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Report to UNICEF on the Vietnam Multi-center Injury Survey

carried out by

The Vietnam Public Health Research Network

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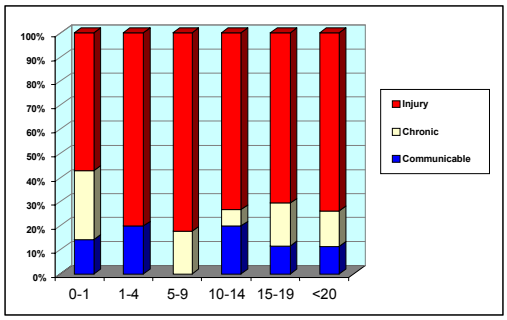
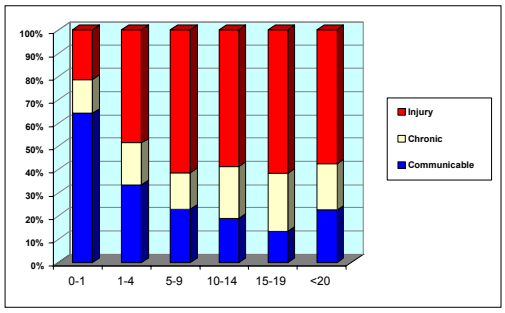
Executive summary

VMIS was a national survey looking at death from all causes and episodes of serious injury among all ages in the Vietnamese population. 27,000 Vietnamese households, with 128,000 residents were selected in all eight regions and were visited to administer a questionnaire on death from all causes (infectious and chronic disease and injury) and occurrences of nonfatal injury in the previous year. These were analyzed to determine the different patterns of mortality and morbidity by age, sex and cause. This report presents the results for the childhood ages (infants and children to age 19). As a household survey done in the community, it shows the pattern of morbidity and mortality free of the biases associated with hospitals, and other facility-based systems. It provides national baseline data on child injury, and should be repeated at intervals of several years to follow the trends of injury in children and monitor the effectiveness of prevention programs at the national and regional levels.

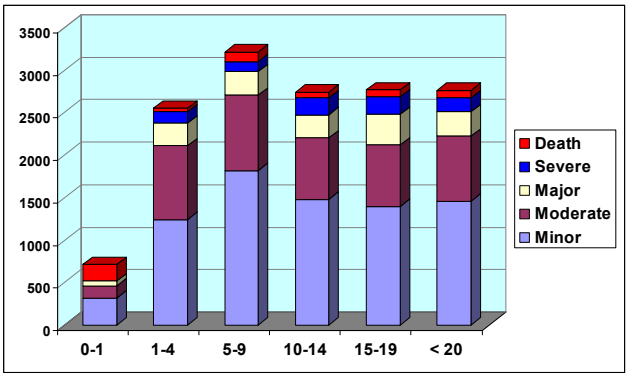
VMIS clearly shows that injury has become the leading cause of death in children in Vietnam. The figure at the right shows that almost 75% of death in children was caused by injury; communicable diseases accounted only for about 12% and chronic disease accounted for about 15%. The fatal child injury rate was 83.2/100,000 children. This means that almost one out of every thousand children in Vietnam died of injury in the preceding year and that over 27,000 children died of injury in 2001. This was 74 children each day, or one child dying every twenty minutes from injury.



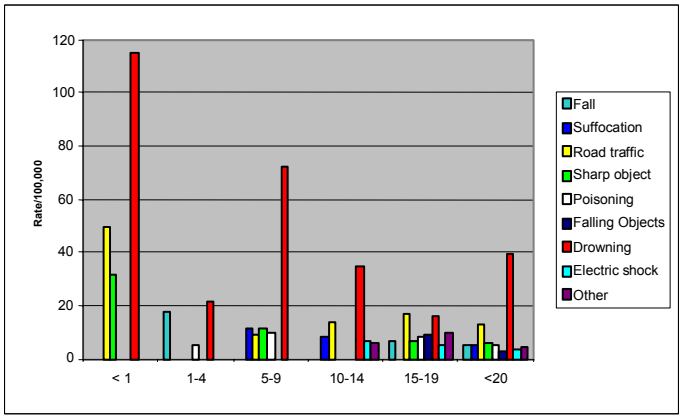
The figure at right shows that the situation is the same for nonfatal causes, or morbidity in children: injury is by far the leading cause at 57%, followed by communicable causes at 23% and chronic causes at 20%. Vietnamese children in 2001 had a nonfatal injury rate of 4,818/100,000 children. This means that almost 5% of children in Vietnam were injured that year, significantly enough to seek medical attention or lose at least one day of work or school. Over 1,500,000 children were injured in the year prior to the survey, or about 4,300 per day. This is an hourly rate of almost 180 children, or one injured child every twenty seconds.



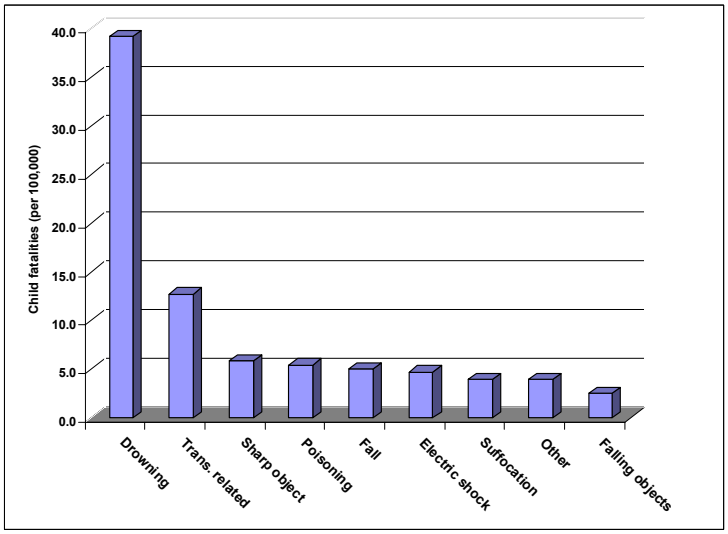
This figure shows that the severity of the injuries suffered did not differ significantly among the child age groups. After infancy; the risk of injury serious enough to require medical care (minor in the figure), hospitalization (figure, moderate), major surgery (figure, major), lead to permanent disability (figure, severe) or death was the same for all the child age groups. There were also few differences in child injury in children residing in urban areas versus rural areas. Overall, for injury the main difference in the age groups was the pattern of the specific type of injury rather than severity level, or place



of residence. There were no differences in crude measures of economic status such as land ownership and risk of a child in the family being injured by drowning or RTA, the two leading causes of fatal injury. On the whole, injury appears to be an "equal opportunity" killer and disabler of Vietnamese children, leaving no groups of children safe, no matter their age, sex, place of residence or economic status.



Children in Vietnam have a characteristic pattern of fatal injury that is dependent on the different ages. This figure shows that from infancy to puberty, drowning is the overwhelming cause of death in every age group and far outstrips other causes. After puberty, road traffic accidents (RTA) begin to appear and then increase in magnitude as age increases. RTA becomes the leading cause of child death in the 15-19 age group. This pattern of drowning predominating in childhood and RTA in adolescence is a common pattern in Vietnam's neighbors. These two causes of child death accounted for two thirds of all child mortality from injury and thus require special attention from health and social policy-makers.



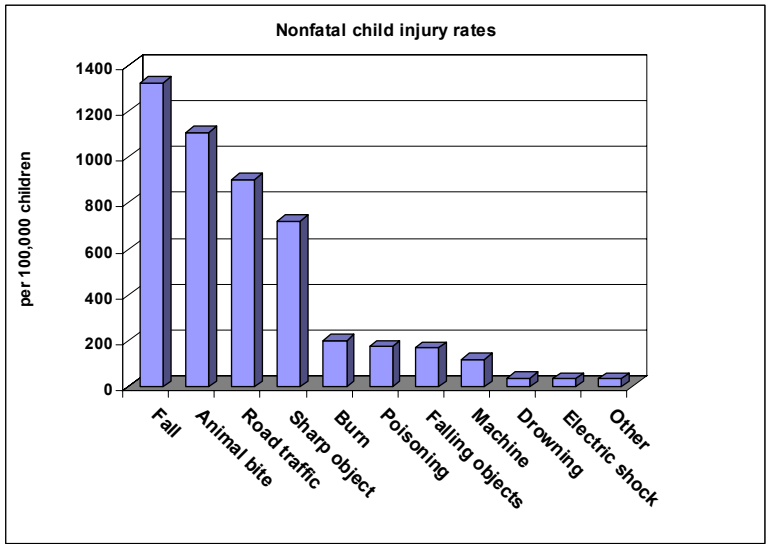
Drowning rates in the younger children were so high that overall, drowning was the leading cause of death among children accounting for almost half (48.8%) of all child deaths. This predominance of drowning is clearly seen in the figure to the right, which shows the fatal injury rates aggregated for the 0-19 age group. The fatal drowning rate in 2001 was 39.2/100,000. There were about 14,300 child drowning deaths in Vietnam in 2001. This was about 35 drownings each day. Since drowning occurred mainly during the daylight hours, this was about one child drowning every 20 minutes during the day. The child drowning rate in Vietnam is over ten times higher than child drowning rates in developed countries.

RTA was the second leading cause of child death with a fatality rate of 12.7/100,000. About 4,100 children died from RTA in 2001, or 11 children each day, mostly adolescents. Effective prevention programs will target the different age groups with specific programs based on the predominant causes of RTA in those groups. For young children, most RTA occurred as pedestrians; for middle children it was a mix of pedestrian and bicycle injury. Motorcycles were not a large cause until late adolescence. Cost-effective and sustainable prevention programs will focus on pedestrian safety and safe road sharing for bicyclists in the early and middle child age groups, and a broadly based program for adolescents that includes well- enforced programs for helmet use, safe driving behaviors and avoidance of drink-driving.

Injury from sharp objects was the third leading cause of death, with a rate of 5.8/100,000 children and responsible for over 1,800 child deaths each year, or five children per day. Poisoning followed in fourth place with a fatal poisoning rate of 5.4/100,000 and killed about 1,750 children

in 2001, or almost five per day. The fatality rate from falls was lower in 5th place at 4.7/100,000. This meant that about four children a day died from falls.

The majority of the health care and social costs associated with injury come from nonfatal injury. In contrast to infectious and chronic diseases, serious injury, by it's very nature generates enormous medical costs due to the need for surgical care, which requires blood banks, anesthesiologists and surgeons plus skilled operative teams, special diagnostic technology like CAT/MRI scanners and surgical intensive care wards. The catastrophic disability resulting from brain and spinal cord injury as well as the frequent amputations of extremities have major economic and social consequences. Facial disfigurements, blinding, and movement restrictions due to scarring after severe scalding are also especially liable to lead to permanent disability and the resultant economic and social costs. Likewise, the crush injuries and amputations caused by machinery and farm tools are major causes of permanent disability. All of these are preventable with some measure of impact and affordability. Given the magnitude of their occurrence in children in Vietnam, efforts to define the most effective and affordable approaches to their prevention are clearly some of the logical next steps.



Falls were the leading cause of nonfatal injury occurring to about 430,000 children per year, or about 1,200 per day. Four percent of these were severe enough to lead to permanent disability, or about 48 children each day.

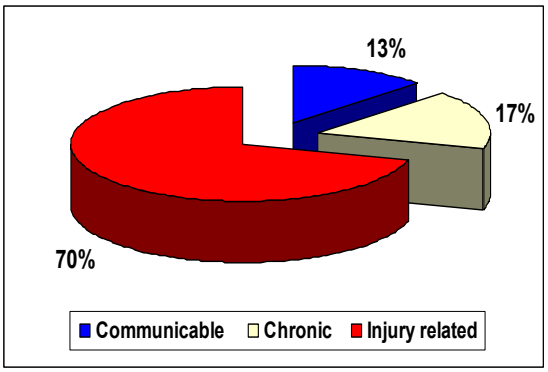
Animal bites were the second leading cause of nonfatal injury. There were almost 360,000 children bitten in 2001, or almost 1,000 each day. Almost four-fifths of these required hospitalization; this was almost 800 children per day. Four percent resulted in permanent disability; over 14,000 children a year; or almost forty children each day. Since rabies is endemic in Vietnam, without rabies prophylaxis, undoubtedly some of these 360,000 bites resulted in rabies deaths.

Road traffic accidents were the third leading cause of nonfatal injury. They consumed particularly large amounts of medical resources, especially in older teenagers who suffered high velocity crashes on motorcycles. RTA led to over 290,000 children injured in 2001 or about 800 per day.

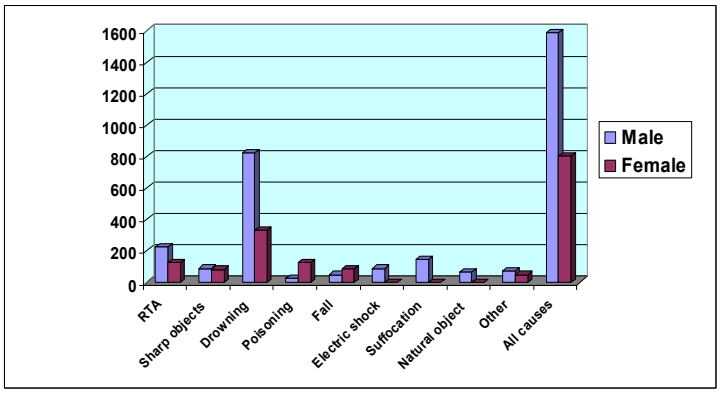
Injury from sharp objects was the fourth leading cause of nonfatal injury and over 230,000 children were affected. Half of these occurred while children were working. Over 95% were caused by knives or knife-like objects. About 3 percent was intentional injury (assault) and this was predominantly in males.

Burns were the fifth leading cause of injury morbidity, most commonly from scalding. Scalding causes severe morbidity, and requires lengthy surgical treatment. The resultant scars are often both disfiguring and disabling. Considering only scalds rated as major (requiring extensive surgical care; or severe, resulting in permanent disability), the numbers were enormous: over 13,000 children in 2001, or over 35 children each day.

One useful public health measure for policy makers is the Years of Potential Life Lost (YPLL) that takes into account the loss of future productivity and earnings potential for those who die before the age of 65 years. This figure shows the relative contribution of YPLL in Vietnam in 2001 of the different causes of death. Clearly, injury is the leading cause of lost years of productivity and wages.



Within the broad category of injury, it is possible to look at the specific contribution to YPLL by the different categories of injury. The figure at right does that for males and females and shows clearly that drowning is the major contributor to YPLL, being responsible for slightly more than half of all potential years lost. Clearly, drowning prevention needs to be a major, high-priority focus for all child health programs, targeted with the same energy and effect as the last century's leading killer of children: infectious disease. That focus and effort paid enormous dividends to Vietnam's children; it reduced infectious disease from the leading cause of child death to a secondary status. This focus and priority could achieve the same results for child drowning, and other causes of fatal child injury.



