurrence of injury**; Month ☐ Date ☐ 2.Time of occurrence injury ☐

3.**Place of occurrence** 1.Within the house ☐ 2. Outside ☐

4. What was the victim doing at the time of injury 1.While cutting vegetables ☐ 2.While playing ☐

3.While working in the field ☐ 4.While sharpening the pencil ☐ 5.While riding a vehicle ☐

6..Leisure activity ☐ 7..Unspecified activities ☐

5.Brief description about the accident/injury

6.Type of injury1 Superficial wound ☐ 2open wound ☐ 3. Incised wound 4.Disloca ☐
5.Fracture ☐ 6Injury to nerve &vessels ☐ 7.Crushing injuries ☐ 8.Injury to internal organ ☐ 9.Tramatic amputation ☐ 9.Other unspecified injuries

7.Instrument used 1.Knife ☐ 2.Blade ☐ 3. Growbar ☐ 4.Spade ☐ 5.Sharp Instrument ☐

6.Sharp Glass ☐ 7.Others ☐

8.Parts of the body Affected 1.head ☐ **2.**LUL ☐ 3.RUL ☐ 4.RLL ☐ 5.LLL ☐ 6.TRUNK ☐
7.ABDOMEN ☐ 8.OTHERS

9.Does the injury is related to occupation of the victim.1.yes ☐ 2.No ☐

10..Treatment seeking Behaviour.

1. Treatment taken or not 1.Yes ☐ 2.No ☐

2. Where 1.Self ☐ 2.Private ☐ .3.Govt ☐ 4.Others ☐

3. If Govt. where1Subcentre ☐ 2.PHC. ☐ 3.G.H ☐

4.Referred or directly gone for treatment 1.Referred ☐ 2. Self referral ☐

11 Disability;
a. Have you been Prevented from doing usual daily routine work 1,Yes ☐ 2.No ☐
b. If yes how many days /weeks ☐
c. Have you been confined to Bed 1,Yes ☐ 2.No ☐
d. If yes how many days /weeks ☐

.

Form –B3
FALL

1. **Date of occurrence of injury**; Month ☐ Date ☐ **2.Time of occurrence injury** ☐

3.Place of occurrence 1.Within the house ☐ 2. Outside ☐

4. **Site of fall1.** 1.On the ground ☐ 2. On the smooth surface ☐ 3 On a hard surface ☐

5.**Nature of fall** 1. From a height ☐ 2. From the surface ☐ 3.Others ☐

6.What was the victim doing at the time of injury. 1..Leisure activity ☐ 2.Working for income ☐
3.engaged in other activities(like cooking, cleaning,) ☐ 4.unspecified activities

7.Brief description about the accident

8.**Parts of the body Affected** 1.head ☐ **2.**LUL ☐ 3.RUL ☐ 4.RLL ☐ 5.LLL ☐
6.TRUNK ☐ 7.ABDOMEN ☐ 8.OTHERS ☐

9.Type of injury 1 Superficial wound ☐ 2open wound ☐ 3. Incised wound ☐ 4.Dislocation ☐
5.Fracture ☐ 6Injury to nerve &vessels ☐ 7.Crushing injuries ☐ 8.Injury to internal organ ☐ 9.Tramatic amputation ☐ 9.Other unspecified injuries ☐

10.Condition of the individual at the time of injury

A consumed .Alcohol 1.Yes ☐ 2.No ☐
11. **Does the injury is related to occupation of the victim**.1.yes ☐ 2.No ☐

12.Treatment seeking Behaviour.

1. Treatment taken or not 1.Yes ☐ 2.No ☐

2. Where 1.Self ☐ 2.Private ☐ .3.Govt ☐ 4.Others ☐

3. If Govt. where1Subcentre ☐ 2.PHC. ☐ 3.G.H ☐

4.Referred or directly gone for treatment 1.Referred ☐ 2. Self referral ☐

13.Disability;
a. Have you been Prevented from doing usual daily routine work 1,Yes ☐ 2.No ☐
b. If yes how many days /weeks ☐
c. Have you been confined to Bed 1,Yes ☐ 2.No ☐
d. If yes how many days /weeks ☐

Form –B 4

Bite

1. Date of occurrence of injury; Month ☐ Date ☐ **2.Time of occurrence injury** ☐

3.Place of occurrence 1.Within the house ☐ 2. Outside the house ☐

4.Type of bite 1Animal ☐ 2 Insect ☐

5.Type of animal or insect ☐

6.What was the victim doing at the time of injury. 1..Leisure activity ☐ 2.Working for income ☐
3.engaged in other activities(like cooking, cleaning,) ☐ 4.unspecified activities **5 Sleeping**

7.Brief description about the accident

8. **Parts of the body Affected** 1.head&neck ☐ **2.**LUL ☐ 3.RUL ☐ 4.RLL ☐ 5.LLL ☐

6.TRUNK ☐ 7.ABDOMEN ☐ 8.OTHERS ☐

9.Condition of the individual at the time of injury

A.Consumed Alcohol 1.Yes ☐ 2.No ☐

10.Does the injury is related to occupation of the victim.1.yes ☐ 2.No ☐

11.Treatment seeking Behaviour.