One telling measure of the true burden of injury mortality is that if all child injury were to be prevented, it would increase life expectancy at birth in Vietnam by over seven years. Additionally, if injury was prevented in infants and children, the U5MR (under-five mortality rate) would fall by almost forty percent from 48.6 to 29.7. Of course, it cannot be completely eliminated and thus these projected effects are simple speculations. However, it clearly shows where the future gains are in preventable child death for UNICEF Vietnam. It is worth noting that if the remaining infectious disease mortality were to be eliminated in children under five, it would only decrease the U5MR from 48.6 to 41.3, a decrease of 15%.

Throughout the report, there are caveats regarding the interpretation of the data, due to sampling issues, wide confidence intervals, and small numbers. While these are germane technical issues that need to be considered, it is very clear that injury is an enormously significant issue for Vietnamese children. ***What clearly stands out from all of the data is that in all age groups of infants and children, injury is a major cause of death, disability and serious morbidity. In most infant and child age groups, it is the leading cause***. It is time to act on this knowledge and place injury prevention and control programs as core components of UNICEF Vietnam's programs. In the new millennium, child health programs cannot be considered to be complete without injury prevention and control being major, integral parts.

Chapter
1

1. Background

1.1. Injury

Injury is defined as damage to health due to the transfer of energy*. The type of energy can be mechanical, thermal, chemical, electrical, radiation, or the absence of essentials such as oxygen (asphyxiation, drowning) or heat (hypothermia). Mechanical energy is the most frequent cause of injury.

Injuries can be classified into two broad categories based on whether the injury resulted from an action with intent to cause injury or without intent to cause injury. Unintentional injury has a number of mechanisms of cause, but principally can be classified as injury from transport (road, rail, water, air), asphyxiation (drowning, choking, hanging, smothering, smoke inhalation), burns (chemical, thermal, electrical), poisoning (food, plant, chemical, pharmaceutical, envenomation), trauma (sharp objects, blunt objects, crush) and falls. Intentional injuries result from these same mechanisms, but can be further sub-classified as assault, homicide or suicide.

1.2. The infectious disease reporting bias

There is a tendency in international health to lump countries into two large categories: the developed countries (for the most part, Western Europe, the UK, Canada, the US, Japan and Australia) and less developed countries (LDCs-- primarily everywhere else). The "common wisdom" in this simplistic model is that the causes of death in the developed countries are primarily chronic disease and injury, and the causes of death in the less developed countries are primarily infectious diseases.

This greatly oversimplifies a complex issue, and overlooks the reality that there are enormous differences in levels of health and social development in the LDCs. The common measures of mortality, such is IMR (infant mortality rate), CMR (child mortality rate), and LEb (life expectancy at birth) vary enormously in LDCs, in large part as a result of economic, social and health gains over the last several decades. In well over half of the countries characterized as LDCs, the IMR, CMR and LEb are now very close to those of the developed countries. As such, the patterns of mortality in these countries are becoming similar to the patterns of mortality in the developed countries; that is, chronic disease and injury have replaced infectious diseases as the major killers.

In children in developed countries, injury has been recognized as one of the leading causes of death and disability. This is due to two reasons: one is the epidemiologic fact that injury often outstrips infectious diseases and other causes; and the second is that this has been visible in developed countries due to the excellence of the public health infrastructure. Injury and all other causes of death are easily measured due to high

* References and other documentation for assertions made throughout this report are available upon request from the HSPH/CIPPR. This report is a non-technical document intended for a non-technical audience, and the lack of footnotes, endnotes and other documentary comments is intended to avoid distractions.

quality vital registration systems, death certificates and other reporting systems that are complete, reliable and timely. This is not the case in developing countries. Most developing countries do not have reliable vital registration systems, or other systems to track mortality (death) and morbidity (illness) at the individual level

The primary reason that child injury has been unrecognized in developing countries is the nature of injury and the health reporting systems in developing countries. Most rely on reports of hospitals to track causes of death. The deaths reported by the hospitals are ones that happen in the hospital. These deaths are usually the result of diseases that kill slowly, over days or longer, allowing those sick with them time to reach the hospital for treatment before dying. These are mostly infectious diseases, which occur primarily in infants and children, such as diarrheal diseases, measles or other causes of pneumonias. The infant or child has several days of increasingly severe symptoms that are recognized by the mother as requiring medical attention. The child is brought to the clinic or hospital where it gets diagnosed and treated before dying. The death, and its cause is then recorded at the hospital, and reported within the health system.

Compare this to a drowning, electrocution, poisoning or traffic crash where the death occurs within seconds or minutes; the infant or child dies at home, or at the scene of the injury. The death is simply reported to the village or town authority and the child is buried. The dead infant or child is not taken to the hospital so the hospital is unaware of the death. Additionally, in many developing countries, cultural norms are that people prefer to die at home, rather than in a hospital. Children (and adults) who have been brought to hospital and found to be injured so severely that they will die are often discharged to be taken home to die. In a study in one hospital in Hanoi, Vietnam, over one-third of those severely injured were discharged while still alive, but expected to die at home. When the hospital mortality statistics are collated at higher levels of the health sector, the quick, injury-related and the early discharge-to-die-at-home deaths are missing from the aggregate data so the infectious deaths happening in hospitals are over-represented. In most developing countries today, the true pattern of child and adolescent mortality is hidden. Injury kills quickly and in developing countries, this usually means invisibly.

This has led to the prevailing view that in developing countries the major causes of child death are respiratory diseases (pneumonia) and diarrheal diseases. As a result, most of the prevention services and activities are focused on preventing these infectious causes of mortality.

1.3. The impact of infectious disease prevention in LDCs

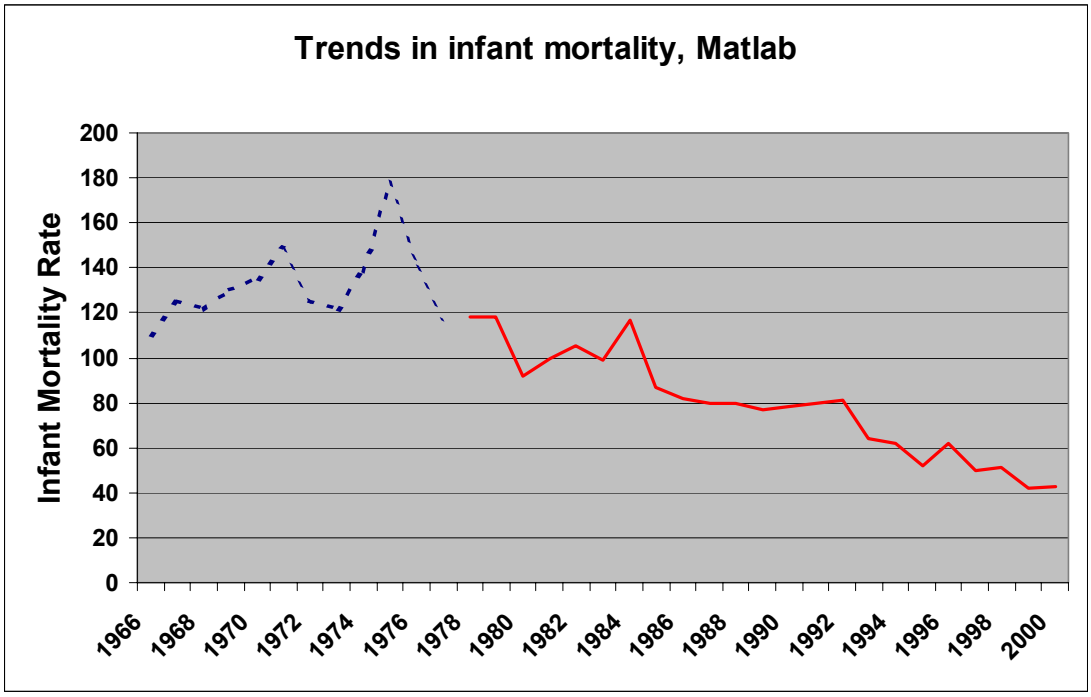
Programs such as EPI (Expanded Program on Immunizations), CDD (Combating Diarrheal Diseases) and ARI (Acute Respiratory Infections) have been operating throughout the developing world for over two decades. In many countries, they have had a major impact on infant and child mortality. Many of the LDCs have reduced mortality rates in these groups by well over two-thirds and some by over three-quarters. In many countries that had infant mortality rates of over 100/1,000 live births three decades ago, it is now in the 30s, 40s and 50s. This has resulted in a major change in the patterns of mortality for the child, adolescent and adult age groups in these countries.

Bangladesh can serve as an example of what has occurred, as the data exists from a variety of community level sources, which allows the complete description of child deaths without the usual bias of hospital reporting systems. Bangladesh also serves as an example of a country that, while it has achieved a reduction in infant and child mortality of over half, it is still widely regarded as a country where infectious diseases such as

respiratory and diarrheal diseases are the overwhelming cause of death in the child and adolescent age groups.

Data is available from the demographic and health surveillance system at the International Center for Diarrheal Disease Research, Bangladesh (ICDDR,B) to show what has happened within the Matlab study community. It is a community of about 400,000 population, primarily rural, where monthly household visits allow precise data to be obtained on child illness and death. The data from Matlab is very instructive regarding the impact of the maternal and child health services and the resultant effect on infant (less than one year old) mortality:

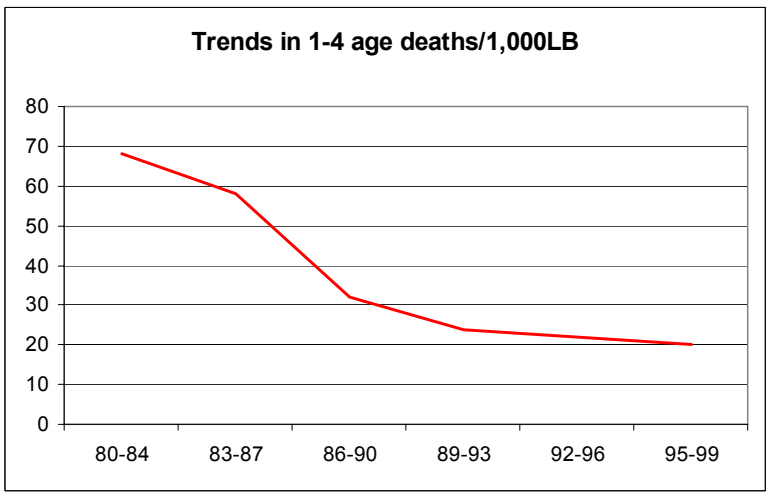
Figure 1.1. Trend of infant mortality, Matlab, Bangladesh



This graph of the trend in infant mortality shows convincing decrements in infant mortality, documenting the success of the government in implementing basic maternal and child health programs. The continuously falling IMR is solid evidence of their impact. The data from the time before immunizations and other child survival interventions were available (dashed blue) show a rising trend, while post-intervention data (solid red) clearly show the impact and the continued steady progress in decreasing infant mortality.

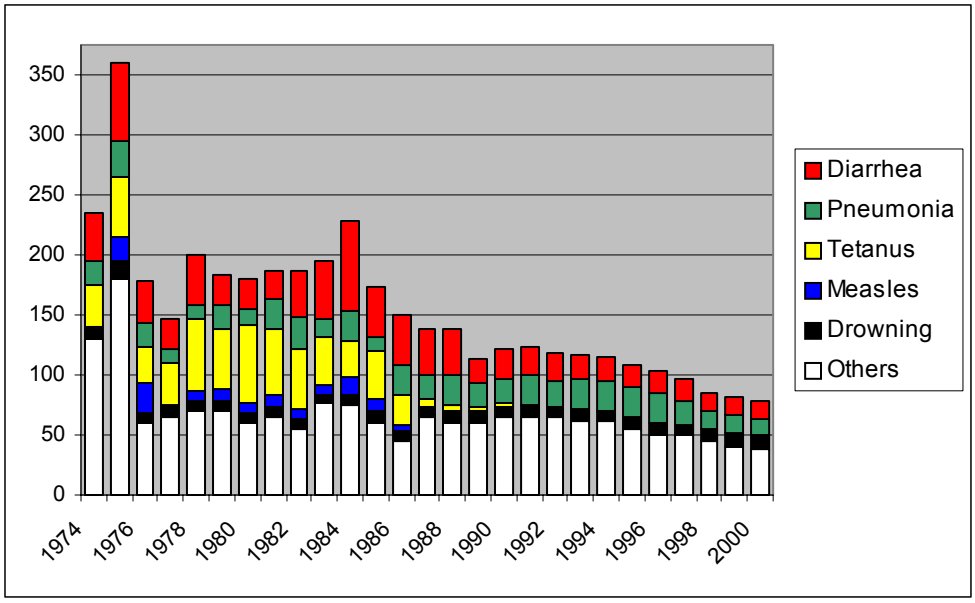
Figure 1.2. Early child mortality trends – Matlab, Bangladesh

Figure 1.2 at right shows that the trends seen above for infants are mirrored in the trends in early childhood mortality (children aged one to four) in Matlab. It clearly shows the positive impact of the services being provided in the project area. Figure 1.3



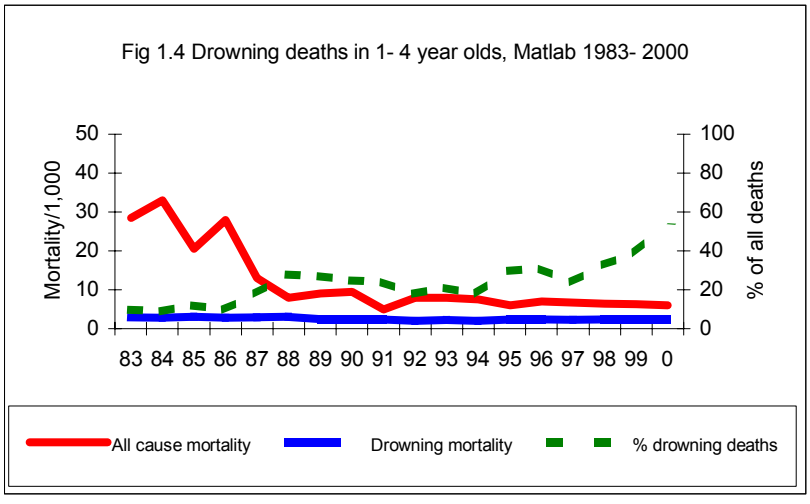
shows very clearly why this is occurring.

Figure 1.3. Trend of U5 mortality rates, Matlab, Bangladesh



This demonstrates what has happened as programs for immunization, diarrheal and respiratory disease prevention and other infectious disease and nutritional interventions are being implemented and taking effect. The vaccine preventable diseases of tetanus and measles, which contribute significantly to infant and child mortality in the early period disappear as causes of mortality in the late 1980s. The decreases in diarrheal diseases, as well as pneumonias are clearly evident over the time course of the last quarter-century. Thus, the decrease in under-five mortality by almost two-thirds over the quarter century has been accomplished mainly through the reduction of infectious causes. This results in an increase in proportional mortality of non-communicable causes such as drowning, which actually remains at relatively constant (and large) levels throughout the quarter century. While infectious diseases remain a cause of child death, they have been significantly reduced. Consequently, with the reduction in rate of infectious disease, the high incidence of injury as a cause of mortality and morbidity has become more obvious.

Figure 1.4 shows this phenomenon clearly happening. Drowning, while remaining at a relatively constant rate throughout the time period, emerges as the major injury-related cause of death in the 1-4s as other causes of early child death decrease.



1.4. Child mortality and morbidity in Vietnam

Health authorities in Vietnam have recognized that the health situation has changed dramatically over the last three decades, in large part due to the widespread access to preventive services such as immunization programs, nutrition programs and other mainstays of maternal and child health, as well as the economic progress that has come as a result of the economic opening. Over the last thirty years, the infant mortality rate has fallen from 104/1,000 live births to 35/1,000 live births and the average life expectancy has risen from 55 years to 68 years. These health indicators strongly suggest that Vietnam has passed through its own epidemiologic transition. In achieving this milestone, the predominant causes of child and adolescent death will have changed from the infectious causes such as ARI and diarrheal diseases, to injury causes such as drowning, falls and traffic crashes. This has dramatic implications for maternal and child health program implementation, as well as major implications for national health policy.

However, Vietnam, like most developing countries, relies primarily upon hospital and facility based reporting systems for direct reporting of causes of mortality. As noted, these are heavily biased and do not accurately reflect actual patterns and causes of mortality in the community. Over the last five years, the public health community in Vietnam began to address the issue of the epidemiologic transition, but has lacked the ability to look at causes of mortality using nationally representative community acquired data. However, several small-scale studies have shown that the transition is in progress and have identified injury as a leading cause of death in Vietnam.

While there have been many small studies on injury, nationally representative and community-based research on fatal and nonfatal outcomes of injury has not been carried out in Vietnam. Small regional studies have been undertaken by the Hanoi School of Public Health in Chi Linh District (Hai Duong Province) and An Hai District (Hai Phong Province) in early 2001. Similar studies were carried out in the southern region by colleagues at the University of Medicine and Pharmacy in Ho Chi Minh City in 1999. The closest attempts to a survey of national scope were two community-based surveys conducted in eight major cities in Vietnam in November 1999 and five major cities in November 2000 (Phuong, LN and Linnan, MJ). These studies confirmed the suspicion that the reported national injury data, which relies heavily on hospital and police records, significantly under-represent the true injury situation.

1.5. The development of the Vietnam Public Health Research Network

Following these studies, it was recognized by the Hanoi School of Public Health that the causes of child death and disability were changing, but the change could only be accurately seen in a national, community-based survey. Thus, the school endeavored to create a public health research network to allow such a national survey to be done.

The Vietnam Public Health Research Network (VPHRN), under the coordination of the Hanoi School of Public Health, is the research infrastructure set up to carry out community-based surveys on mortality, morbidity and disability. The VPHRN membership includes:

- In the North: Hanoi School of Public Health, Hanoi University of Medicine, Thai Nguyen Medical School, Hai Phong Medical School, Thai Binh Medical School, and the Institute of Health Policy and Strategy
- In the Center: Hue Medical School and Tay Nguyen Medical School

- In the South: HCMC University of Medicine and Pharmacy, and School of Medicine at Can Tho University

The Vietnam Multi-center Injury Survey (VMIS) is a collaborative, regionally and nationally representative injury study that pools the resources and expertise of VPHRN members. VMIS hopes to describe comprehensively for the first time, the nature of injury in Vietnam and to quantify the problem that injury poses to the health of the Vietnamese people in a manner that allows statistically accurate comparisons to be made across regions and populations so that the true magnitude of the burden of injury can be defined, and so prevention programs can be designed.

This report to UNICEF is based on the VMIS survey, which was partially funded by UNICEF. While VMIS was an all-cause mortality and morbidity survey of all ages, it examined injury mortality and morbidity in depth, and thus this report relates the findings on the pattern of mortality and morbidity due to injury in Vietnamese children.

Chapter
2

2. Methods

2.1. Research methodology

A cross-sectional survey was carried out in eight regions of Vietnam from August to October 2001 and a capture-recapture validation survey was conducted in May and June 2002.

2.2. Sampling and sample size

Members of the Technical Advisory Group (TAG) formulated the sampling methodology with contribution from experts from the Government Statistical Office and the CDC Resident Advisor. The methodology was established to maintain the statistical integrity of the study while minimizing the logistical considerations posed by such a large study:

- A multi-stage cluster sampling was used to choose a total sample size of about 27,000 households. The household was the designated sampling unit for the survey.
- The number of households was calculated based on the result of the 1999 census, with 4.6 persons per household.
- The target number of sample households for each region was allocated based on the proportions of the square root of population for each region. This allowed a minimum number of clusters to be located within each region, as some regions had very small populations.
- In each region three provinces were randomly chosen with equal probability.
- In each province three districts were randomly chosen with equal probability (a total of nine districts per region).
- The number of households per district was identified by dividing the number of households in each region among the nine districts.
- A "block" was defined as an area comprising 90 households.
- In each district, blocks were identified with the number of blocks proportional to the size of the district with adjustment for fractional blocks.

The national sample calculation used the following formula with the assumptions noted:

$$n = \frac{z^2_{1-\alpha/2}\, p(1-p)}{(\varepsilon p)^2}$$

Assumptions:

Precision = 20%
Alpha = 0.05 (two-sided)
Response rate = 95%
Design effect = 1.1

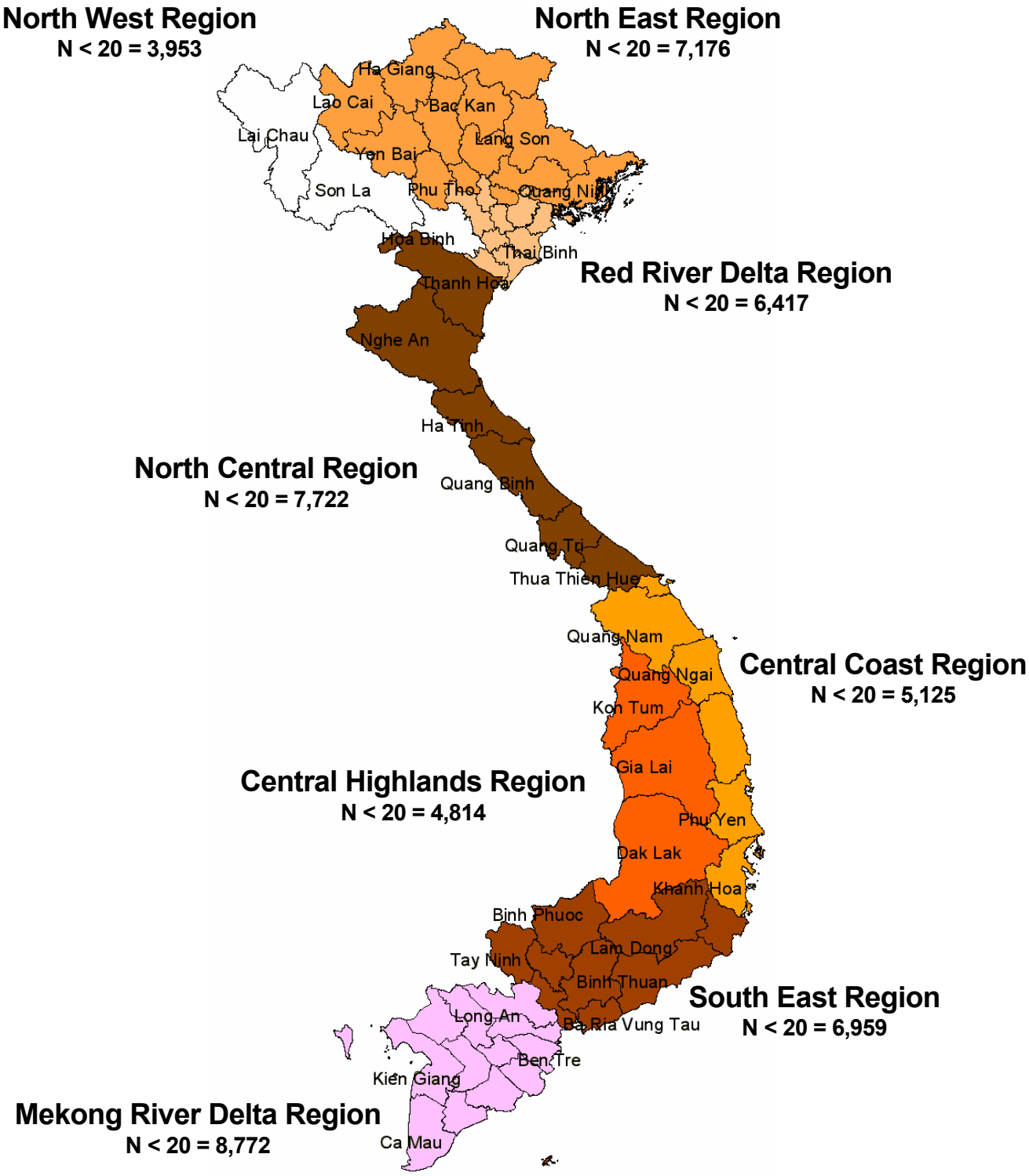


Figure 2.1. VMIS sampling regions and number of children under 20 in regional samples

The following table shows the numbers of households selected in each zone.

Table 2.1. Population and number of households allocated in each zone

Zone	Population	No of Household	Sq.root of pop	# HH selected
North East	10,860,000	2,648,780	3,295	3,757
North West	2,228,000	543,415	1,493	1,702
Red River Delta	14,800,000	3,609,756	3,847	4,386
North Central	10,007,000	2,440,732	3,163	3,606
Central Coast	6,526,000	1,591,707	2,555	2,912
Central Highlands	3,062,300	746,902	1,750	1,995
Southeast	12,711,000	3,100,244	3,565	4,064
Mekong River Delta	16,133,000	3,934,878	4,017	4,579
Country	76,327,300	18,616,414	23,685	27,001

Thus, by sampling to obtain a representative sample of each region, and including all eight regions of Vietnam weighted for the population proportion in each region, a nationally representative sample was drawn that allowed approximately 27,000 household interviews to be done. The detailed sampling process and lists of provinces and districts chosen is available through the HSPH/CIPPR.

2.3. Instruments

Trained surveyors administered a questionnaire at each household. The questionnaire was developed and tested through repeated small-scale studies in rural, peri-urban and urban areas in the year leading up to the actual survey.

The questionnaire was divided into three parts:

Part 1 was a form to collect general information about the household that included information about household members (age, sex, education, occupation).

Part 2 was information about illness or death in the past 12 months. This part included information about household members who were ill or died and the cause of the illness and/or death.

Part 3 was the information about injury cases, which consisted of a number of questions such as: causes, circumstances and consequences of the injury.

The questionnaires used are available through the HSPH/CIPPR.

2.4. Respondents

The respondents were the most knowledgeable member of the household present at the time of interview. Where possible, it was the head of household, and as many members of the household were present as possible to corroborate or add detail to the respondents interview answers. The respondents were asked about the health histories of each member of the household over the preceding year. If any child deaths were detected, the interviewer asked that the child's primary caretaker be present to assist with answers to the questions. In the cases where a household was visited but no respondent was

present at first visit, a second repeat visit was made. If, on repeated visit, there were no respondents available, another household was chosen by protocol and substituted.

2.5. Survey implementation

The TAG oversaw the development and approved the various protocols and instruments for sampling, interviewing, data management and quality assurance and the analytic strategy and outputs. The Hanoi School of Public Health served as the coordination point for this, and for the training of the survey supervisors and associated staff in the network institutions in the northern half of the country. The HCMC School of Medicine and Pharmacy performed a similar function for the network in the southern half of the country.

Two rounds of training for supervisors, interviewers and data management staff were conducted. All the supervisors were professional teaching staff of the network institutions and the interviewers and data management staff were a mixture of teaching staff and students in the various network institutions.

2.6. Validation methods

The VMIS was conducted in two phases. In the first phase, all information was collected at household level by interviewers from the eight different institutions.

After the first phase, the validation study was conducted with the use of capture-recapture methods to validate the mortality data from VMIS. All of the locations that had been surveyed in the first round were re-visited. Mortality information obtained in the first household survey was rechecked for accuracy. Additional sources of data were identified to use as recapture systems (the population registration books maintained by the People's Committee, the vital registration system maintained by the Ministry of Justice, and the clinic and/or hospital serving the sampling block). All deaths recorded in the first survey were checked to see if they had been reported, listed or logged in the various recapture systems, and all deaths noted in the recapture systems were checked to see if any had occurred in any of the households visited in the initial survey.

2.7. Definitions used in the study

Injury was defined in the study as a health incident that either caused the respondent (or member of the respondent's family) to miss work or school, visit a health facility, limit his/her daily activities for at least one day, or resulted in death. The recall period was one year.

Injury cases were categorized into the following types:

(1) Road Traffic Accidents (RTA)
(2) Injury caused by sharp objects
(3) Drowning
(4) Poisoning (including food poisoning)
(5) Falls
(6) Animal bites
(7) Electric shock
(8) Burn/Fire
(9) Suffocation
(10) Injury caused by falling objects
(11) Injury caused by machines.

A household member was defined as a member having a relationship, living in a house, sharing meals and information during the previous three months

The traditional ICD 9-10 classification codes were not used after extensive pilot studies demonstrated that the modified typology above was more readily accepted.

The following definitions were used for the different gradations of severity of injury:

Minor injury: injury requiring either seeking trained medical care or missing one day of work or school. This requirement was intended to limit the severity of injury to that significant enough to require trained medical care or resulting in lost work or school. Any injury that did not meet this minimal criterion was deemed insignificant in terms of health care, economic or social costs and was not included in the survey.

Moderate injury: injury requiring hospitalization but duration of nine days or less. This definition was intended to capture those injuries serious enough to require significant medical care with hospitalization, but not so severe that major surgical procedures were necessary.

Major injury: injury requiring hospitalization and the duration of the hospitalization was over ten days. This definition was intended to capture those injuries so severe that they required a major surgical procedure.

Severe injury: injury that resulted in permanent disability from blindness, deafness, loss of an extremity or the ability to handle/walk or the loss of mental abilities.

Death; injury that was fatal.

2.8. Data management and analysis

All data collected by VMIS were entered using the VMIS data entry program developed by HSPH. The database was managed with MS Access 2000. After cleaning, the data was exported for analysis using SPSS 11.0 and STATA SE 8.0.

Sampling weights were calculated after the survey. Sampling weights, allocation weights and response weights were used during the analysis. The weighting process was done to adjust for the differing inter-regional and intra-regional proportions of the populations.