1. Treatment taken or not 1.Yes ☐ 2.No ☐

2. Where 1.Self ☐ 2.Private ☐ .3.Govt ☐ 4.Others ☐

3. If Govt. where1Subcentre ☐ 2.PHC. ☐ 3.G.H ☐

4.Referred or directly gone for treatment 1.Referred ☐ 2. Self referral ☐

12.Disability;

a. Have you been Prevented from doing usual daily routine work 1,Yes ☐ 2.No ☐
b. If yes how many days /weeks ☐
c. Have you been confined to Bed 1,Yes ☐ 2.No ☐
d. If yes how many days /weeks ☐

Form – B 5

Drowning

1. **Date of occurrence of injury**; Month ☐ **Date** ☐ 2.**Time of occurrence injury** ☐

3.**Place of occurrence** 1.Within the house ☐ **2.** Out side the house ☐

4.Source of water 1. Pond ☐ **2.**Lake ☐ 3.River ☐ 4.Well ☐

5 Nature of injury 1. Fatal ☐ 2.Non fatal ☐

6.Mechanism of injury 1.Accidental fall ☐ 2. While swimming ☐

7.Brief description about the accident

8.What was the victim doing at the time of injury. 1..Leisure activity ☐ 2.Working for income ☐
3.engaged in other activities(like cooking, cleaning,) ☐ 4.unspecified activities

9.**Site of injury** 1.External ☐ 2 .Internal ☐ 3.Both

10.If internal, nature of injury 1.Unconcious with external injury ☐ **2.**No lose of consciousnes ☐

11. If external what are Parts of the body Affected ☐

12.Condition of the individual at the time of injury 1. Consumed alcohol 1.YES ☐ 2.No ☐

13.Does the injury is related to occupation of the victim.1.yes ☐ 2.No ☐

14.Treatment seeking Behaviour.

1. Treatment taken or not 1.Yes ☐ 2.No ☐

2. Where 1.Self ☐ 2.Private ☐ .3.Govt ☐ 4.Others ☐

3. If Govt. where1Subcentre ☐ 2.PHC. ☐ 3.G.H ☐

4.Referred or directly gone for treatment 1.Referred ☐ 2. Self referral ☐

15.Disability;
a. Have you been Prevented from doing usual daily routine work 1,Yes ☐ 2.No ☐
b. If yes how many days /weeks ☐
c. Have you been confined to Bed 1,Yes ☐ 2.No ☐
d. If yes how many days /weeks ☐

Form – B 6

Fires and burns

1.Age ☐ Sex ☐

2. **Date of occurrence of injury**; Month ☐ Date ☐ 3.**Time of occurrence injury** ☐

4.Place of occurrence 1.Within the house ☐ 2. Outside the house ☐

5 Nature of injury 1. Fatal ☐ 2.Non fatal ☐

6.What was the victim doing at the time of injury. 1..Leisure activity ☐ 2.Working for income ☐
3.engaged in other activities (like cooking, cleaning,) ☐ 4 Sleeping. ☐ 5. unspecified activities ☐

7.Brief description about the accident

8..Nature of fire/burn;1.Dry heat/ Flame ☐ 2.Hot liquid ☐ 3.hot Vessel ☐ 4.Steam ☐ 5..Hot instrument ☐ 6.electricity ☐ 7.lightening ☐

9.**Natureof injury** 1.External ☐ 2 .Internal ☐ 3.Both ☐

10.If internal, nature of injury 1.Unconcious with external injury ☐ **2.**No lose of consciousness ☐

11. What Parts of the body are Affected 1.head&neck ☐ **2.**LUL ☐ 3.RUL ☐ 4.RLL ☐ 5.LLL ☐
6.TRUNK ☐ 7.abdomen ☐ 8Wrist&hand ☐ 9.Ankle&foot ☐ 10.OTHERS ☐

12.Type of injury 1.Fatal ☐ 2.Non fatal ☐

13.Type of injury 1 First degree (Erythema) ☐ 2.Second degree (Blisters) ☐ 3.Third degree (Full thickness skin lost) ☐

14.Condition of the individual at the time of injury
A.Consumption of alcohol 1.Yes ☐ 2.No ☐
15.Does the injury is related to occupation of the victim.1.ye ☐ 2.No

16.Treatment seeking Behaviour.