The capture-recapture method was used to estimate the total, and cause-specific numbers of death. Comparison between the proportions of all deaths found by capture during the household interviews and all deaths found by recapture during the validation study allowed calculation of the adjusted number of deaths in each region. The recapture-adjusted deaths were distributed based on the distribution of cases found by capture.

Detailed information on the weights, protocols for the recapture surveys and detailed descriptions of the adjustment processes used for capture/recapture are available through the HSPH/CIPPR.

Standard life table, and multi-decrement life table methods were used to calculate the life expectancy and Years of Potential Life Lost (YPLL).

2.9. Discussion

While the acronym VMIS stands for the Vietnam Multi-center Injury Survey, VMIS was an all-cause mortality and morbidity survey. It asked about all deaths and instances of

morbidity of all causes. It is called an injury survey because much more detailed information was collected regarding the deaths caused by injury than infectious or chronic causes. All deaths and occurrences of serious morbidity were determined for two reasons: first, in order to determine the proportional contributions of injury, chronic disease and infectious disease to overall mortality and morbidity, all deaths had to be classified by one of the three causes to determine what proportion of all deaths they represented: secondly, to avoid any systematic sources of selection or classification bias, all instances of death and serious morbidity had to be determined and then classified.

2.9.1. Issues of bias: classification errors

The classification process was designed to be as bias-free as possible. First, when a household was visited and after all household members had age, sex and socio-economic data recorded, a simple, single screening question was asked: "Has anyone residing in this household died in the last year?" If the answer was yes, the age, sex and cause of death was determined. Cause of death was first asked in an open-ended fashion: "why did the person die?" and the response recorded. Following this, a standard verbal autopsy was administered. This was to provide a systematic process of death and morbidity classification that allowed a translation of the layman's description to a medical diagnosis. Coding the unprompted cause first allowed all causes to be represented and to ensure that all causes, even the uncommon were ascertained. Following this, a systematic verbal autopsy allowed for correct medical causes to be assigned.

Classification error is a serious problem of community-based surveys, as laypeople will usually describe the final, ultimate cause of death, but often will not relate this to the underlying cause of death. For example: A death described as rapid breathing could be caused by heart failure with rapid breathing due to fluid in the lungs (pulmonary edema); by an infection of the lungs (pneumonia) that occurred by itself, or by a pneumonia resulting from severe injury and subsequent respiratory complications. In each case of death, the final cause would be the same rapid breathing, but the underlying cause in each would be different. The first would be congestive heart failure, a chronic disease; the second would be a primary pneumonia, which is an infectious disease; and the third would be a complication of a secondary pneumonia, due to an injury. Thus, a detailed, systematic and thorough process had to be used to adequately classify the underlying cause. In many cases, (as many as twenty to thirty percent) there was insufficient knowledge of the death by the respondent, to allow adequate classification. It was coded as unknown if this were the case. Later, characteristics of those deaths coded as unknown were compared to those with a known cause to try to ensure that there was not a systematic source of classification bias introduced by the classification system.

By asking the same screening question to each household visited and recording the response, and then proceeding to conduct a standardized verbal autopsy, the issues of classification bias were minimized. All causes of death or serious morbidity were elicited thus minimizing the potential to overlook any particular cause of death. This systematic process also ensured that there was not an interviewer bias introduced with consequent skewing of the results towards one particular cause of death.

2.9.2. Issues of bias: enumeration errors

One important issue regarding community surveys needs to be understood. At the community level, how the sample is obtained has a large effect on the completeness of the sample taken. Ideally, the goal of the sampling process is to allow the potential for each and every person from the area to be in the actual sample taken. In practice this is impossible to achieve, as at any one point in time, many normal residents of an area are not there. Many are part of the "migratory" population that is away working or seeking

work; many are visiting family members in other communities or are traveling for business or other reasons. Their deaths, or their knowledge of deaths of others cannot be determined, and these are "lost" to the survey. Additionally, in some areas, there are people who do not want to be counted, visited or interviewed by researchers, for a variety of reasons; lack of documentation, fleeing from family or authorities, etc. They are also "lost" to the survey. There are also "lost deaths" for several other reasons. If a person normally not resident in an area is killed or dies in that area, they do not get "listed" in the vital registration records of that area. If the sampling is done by household, then most deaths occurring to heads of the household are lost, because when the head of household dies the household disbands with the remaining dependents joining families elsewhere. In the case of the death of a head of household, both the death and the health experience of all members of the disbanded household are lost.

Despite these known problems, for logistical reasons, sampling in community surveys is usually done by households and that was the case with VMIS. Thus, the initial deaths captured in the household survey underestimated the true numbers of deaths that had occurred in that geographic region for the reasons noted above. These "lost" deaths usually are not randomly distributed by cause– they tend to occur in young, mobile and traveling populations, which have an increased risk of death from injury. Since one major goal of VMIS was to look carefully at injury, it was necessary to find ways to add to the completeness of the original sample of deaths found. The capture/recapture method was used to identify as many additional deaths as possible that were not found in the first survey, and to then use this data to adjust the rates from the first survey. These adjusted rates were used to calculate the national age, sex and cause-specific rates for VMIS.

2.9.3. Issues of interpretation: sample size and power

One of the most important issues that the reader must consider in interpreting the results of VMIS relates to what is commonly called the "sample size issue" or the "power of the survey". It is extremely important to understand the limitations of the data imposed by the sample size in order to correctly interpret the results. Today in Vietnam, due to the excellent progress in health development over the last thirty years, life expectancy has increased to levels associated with developed countries. The life expectancy for an infant born in 2000 was 70.6 years if a girl, and 68.5 years if a boy. These long life expectancies, a major achievement for Vietnam's health sector, are directly related to the relatively low crude mortality rates in the various regions of the country. A crude mortality rate in the range of four to five per thousand, as seen in Vietnam means that deaths are relatively rare events in the general population. Finding a rare event at the community level means having to interview hundreds of households in order to find one household that had a death in the previous year. This low rate of households with a death from any cause, means that the sample size must be quite large to find a significant number of deaths. The costs of a community-based survey are directly related to sample size, and large sample sizes impose prohibitive costs on the survey. Thus, a national community-based survey requires a balance of size (numbers of houses screened for deaths found) with cost (dollars available for the survey). This balance means that only relatively frequent causes of death are able to be determined with reasonable precision by the survey. Rare causes of death are not picked up by the survey. It is not that they do not exist, or are not important, but that they are too infrequent to be ascertained by a survey with a sample size that would be affordable. With relatively rare causes of death, the more efficient way to ascertain these is a search using indirect methods for cases and if warranted, further analysis by case-control study.

The need to balance sample size with survey costs results in a relatively small number of deaths in the selected sample. This issue then compounds itself when the data are categorized and analyzed by smaller and finer groups. The decreasing numbers of illness

and death when subdivided into smaller age groups has a dramatic effect on the resolving power of the VMIS when looking at the childhood age groups, and particularly in the age groups that only have one year included, such as infants <1. In many cases, the numbers are so small in these age groups that there were no deaths. While this is the single largest limitation of VMIS, it is due to the amazing progress that Vietnam has made in health over the last three decades. As a result, the lack of precision by age group and region is a very beneficial cost of successful health development. Increasing the sample size to an amount necessary to resolve all the causes of death in each age group with similar relative precision would require at least a five-fold increase in the sample size which would mean a much lower cost-benefit ratio for the information provided.

In the case of VMIS, the maximum affordable sample size was 27,000 households, with a total of approximately 128,600 health histories obtained. The survey found 460 deaths (unweighted), which occurred in all age groups. When classified by age group, the numbers of death in any one age group get smaller; when sub-classified by sex, further sub-classified by cause, and then further sub-classified by region, the numbers of deaths get very small. When subdivided this many times, in many groups, they are often zero. This is apparent when looking at death rates for various causes of injury deaths when classified by age, sex and region. This is a normal problem of large, national surveys.

2.9.4. Issues of interpretation: resolving power of VMIS and its effect on special population groups

Another issue to be aware of for interpretation is that because of the sample size issue, causes of death that are mainly regional in distribution must be relatively frequent in order to be found. A clear example of this is death or serious injury due to unexploded ordnance (UXO). VMIS found no cases of death from UXO. This was not due to ascertainment bias: by asking the household respondent unprompted first for the cause of death and recording it, had anyone said the death was caused by an exploding mine or bomb, it would have been recorded as such. The recording forms had free text fields for entry of rare causes of death. In the subsequent verbal autopsy, if a traumatic cause of injury was described, the cause of the trauma was asked about in increasing detail until the actual cause for the trauma was identified. No incidents of UXO related deaths were described despite this detailed probing. Deaths due to explosives were found; but they were due to the use of explosives while fishing.

VMIS was designed to be free of interviewer bias in order to provide accurate and representative data. It was also designed to be cost-effective and rapid. Thus, a balance was struck between cost and statistical power of resolution at the regional level. In the case of UXO related deaths, while not entirely confined to the central region of Vietnam, they are concentrated there due to the fact that most of the UXO is found there for the historic reasons of the war. Since only one fifth of all deaths occurred in the central region, the numbers were quite small due to the sample size issue. Deaths due to UXO were not picked up at the national or regional level due to the sample size issue. It can be clearly seen by examining the actual numbers. In recent years, in the central provinces there are approximately 200 – 300 deaths annually due to UXO; this translates into a UXO mortality rate around one death per 50,000 population. The central regions sample only had about 9,900 children. Therefore, the odds of any death from UXO being within this small group were small, and the actual UXO child death rate was well bellow the precision level of the survey. While the 1/50,000 number is significant at the local level in the actual locality that the death occurs in, it is not high enough to be ascertained at the regional level. Statistically, in order for UXO deaths to have been registered as a cause of death by the survey, the regional sample would have had to be 30 times larger than it was. To maintain statistical comparability across regions, it would have meant a national

sample of almost four million respondents. This would have raised the costs of VMIS to well over two million dollars. Thus, resolving relatively rare or highly localized causes of death is beyond the ability of VMIS.

The same issue pertains to looking at special populations. The overall rates nationally and regionally reflect the true pattern of morbidity and mortality occurring in Vietnam in 2001, within the limits of the precision allowed by the sample size. The figures are generally descriptive of the Vietnamese population (and for this report, children). However, the rates obtained should not be applied to separate groups that do not reflect the overall composition of the population. For example, groups such as ethnic minorities, populations in special circumstances due to issues such as migration, or those living in areas associated with marginal conditions fall well under the resolving power of this survey. The rates obtained from the national and regional samples cannot be assumed to be representative of these populations. These populations and groups very likely have markedly different rates and they require special dedicated surveys to look at rates and causes of morbidity and mortality within the group or area.

2.9.5. Issues of interpretation: confidence intervals and precision of estimates

Another related issue is that when sample sizes are small and are subdivided into even smaller groups, the confidence intervals are increased. Thus, the confidence intervals around the sub-classifications are large and with each further sub-classification they get much larger. This means that there are problems to interpretation of the numbers: One, rare causes at the national level do not show up in the numbers:. two, less rare causes have very large confidence intervals, which make direct comparisons difficult because of problems with statistical significance. The overall resolution of the survey at the national level is high but it falls quickly when trying to resolve causes of death by region, age, sex and cause. Thus, in many cases, it is impossible to compare causes of mortality within certain small age groups from region to region.

One way to address the issue of deaths being rare events in the community is to increase the length of the recall period. VMIS used a one-year recall period. Increasing this to two years or even three years would have doubled or tripled the numbers of deaths, thereby increasing the ability to resolve less frequent causes of death. Increasing the recall period increases the bias introduced by imperfect memory, called recall bias. With deaths, recall bias over several years is usually felt to be relatively small. But, for morbidity, recall bias is a very significant source of bias, and because VMIS looked at both death and morbidity, and established interconnected rates for them, it was necessary to limit the recall period to one year.

While the issues of sample size and power, and the consequent problems with confidence intervals and statistical significance are impediments to detailed comparisons of different regions or sub-groups it is important to recognize that the overall patterns of mortality, regionally and nationally, and the trends defined by the sample are internally consistent and validated by demographic techniques such as life table analysis. This consistency adds confidence to the findings at the national and regional levels.

In the design stages, the VPHRN technical working group determined that the primary utility of VMIS would be as an instrument of relatively low cost, able to be rapidly administered and to resolve the predominant causes of mortality in Vietnam and at the regional level. This design philosophy, i.e. public health utility, meant that it was most important to measure the major causes of mortality and morbidity at the national and regional level, as these are the predominant factors that drive cost-effective health policy. This is not to say that relatively rare or localized causes of death are not important-- they are, but are best addressed through more efficient means of measurement or through

policy and programs determined in the areas where they are highest, and not at national level. This is the normal design philosophy for national health surveys around the world.

2.9.6. Summary: methodological constraints

The issue of small numbers is the single greatest constraint for VMIS. There are others, particularly the difficulty in obtaining sufficient information after the fact, sometimes almost a year later, to allow complete and accurate classification of the cause of illness or death. Additionally, the capture/recapture survey documented a very high degree of under-ascertainment and reporting of deaths of all kinds, but especially injury. The recaptured deaths were difficult to get information on and to classify. This is a generic limitation of the epidemiologic method and not due to VMIS. The reader must understand these issues and take them into consideration when reading the results sections and interpreting them.

Chapter
3

3. Overall results

3.1. General information

From August to October 2001, 26,733 households with 128,662 household members in 24 provinces, 72 districts and 292 communes were surveyed. The sample characteristics are listed in Appendix 1. The distribution of the socio-economic factors and the household descriptors in the sample taken from each region closely matched the known data for the region as recorded by Vietnamese government sources, and the aggregated regional samples closely matched the known national data for Vietnam; thus the VMIS sample was considered a representative sample by region and nationally.

This report focuses on children in the age group of infancy through 19 years of age (0 – 19). There were a total of 52,923 children included in the national sample.

3.2. Overall child injury patterns in Vietnam

There were a total of 2,533 nonfatal child injuries that either required medical attention or caused the child to miss at least one day of work or school. Table 3.1 lists these:

Table 3.1. Overall nonfatal child injury by cause and age/100,000

Causes \ Age group	< 1	1-4	5-9	10-14	15-19	<20
Fall	265.2	1469.2	1591.1	1416.4	1057.7	1322.1
	5	*115*	*201*	*215*	*159*	*695*
Animal bite	241.3	983.3	1464.0	1396.9	681.1	1105.2
	5	*77*	*185*	*212*	*102*	*581*
Road traffic	69.3	722.7	907.3	688.3	1307.4	900.2
	1	*57*	*115*	*105*	*196*	*473*
Sharp object	22.1	407.4	558.8	836.9	989.1	719.9
	0	*32*	*71*	*127*	*148*	*378*
Burn	398.2	504.2	175.1	166.2	74.4	201.0
	8	*40*	*22*	*25*	*11*	*106*
Poisoning	242.4	148.8	265.0	114.8	141.1	168.1
	5	*12*	*33*	*17*	*21*	*88*
Falling objects	56.9	180.1	123.0	155.7	253.7	175.9
	1	*14*	*16*	*24*	*38*	*92*
Machine	0.0	30.7	87.2	94.3	230.7	118.6
	0	*2*	*11*	*14*	*35*	*62*
Drowning	0.0	106.8	74.0	8.0	6.2	37.8
	0	*8*	*9*	*1*	*1*	*20*
Electric shock	0.0	100.5	17.5	40.3	16.0	35.4
	0	*8*	*2*	*6*	*2*	*19*
Other	0.0	0.0	73.4	27.6	28.9	33.8
	0	*0*	*9*	*4*	*4*	*18*
All causes	1,295.4	4,653.7	5,336.4	4,945.4	4,786.3	4,818.0
	25	*365*	*674*	*750*	*717*	*2,532*

** actual number of cases in italics*

Fall injury ranked as the number one cause of nonfatal child injury with a rate of 1,322.1 per 100,000. Animal bites followed at a rate of 1,105.2 per 100,000. RTA ranked as third cause of nonfatal injury for children with 900.2 per 100,000 and sharp objects ranked as fourth at 719.9 per 100,000. The other causes (burns, poisoning, falling objects, etc.) occurred at much lower rates than these top four causes. Overall, the most vulnerable age group was 5-9; this group had the highest rate of nonfatal injury. In this group, falls were the leading cause of injury and animal bites followed at number two, RTA ranked as third and sharp objects was in fourth place. Figure 3.1 below shows the proportional distribution of the types of nonfatal injury in the child age groups.

Figure 3.1. Nonfatal injury cases by cause and age group

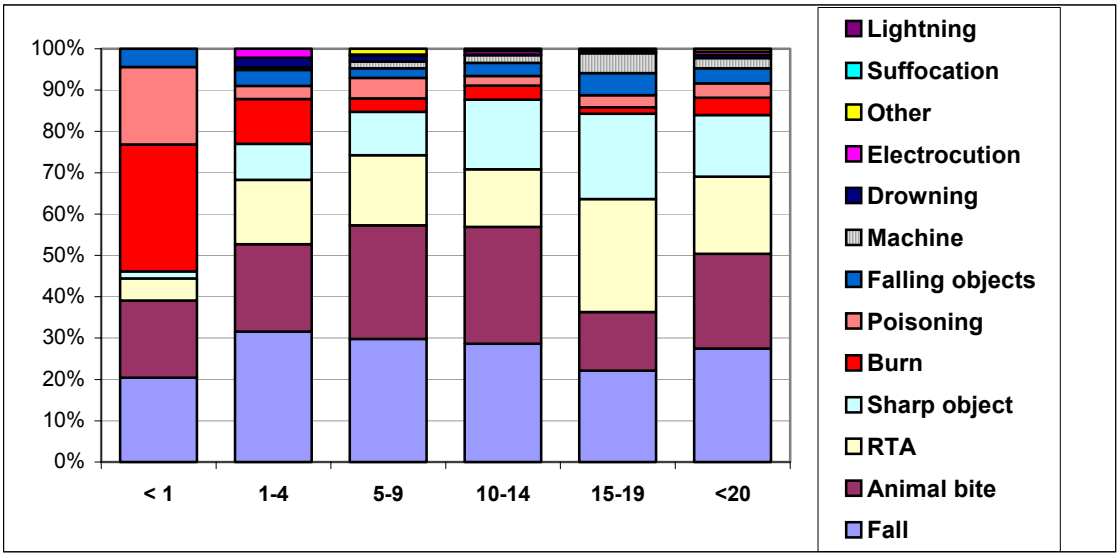
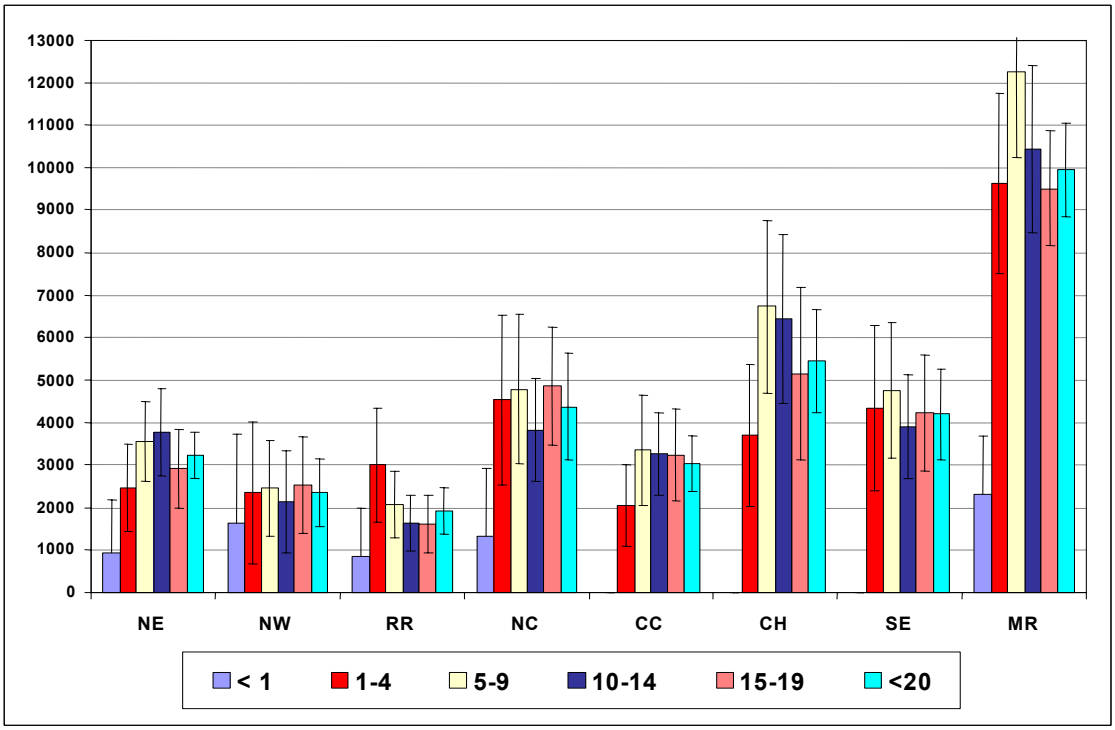


Figure 3.2 below shows the distribution of injury by age groups within the 8 regions:

Figure 3.2. Nonfatal child injury rates (/100,000) by region and age group



The Mekong River region had the highest rate of injury across all age groups, followed by Central Highland, and North Central Region. In the Red River Delta, and South East regions where Hanoi and Ho Chi Minh cities are respectively located, overall injury rates were lower than other regions. There were no significant differences between the nonfatal injury rates by age. There were no significant differences among the seven regions excluding the Mekong River region. The MR injury rates were significantly higher than the other regions due to somewhat higher drowning rates and markedly higher RTA rates in the Mekong River region.

There were a total of 44 fatal child injuries. These can be seen below:

Table 3.2. Overall fatal child injury rates (/100,000) by cause and age group

Causes \ Age group	< 1	1-4	5-9	10-14	15-19	<20
Drowning	115.0	21.8	71.8	34.5	15.9	39.2
	2	*2*	*9*	*5*	*2*	*21*
Road traffic	49.4	0	8.7	13.9	16.8	12.7
	1	*0*	*1*	*2*	*3*	*7*
Sharp object	31.6	0	11.1	0	7	5.8
	1	*0*	*1*	*0*	*1*	*3*
Poisoning	0	5.4	9.6	0	8.1	5.4
	0	*0*	*1*	*0*	*1*	*3*
Fall	0	17.9	0	0	7.1	4.7
	0	*1*	*0*	*0*	*1*	*2*
Electric shock	0	0	0	7.1	4.7	3.4
	0	*0*	*0*	*1*	*1*	*2*
Suffocation	0	0	11.1	8	0	5
	0	*0*	*1*	*1*	*0*	*3*
Falling objects	0	0	0	0	8.8	2.5
	0	*0*	*0*	*0*	*1*	*1*
Animal bites	0	0	0	0	0	0
	0	*0*	*0*	*0*	*0*	*0*
Burn	0	0	0	0	0	0
	0	*0*	*0*	*0*	*0*	*0*
Machine	0	0	0	0	0	0
	0	*0*	*0*	*0*	*0*	*0*
Other	0	0	0	6.2	9.6	4.5
	0	*0*	*0*	*1*	*1*	*2*
All causes	196.0	45.0	112.3	69.6	78.0	83.2
	4	*4*	*14*	*11*	*12*	*44*

** actual number of cases in italics*

Drowning, although ranked as the ninth cause of non fatal injury, was ranked as the leading cause of fatal injury in children with the rate of 39.2/100,000; Road traffic followed with a rate of 12.7/100,000. Sharp objects causing injury was third and poisoning followed closely in fourth rank. There were no child deaths due to animal bites even though it ranked as the second leading cause of nonfatal injury. There were also no child deaths due to burns or machinery.

Figure 3.3. Fatal injury rates (/100,000) by type of injury and age group

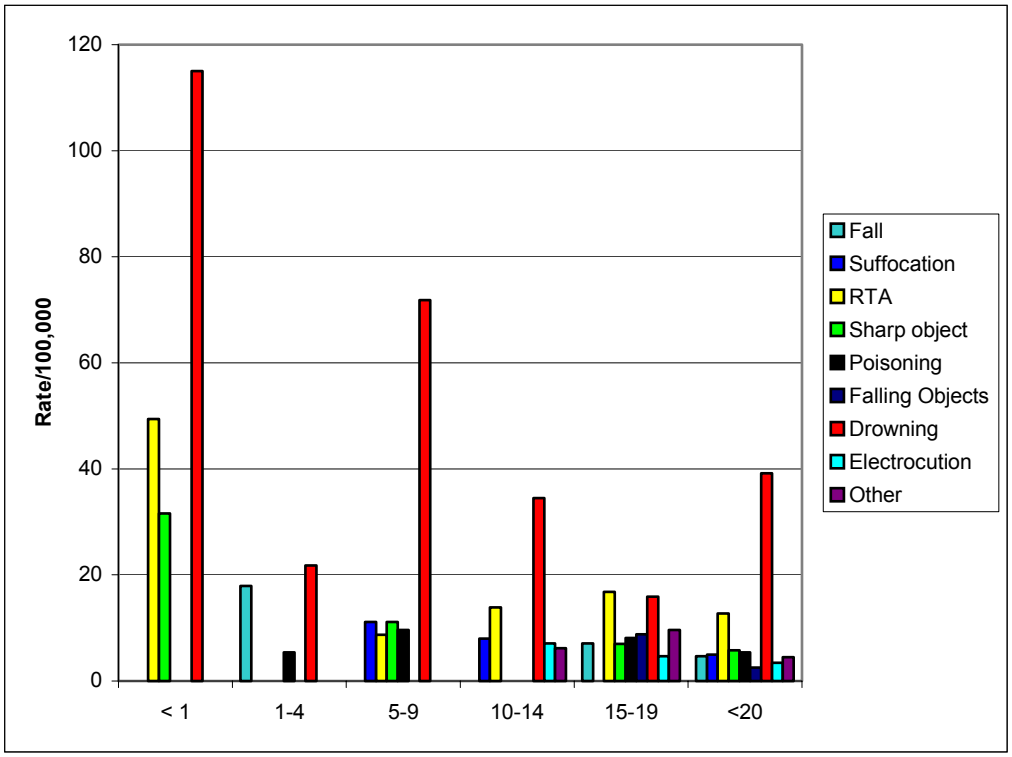


Figure 3.3 is a graphical portrayal of the fatal injury data listed in table 3.2. It clearly shows the predominance of drowning as the leading cause of child injury death. There were drowning deaths in every age group from infants (<1) through young adults (15-19), and in the younger child age groups the rates are extremely high. RTA can also be seen to be a significant cause of child death, but at rates well below those of drowning. The high rate in the infant age group and the lack of fatalities in the 1-4 group is most likely due to chance and the small sample size.

Table 3.3. Fatal child Injury rates (/100,000) by region and age group

Region	< 1	1-4	5-9	10-14	15-19	<20
NE	415	0	50	40	46	50
	1	*0*	*1*	*1*	*1*	*4*
NW	0	162	232	0	0	77
	0	*1*	*2*	*0*	*0*	*3*
RR	0	0	117	208	191	143
	0	*0*	*2*	*4*	*4*	*10*
NC	0	0	48	86	0	38
	0	*0*	*1*	*2*	*0*	*3*
CC	0	0	239	201	121	156
	0	*0*	*3*	*3*	*2*	*8*
CH	537	129	0	0	86	67
	1	*1*	*0*	*0*	*1*	*3*
SE	663	0	56	0	93	55
	1	*0*	*1*	*0*	*2*	*4*
MR	178	156	225	0	38	88
	1	*2*	*4*	*0*	*1*	*8*
Whole country	196	45	112	70	78	83

** actual number of cases in italics*

While there were no significant differences in nonfatal injury by region other than the rates in the Mekong River Delta, the rate of fatal injury in children differed greatly by region. It is important to note that this apparent difference was not statistically significant. It is due to the small numbers of deaths in each age group. With very small numbers, each additional death in a region makes a very large difference in the rate for the region; thus giving the appearance of large differences. However, when the 95% confidence intervals are taken into account, the different rates have overlapping confidence intervals, and are not statistically different.

This is a function of the sample size issue. Even with a sample size of 128,600+ for the national survey, when stratified by age to children, there were only 50,000+ in the sample. When stratified again by the eight regions, the numbers of children in each region was relatively small, and given the low mortality rate in Vietnam today, statistically, there are very few deaths to be expected in each region. Within some age groups in regional strata, there were no deaths. With small sample sizes, it is most useful to look at nonfatal injury as it occurs much more frequently, and thus is a better indicator of the overall distribution of injury.

The following table presents data on the nonfatal injury rate by region and age. Sample sizes for nonfatal injury were large enough to allow this comparison to be made.