1. Treatment taken or not (For first contact) 1.Yes ☐ 2.No ☐

2. If yes Where 1.Self ☐ 2.Private ☐ .3.Govt ☐ 4.Others ☐

3. If Govt. where1Subcentre ☐ 2.PHC. ☐ 3.G.H ☐

4.Referred or directly gone for treatment (For 2nd contact) 1.Referred ☐ 2. Self referral ☐

17.Disability;

a. Have you been Prevented from doing usual daily routine work 1,Yes ☐ 2.No ☐
b. If yes how many days /weeks ☐
c. Have you been confined to Bed 1,Yes ☐ 2.No ☐
d. If yes how many days /weeks ☐

Form – B 7

Poisonings

1.Age ☐ Sex ☐ 2. **Date of occurrence of injury**; Month ☐ Date ☐

3.**Time of occurrence injury** ☐

4.Place of occurrence 1.Within the house ☐ 2. Outside the house ☐

5 Nature of injury 1. Fatal ☐ 2.Non fatal ☐

6.Mechanism of injury; 1.Accidental ☐ 2. While cooking ☐ 3. While doing work in the field 4.Others ☐

7. Route of entry 1.Oral ☐ 2.Nasal ☐ 3.Skin ☐

8.Type of poisoning 1.Drug ☐ **2.Alocohol.** ☐ **3.Chemical (Solid, liquid, gas, vapor, corrosive substance,Metals)** ☐ **4.other unspecified** [1] ☐

9.Brief description about the accident

10.What was the victim doing at the time of injury. 1..Leisure activity ☐ 2.Working for incom ☐ 3.engaged in other activities(like cooking, cleaning,) ☐ 4.unspecified activities

11.**Parts of the body Affected .1.Skin** ☐ **2.G.I.T** ☐ **3.R.S** ☐

12.Condition of the individual at the time of injury
A. Consumed Alcohol 1.Yes ☐ 2.No ☐

13.**Does the injury is related to occupation of the victim.**1.yes ☐ 2.No

14.Treatment seeking Behaviour.

1. Treatment taken or not 1.Yes ☐ 2.No ☐

2. If yes Where 1.Self ☐ 2.Private ☐ .3.Govt ☐ 4.Others ☐

3. If Govt. where1Subcentre ☐ 2.PHC. ☐ 3.G.H ☐

4.Referred or directly gone for treatment 1.Referred ☐ 2. Self referral ☐

15.Disability;
a. Have you been Prevented from doing usual daily routine work 1,Yes ☐ 2.No ☐
b. If yes how many days /weeks ☐
c. Have you been confined to Bed 1,Yes ☐ 2.No ☐
d. If yes how many days /weeks ☐

1 Unspecified likes, effect of asphyxia, effect of suffocation, Complications of surgical/medical care.

Appendix 3 Distribution of study population, Tiruchirappalli, Tamil Nadu, 2003

Health sub centres	Villages (code number)	Population*	Number of households *	Serial number used in the survey	Number of households selected	Number of respondents (including proxy respondents)
Vengur	Vengur (8)	2437	601	1-626	145	692
	Murukkur (9)	721	187	627-774	42	105
	Arasankudi (10)	1243	306	775-1079	74	304
	Thondamanpatti (11)	206	55	1080-1123	10	41
	Mudukkupatti (12)	151	38	1124-1173	12	57
	Total	4758	1187			1206
Pattala Pattai	East Vilankulam (1)	288	62	1-76	1-15	69
	West Vilankulam (2)	201	54	77-134	16-28	47
	Kiliyur (3)	1091	248	135-392	29-84	265
	Pattala Pattai (4)	1369	395	393-678	85-151	302
	Krisnasamudram (5)	545	128	679-821	152-186	152
	Chettiar Pattai (6)	300	73	822-892	187-203	77
	Kotrapatti (7)	460	102	893-1028	204-229	105
	Total	4254	972			1010

* as per the PHC records

Appendix 4. Methods used for measuring Socio-Economic Status

Socio-economic Score (SES)

SES was constructed by combining the socio-economic variables like caste, education, occupation and type of houses

Indicators for Socio-Economic Status

1. Castes: 1-5 (1. Scheduled caste: 2. Sc heduled Tribes3.B.C 4.M.B.C.5. Forward)

2. Type of house: 1-5 (1=hut; 2=kutcha; 3=mixed; 4=pucca; 5=mansion)

3. Education in the family: 1-7 (1=no education; 2=primary (1-5); 3=middle school (6-8); 4=high school (9-10); 5=higher secondary (11-12); 6=college/Technical; 7.Professional/PG)

4. Occupation in the family: 0-6 (0=presently not employed gainfully; 1=Labour unskilled/agri; 2=Labour skilled; 3= small business; 4=independent profession; 5=cultivator owner/tenant/land owner; 6=service: Govt/private/ex-service)

Socio-economic score was constructed using above-mentioned variables. Socio economic score = Total of scores on the four indicators mentioned above

The maximum and minimum scores were 21 and 3. The scores were then grouped into low, medium and high socio-economic groups by dividing at the 33 percentile. The percent of low, medium and high socio-economic group was 35.5, 40.2 and 24,3 respectively.