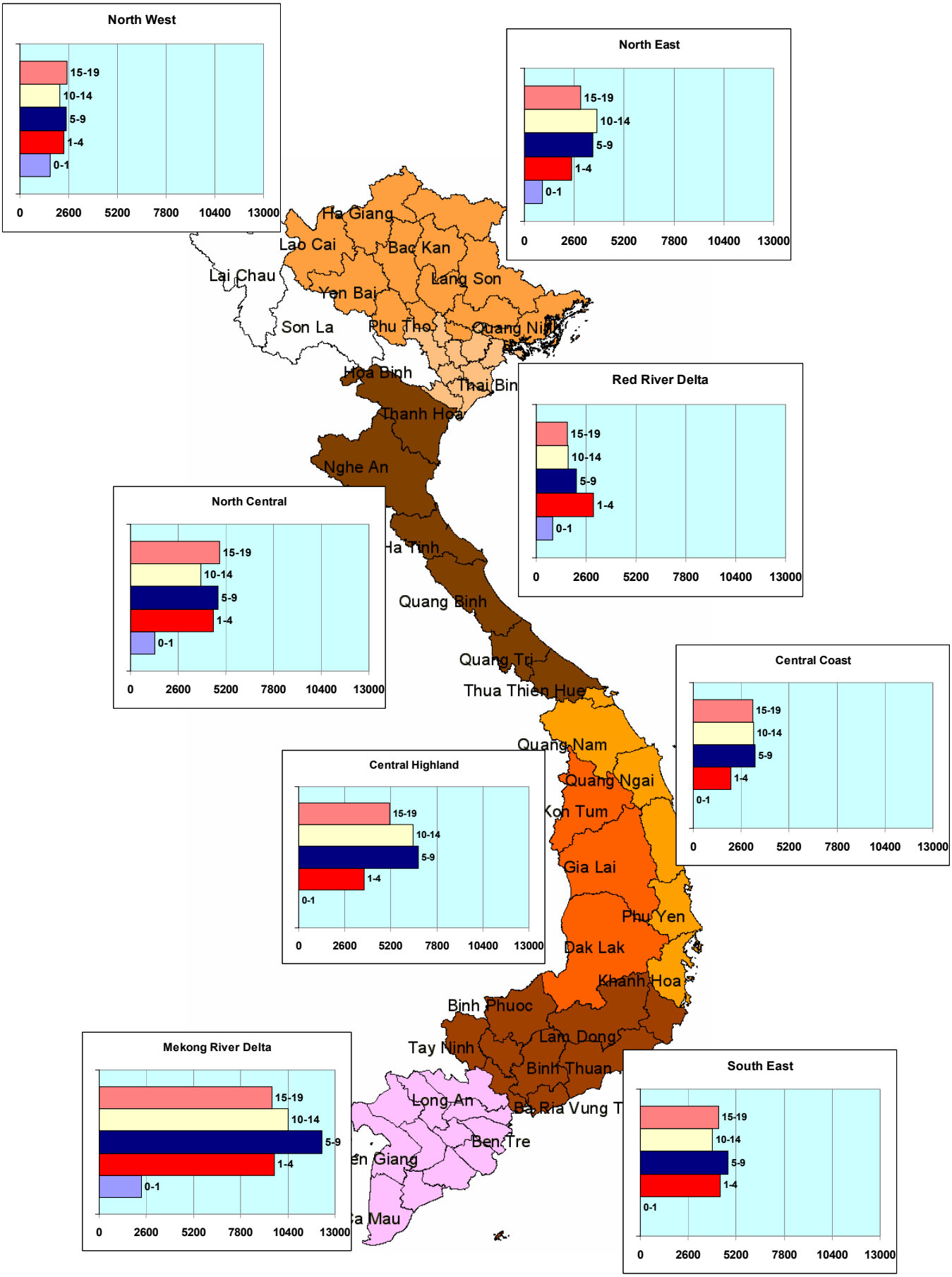
Table 3.4. Nonfatal child injury rates (/100,000) by region and age group

Region	< 1	1-4	5-9	10-14	15-19	<20
NE	920	2,496	3,557	3,780	2,927	3,227
	2	*25*	*67*	*89*	*62*	*245*
NW	1,625	2,350	2,464	2,129	2,530	2,340
	2	*15*	*24*	*28*	*34*	*103*
RR	838	3,004	2,086	1,643	1,614	1,913
	2	*31*	*33*	*31*	*35*	*132*
NC	1,325	4,527	4,790	3,834	4,868	4,373
	4	*59*	*111*	*89*	*100*	*363*
CC	0	2,048	3,351	3,270	3,234	3,020
	0	*16*	*49*	*54*	*47*	*166*
CH	0	3,701	6,743	6,446	5,156	5,456
	0	*32*	*85*	*83*	*65*	*265*
SE	0	4,342	4,761	3,903	4,231	4,200
	0	*50*	*88*	*82*	*90*	*310*
MR	2,329	9,640	12,261	10,423	9,514	9,956
	12	*124*	*220*	*286*	*270*	*912*
Whole country	1,295	4,654	5,337	4,946	4,786	4,818

** actual number of cases in italics*

The figure on the following page allows a comparison of the regional differences in childhood injury patterns across the eight regions of Vietnam. While not significantly different as noted before, there is a trend for the rates to increase when going from north to south geographically.

Figure 3.4. Nonfatal injury rate (/100,000) in Vietnam by region and child age group



3.3. Intentional vs. unintentional injury

Intentional injury, or injuries from violence are injuries purposely inflicted by an aggressor or self-inflicted by the victim. Such injuries include homicide and nonfatal assaults, as well as suicide and attempted suicide. In this study we also looked at intentional injury by asking questions about the intention, relationship between victim and the person who caused the injuries. Intention was categorized into four main categories:

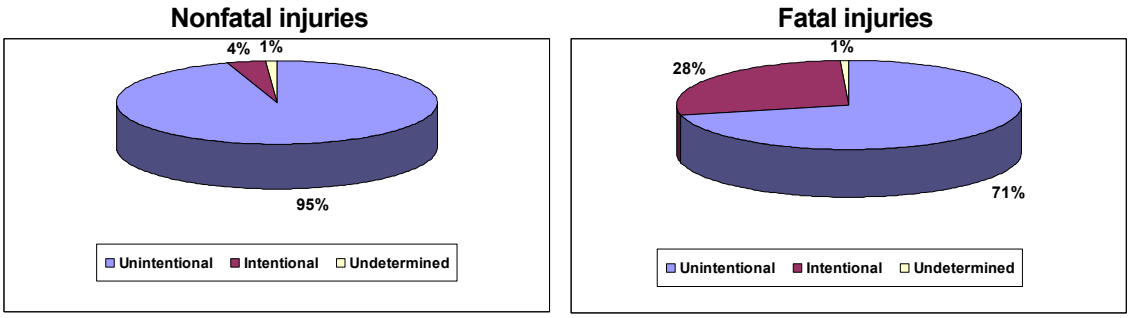
- Unintentional injury by other
- Intentional injury by other
- Intentional self-harm
- Undetermined intent.

Table 3.5. Intentional injuries by region and age group

Region	<1		1-4		5-9		10-14		15-19		<20	
	n	*%*	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*
NE	0	-	0	0%	1	4.8%	2	6.7%	1	2.0%	4	3.8%
NW	0	-	0	0%	0	0%	1	3.3%	0	0%	1	1.0%
RR	0	-	0	0%	0	0%	0	0%	1	2.0%	1	1.0%
NC	0	-	1	25.0%	2	9.5%	3	10.0%	4	8.2%	10	9.6%
CC	0	-	0	0%	1	4.8%	3	10.0%	3	6.1%	7	6.7%
CH	0	-	0	0%	1	4.8%	9	30.0%	12	24.5%	22	21.2%
SE	0	-	2	50.0%	3	14.3%	4	13.3%	6	12.2%	15	14.4%
MR	0	-	1	25.0%	13	61.9%	8	26.7%	22	44.9%	44	42.3%
Total	0	-	4	100%	21	100%	30	100%	49	100%	104	100%

For children, 95% of nonfatal injuries were unintentional and 4% were intentional; undetermined intent were about 1%. About 28% of fatal injury in children was intentional injury, and the rest (71%) was unintentional injury.

Figure 3.5. Intentional injury



3.4. Injury and other diseases

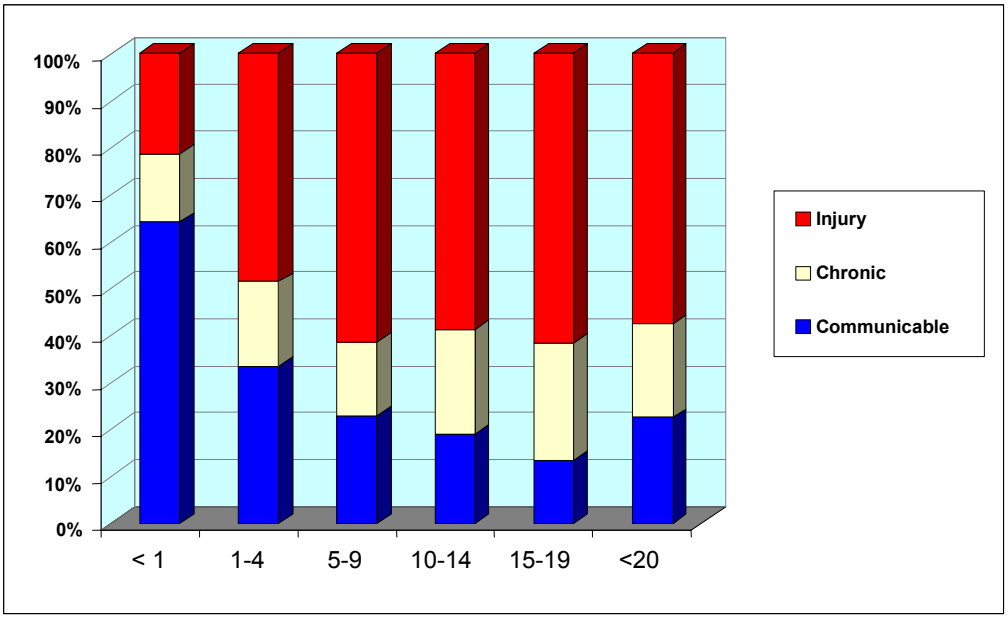
Overall, for all ages there were more than 18,500 instances of morbidity and 460 fatalities found in VMIS. Restricting the analysis to children under twenty there were 2,533 episodes of morbidity and 44 fatalities.

Table 3.6. Nonfatal injury and other disease proportion by age group

Causes	< 1	1-4	5-9	10-14	15-19	<20
Classifiable	78.5%	84.4%	87.3%	88.5%	87.5%	85.5%
	117	*751*	*1096*	*1278*	*1166*	*4334*
Communicable	64.1%	33.6%	22.9%	18.9%	13.3%	22.5%
	75	*252*	*251*	*242*	*155*	*975*
Chronic	14.5%	17.8%	15.7%	22.2%	25.1%	19.9%
	17	*134*	*172*	*284*	*293*	*863*
Injury	21.4%	48.6%	61.4%	58.8%	61.6%	57.6%
	25	*365*	*673*	*752*	*718*	*2496*
Unclassifiable	21.5%	15.6%	12.7%	11.5%	12.5%	14.0%
	32	*139*	*159*	*166*	*166*	*708*

** actual number of cases in italics*

Figure 3.6. Illness and nonfatal injury in children

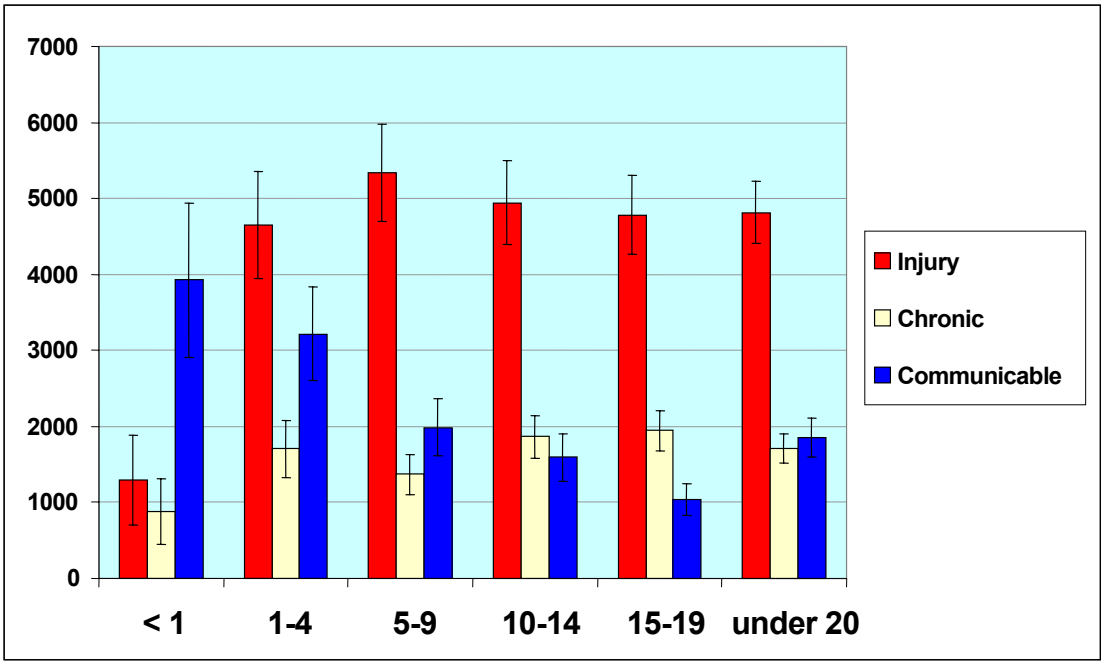


These represent classifiable causes; between 12 % and 21% unclassifiable depending on age group

Table 3.6a. Nonfatal injury and other disease rates (/100,000) by age group

Causes	< 1	1-4	5-9	10-14	15-19	<20
Classifiable	6102.4	9577.0	8686.9	8402.6	7769.7	8382.1
Communicable	3926.0	3218.2	1983.2	1592.3	1036.8	1854.8
Chronic	881.0	1705.3	1366.8	1864.0	1946.6	1708.9
Injury	1295.4	4653.5	5336.9	4946.3	4786.3	4818.4
Unclassifiable	1686.8	1767.6	1259.8	1083.1	1104.1	1255.5

Figure 3.7. Nonfatal injury and other disease rates (/100,000) by age group



For children, 86% of illnesses were classifiable by cause; of these, injury was the leading cause of illness accounting for 57.6%; communicable disease accounted for 22.5% and chronic disease accounted for 19.9%. The unclassifiable illnesses ranged from 12% – 22% depending on age group and there was insufficient information to know if these would have been disproportionately more in one cause or another if the information was available to classify them.

Injury accounted for increasing proportions of morbidity as child age increased. From about one-fifth of morbidity in children under one, it accounted for about half of morbidity in early childhood and almost two-thirds of morbidity in later childhood and adolescence. The relationship of injury as a proportional cause of morbidity through age can be seen clearly in figure 3.7: As injury increases in proportion, infectious causes decrease in proportion and chronic diseases increase slightly in proportion.

Table 3.7. Fatal child injury and other disease proportions by age group

Causes	< 1	1-4	5-9	10-14	15-19	<20
Classifiable	70.0%	62.5%	81.0%	83.3%	100.0%	82.4%
	7	*5*	*17*	*15*	*17*	*61*
Communicable	14.3%	20.0%	0.0%	20.0%	11.8%	11.5%
	1	*1*	*0*	*3*	*2*	*7*
Chronic	28.6%	0.0%	17.6%	6.7%	17.6%	14.8%
	2	*0*	*3*	*1*	*3*	*9*
Injury	57.1%	80.0%	82.4%	73.3%	70.6%	73.8%
	4	*4*	*14*	*11*	*12*	*45*
Unclassifiable	30.0%	37.5%	19.0%	16.7%	0.0%	17.6%
	3	*3*	*4*	*3*	*0*	*13*

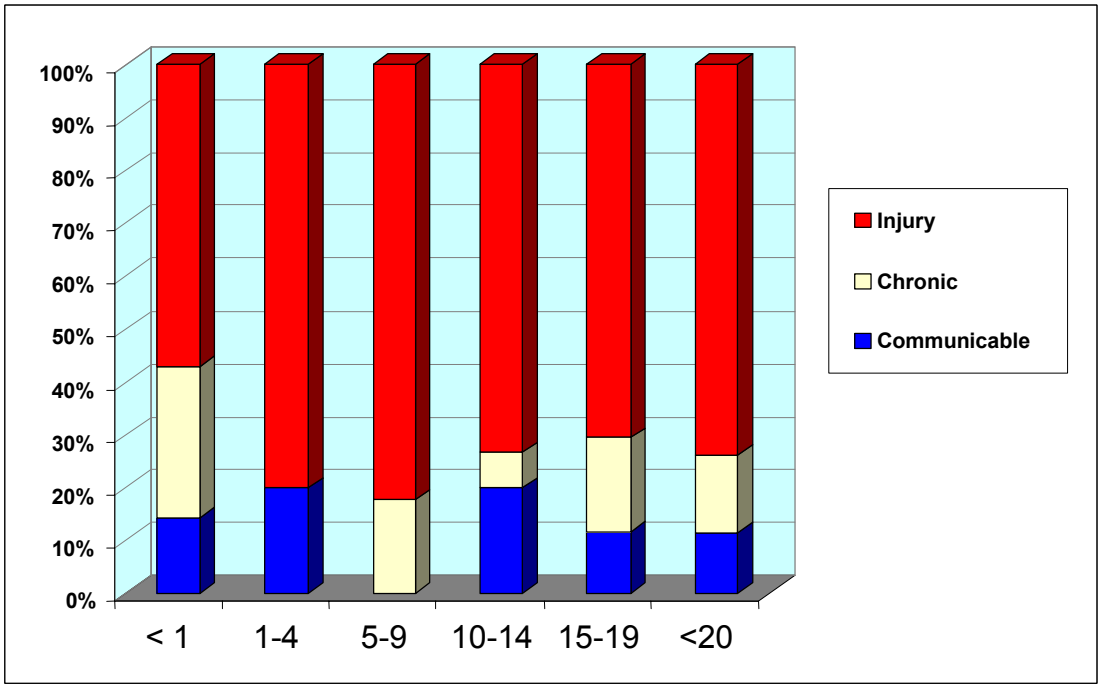
** actual number of cases in italics*

Table 3.7a and Figure 3.8 show the age pattern of fatal injury in children. Fatal injury and illness was harder to classify by cause, as the individual in question had died, and thus was not able to answer detailed questions designed to elicit causation. The respondents

were caretakers, family or others, but since the household visit occurred at a single point in time, in many cases the respondent with the greatest information was not available. Also, the fatal event or illness had occurred at a point in the past, and the further in the past, the less detail was recalled. Despite these inherent difficulties the verbal autopsy process could classify the majority of fatal events. Almost a third (30%) of fatal outcomes in infants were unclassifiable by cause. Data was more complete for older children and adolescents with less than a fifth (19%) and one-sixth (16.7%) respectively being unclassified. Overall, about a sixth (17.6%) of fatal outcomes in children were unclassifiable.

The apparent proportional mortality in the infant age group of 57.1% due to injury is likely an anomaly related to the small number of deaths and the sample size issue. Similarly, the small numbers of deaths most likely explains the lack of chronic disease deaths in the 1-4 year olds and the communicable deaths in the 5-9 year olds.

Figure 3.8. Fatal illness and injury in children

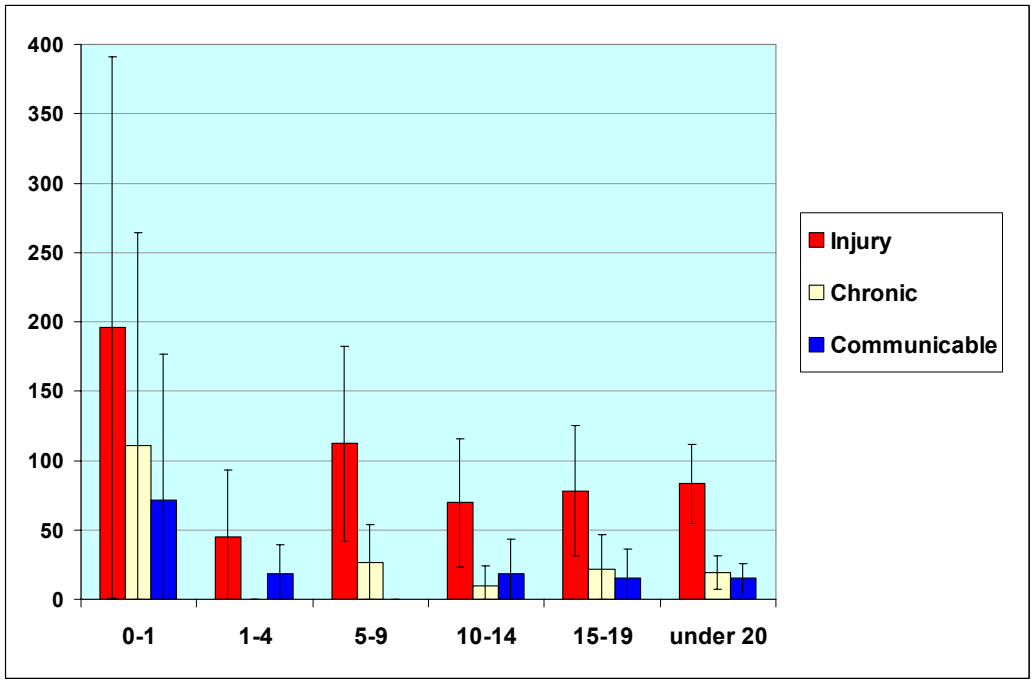


These represent classifiable causes; between 0.0% and 37.5% unclassifiable depending on age group

Table 3.7a. Fatal injury and other disease rates (/100,000) by age group

Causes	< 1	1-4	5-9	10-14	15-19	<20
Classifiable	378.6	63.5	138.6	97.4	115	117.4
Communicable	71.4	18.4	0	18.2	15.2	14.9
Chronic	111.2	0	26.3	9.6	21.7	19.3
Injury	196.0	45.1	112.3	69.6	78.1	83.2
Unclassifiable	182.8	38.2	31.1	17.5	0	24.9

Figure 3.9. Fatal injury and other disease rate (/100,000) by age group

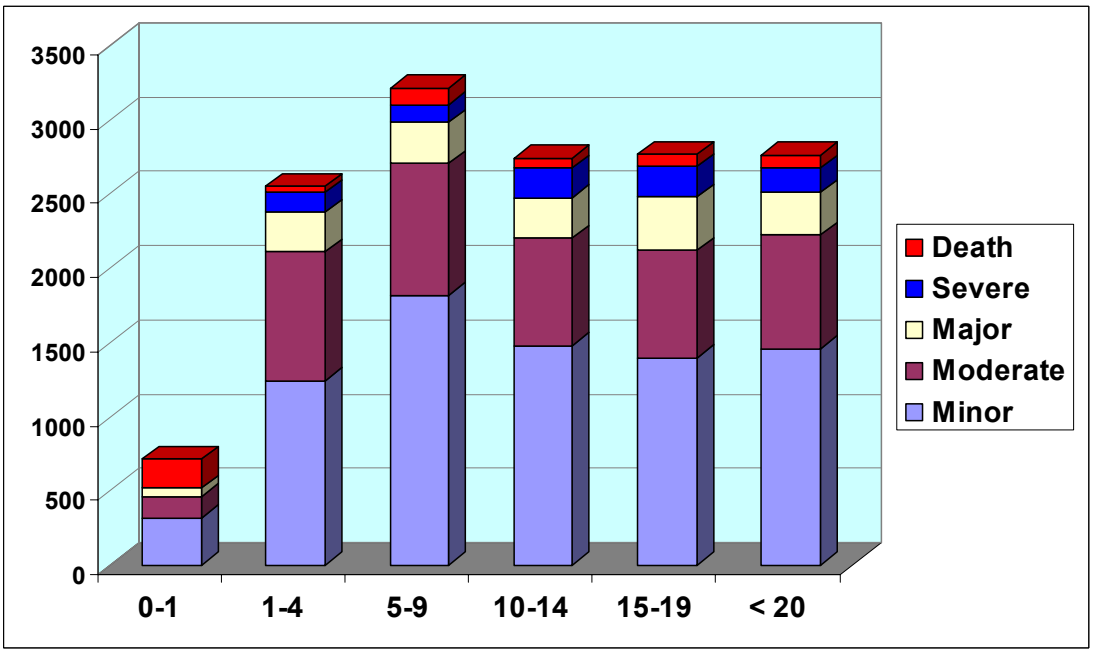


While the small numbers make exact comparisons between causes of death impossible, the overall trends by cause of death and proportions within each age group are quite clear. For deaths able to be classified by cause, injury was the leading cause in all age groups. For the child age group (<20), injury accounted for almost three fourths of deaths (73.8%) far outstripping infectious causes (11.5%) and chronic causes (14.8%).

3.5. Severity of injury

The severity of injury was defined by whether medical care was needed, work or school time was lost, the length of stay in hospital, the presence of permanent disability and/or death. Figure 3.10 shows the distribution of severity.

Figure 3.10. Overall injury rate by severity and age group



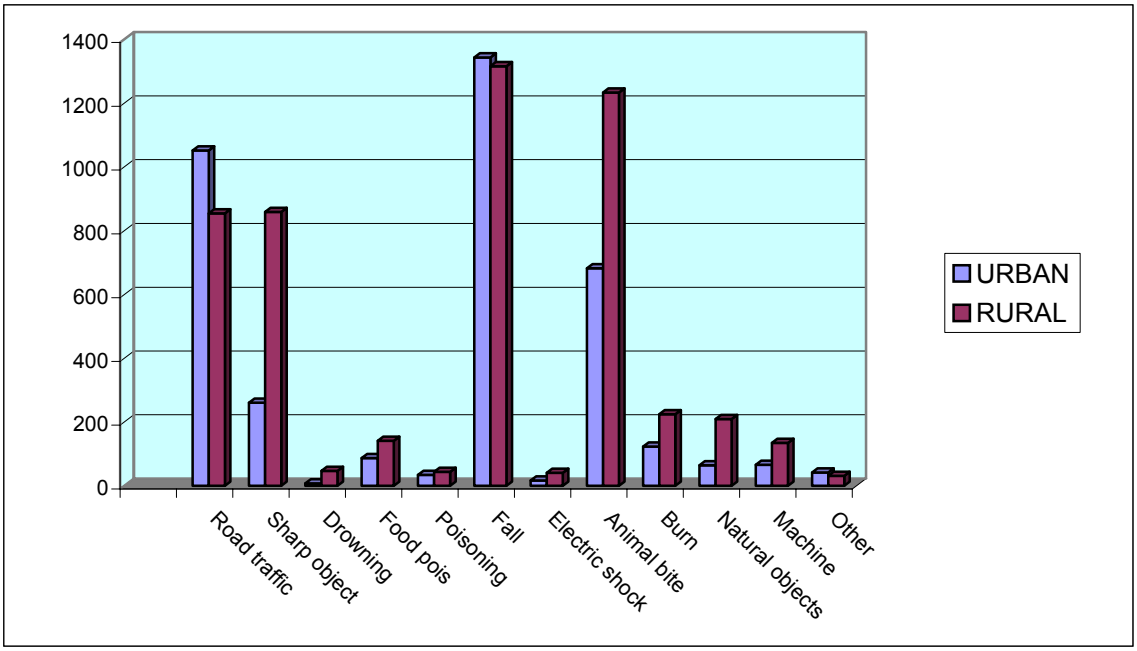
Approximately one-half of all injury was classified as minor (required medical care but not hospitalization). The other half required expending major medical resources or resulted in permanent loss of function or loss of life. The individual age group rates are listed in table 3.8 below. The 5-9 age group had the highest rates of injury, but it was of minor severity. The 15-19 year age groups had the highest rate of major and severe injury, but there was no significant difference in the distribution of moderate, major, severe or fatal injury for ages 1 – 19. Young children had the same high rates of injury severe enough to cause hospitalization, major surgery, and/or result in permanent disability and death as older children and young adults. Infants had much lower rates than children for injury overall, but the proportion of injury with a severity ranking of more than minor was higher than for children.

Table 3.8. Injury rates by age group and level of severity

Age	Minor	Moderate	Major	Severe	Death
< 1	316.9	145.0	56.8	0	196.0
1-4	1240.9	869.4	264.7	131.6	45.1
5-9	1817.9	886	276.8	118.4	112.3
10-14	1478.4	723.1	273.2	197.8	69.6
15-19	1395.0	722.3	363.0	205.9	78.1
< 20	1458.6	762.8	290.6	164.0	83.2

3.6. Urban/rural differences in injury

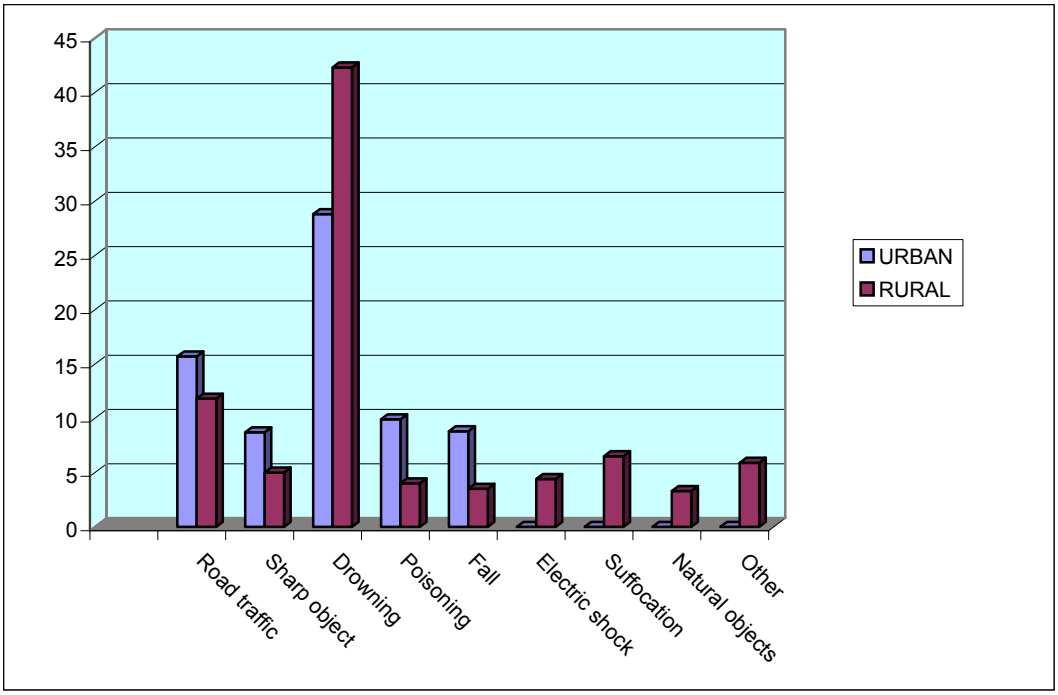
Figure 3.11. Urban/rural differences in nonfatal child injury



Urban and rural designation taken from General Statistics Office census designation

In general, there were not large disparities in nonfatal child injury by place of residence as urban or rural. There were differences in nonfatal injury from sharp objects and animal bites with these predominating in rural areas and fatal drowning rates which were higher in rural areas as can be seen in figure 3.12.

Figure 3.12. Urban/rural differences in fatal child injury



3.7. Years of Potential Life Lost (YPLL)

VMIS used the concept of Years of Potential Life Lost (YPLL) as one measure of the social and public health impact of the mortality measured. YPLL is a method for accounting for the potential years that are lost because of early death. The YPLL endpoint used was 65 years of age. For a five year old who died, the difference between five years and 65 years is the number of potential years lost: 60 years of potential life. The economically productive years (15-65) are within this span so YPLL provides a measure of the economic impact of the early death. YPLL is inversely weighted to the age of death as the earlier the death occurs, the higher the contribution of lost potential years.

Figure 3.13. YPLL65 by classifiable causes of death

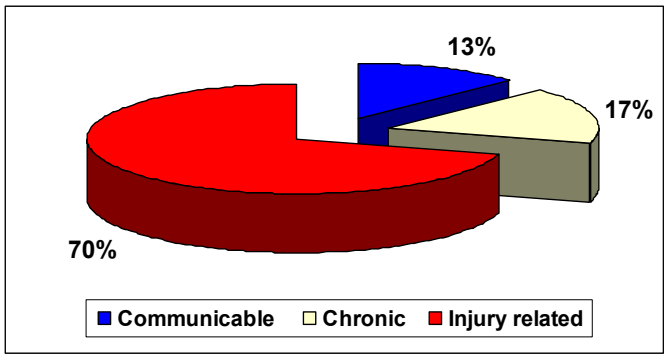


Figure 3.13 shows that injury was the leading cause of years of potential life lost by Vietnamese children in 2001. It accounted for more than two times the number of years of potential life lost of infectious diseases and chronic diseases combined. Along with the economic costs that YPLL is often used to represent, there are also social costs to be considered, as deaths occurring in childhood are for the most part in the childhood age groups where the health investments of antenatal care programs, immunization programs and other prevention programs have already been made in these children. The deaths

represent the loss of these investments as well as the loss of the potential economic productivity of these children later in life.

Figure 3.14. YPLL65 by type of injury

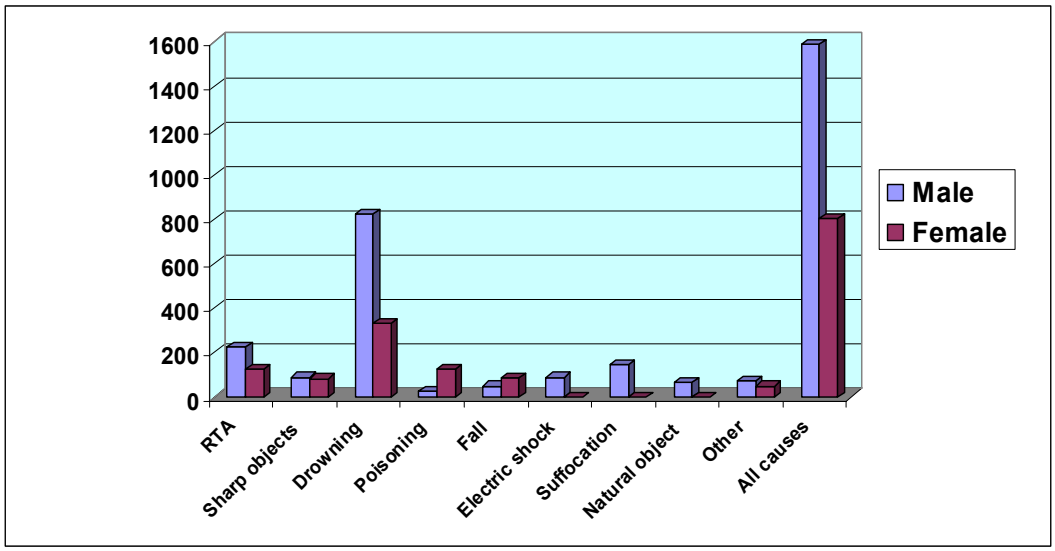
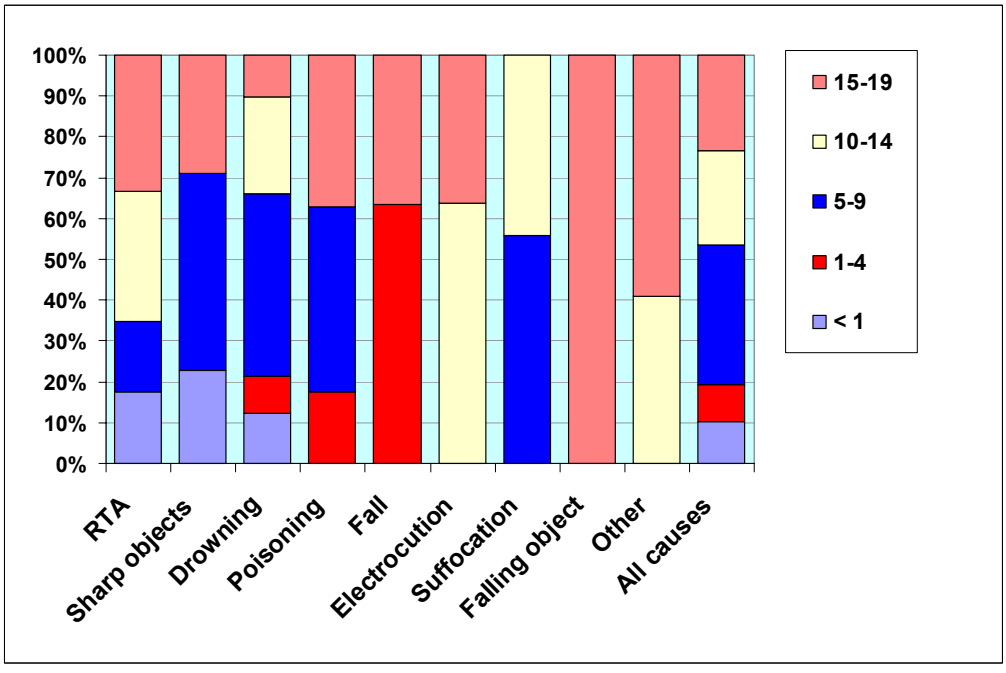


Figure 3.14 shows that drowning was by far the leading injury cause of YPLL. This is both due to frequency of drowning deaths (almost half of all injury deaths and a rate of 39.2/100,000 children) and to the fact that drowning was the leading killer in all the child age groups until the late teenage group (15-19). RTA was the second leading cause of YPLL lost, but it lagged far behind drowning in the early and middle child age groups and did not surpass it until the 15-19 age groups.

Figure 3.15. YPLL65 by cause and age group



The relative contributions of YPLL loss by type of injury within each age group can be seen in the figure above. Drowning is notable in that it is the only injury cause that had significant numbers of fatalities in every age group, from infancy (< 1) through the late teenage years (15-19).

3.8. Discussion

VMIS determined all deaths and episodes of serious injury or illness in the preceding year occurring within the household and classified these events by cause through a verbal autopsy and clinical history screening process. As a national mortality and morbidity survey, it provides information to health planners for a bias-free picture of the distribution of illness and fatal disease in the Vietnamese national population. The need for an unbiased picture of the epidemiology of morbidity and mortality is paramount for planners and policy-makers as it is a necessary starting point for appropriate health policy and strategies. Quite simply, if you don't have a clear picture of what is killing people, you can't devise prevention and control policies that are appropriate. Thus, VMIS was designed to avoid all the known biases of the current HIS and to provide a clear picture of the recent past in terms of causes of death and disease nationally in Vietnam.

3.8.1. Morbidity vs. mortality

The information provided for morbidity is more robust and complete than for mortality. Although the sample size is quite large compared with most injury studies with over 27,000 households interviewed (in 2001 when the survey was done, this was the largest survey on injury ever done in the developing world), the number of morbid and mortal events were low, reflecting how much Vietnam has achieved in health development. Despite having a GDP of only $375/capita it has measures of mortality and morbidity associated with countries at much higher levels of economic development. The infant mortality rate of 35/1,000 live births, the life expectancy of 68 years and the crude mortality rate in the range of 4-5/1,000 mean that even with a sample of 27,000 households, there will be relatively few serious illnesses and even fewer deaths each year. The numbers for morbidity are over 50 fold higher than for deaths, thus allowing a much greater degree of precision in determining rates both at the national level, and at the regional level when subdivided into the different age groups.

3.8.2. Sample size artifacts

The small numbers of deaths especially give rise to data artifacts that confound easy interpretation. One example is the apparent figure of 50% of all infant deaths being caused by injury. This is very unlikely and almost certainly due to the small numbers of deaths in the infant age group and an interaction with random chance. Another example in this same age group, is that there was one male infant death caused by RTA and no female deaths; this statistically results in a very skewed distribution where it appears that no female infants die from RTA. This is highly unlikely in the real world. Given a large enough sample size, it is almost certain that one or more female deaths would have been recorded, and thus there would be a significant female infant death rate associated with RTA. The same statistical problem occurs when there are very few deaths in a category and it is converted into a rate. If there is one death, the rate is one death per 100,000 people in that category; if there is only one additional death for a total of two deaths, it doubles the rate even though the number only increased by one death. Thus, the death rates for causes with few deaths have very large confidence intervals around them, and this makes it difficult to compare them with rates of other causes with any real meaning.

3.9. General comments

The fatal injury rate of 83.2/100,000 means that almost one out of every thousand children in Vietnam dies of injury every year. It is over five times larger in comparison to the risk of dying from infectious diseases for the same age group (14.9/100,000) and is four times larger than the risk of dying from chronic diseases (19.3/100,000). The rate of

83.2/100,000 means there are about 27,000 children who die annually in Vietnam from injury. This is 74 children each day, or one child dying from injury every twenty minutes.

The nonfatal injury rate of 4,818/100,000 means that almost 5% of children in Vietnam are injured each year significantly enough to warrant seeking medical attention and losing at least one day of work or school. Over 1,500,000 children were injured in the year prior to the survey, or about 4,300 per day, which is one child every three minutes. The rate was highest in the 5 -9 age group, but it was not significantly different from the other age groups, implying that children of all age groups are at the same high risk of being injured.

Nonfatal injury is significant for reasons other than its very high rates in Vietnam. Most of the direct medical, other economic and social costs are associated with nonfatal injury and for this reason it represents the major health burden of children in Vietnam.

Drowning, the leading cause of child death at 39.2/100,000, was responsible for almost half (48.8%) of the child deaths. It was followed a distant second by road traffic injury at 12.7/100,000, which caused about one-sixth (15.9%) of child deaths. These two causes accounted for almost two-thirds of all child deaths-- more than all other causes together.

Falls, electric shock, suffocation and natural objects were other leading causes of death in children. There were no deaths resulting from burns, animal bites, or machinery. This does not mean that these are not important and preventable causes of child injury deaths in Vietnam. They are, but they do not happen at rates high enough to be registered in this survey. For these fatal causes of injury to be correctly measured and defined, larger sample sizes or different survey methodologies are necessary.

The severity of the injuries suffered also did not differ significantly among the child age groups after infancy; the risk of injury severe enough to require medical care, hospitalization, major surgery, or lead to permanent disability or death was the same for all the child age groups. There were also few differences in child injury in children residing in urban areas versus rural areas. Overall, for injury the main difference in the age groups was the pattern of the specific type of injury rather than severity level, or place of residence. The socio-economic characterization of families is difficult in a country like Vietnam and thus it is hard to be specific about rates of injury in different socio-economic status (SES) groups, but there were no differences in crude measures of SES such as land ownership and risk of a child in the family being injured by drowning or RTA, the two leading causes of fatal injury. On the whole, injury appears to be an “equal opportunity” killer and disabler of Vietnamese children, leaving no groups of children safe, no matter their age, sex, place of residence or economic status.

As noted throughout the text, there have been caveats regarding the interpretation of these data, due to sampling issues, wide confidence intervals, and small numbers. In a more technically focused report or peer-reviewed publication, there would be much greater emphasis on detailed documentation of every finding, complete with all relevant citations, confidence intervals and other technical notes. These tend to be very distracting for many non-technical people, and they have been avoided so as not to detract from the most important point of the survey, which is that this survey has shown that injury is an enormously significant issue for Vietnamese children. While there is an inherent lack of precision, and large confidence intervals associated with rates in some of the groups, this becomes insignificant when summed up by the following overall finding of VMIS**:** ***In some child age groups, injury is the single leading cause of death and disability. In all age groups, for infants and children injury is a major cause of death and disability*****.** It is time to act on this knowledge and begin developing injury prevention and control programs as integral parts of UNICEF Vietnam’s programs.

The following chapters of this report address the specific causes of child injury in detail.

Chapter
4

4. Drowning

4.1. Introduction

Drowning is defined as death by suffocation due to immersion in water, and is divided into two types: wet and dry. In wet drowning, a person inhales water, which interferes with respiration and causes the circulatory system to collapse. In the less common instance of dry drowning, the airway closes due to spasms caused by the presence of water. Near-drowning may result in neurological damage. Successful recovery depends on prompt rescue and resuscitation.

According to the WHO, nearly 500,000 people drown annually and the vast majority of these drownings occur in low and middle-income countries. While in developed countries many children drown in swimming pools, in the developing world drowning in open bodies of water is common among both children and adults, as is drowning in closed bodies such as ponds and rice paddies. The significantly diverse circumstances in which drowning occurs contributes to the challenge of developing effective and appropriate prevention programs.

In Vietnam, especially in rural areas, there are many open water sources available, and children playing without supervision of adults are at high risk of drowning. The periodic floods caused by monsoons and typhoons are also responsible for many drownings. Many Vietnamese parents refer to the ending of the school year and the beginning of the summer vacation period as “the drowning season".

4.2. Drowning injury

The overall rate of child fatal drowning in Vietnam is 39.2/100,000. The fatal drowning rate in males (55.0/100,000) is significant higher than females (22.9/100,000).

Table 4.1. Drowning rates (/100,000) among children in Vietnam

Cause/age group	< 1	1-4	5-9	10-14	15-19	<20
Drowning (nonfatal)	0	106.8	74.0	8.0	6.2	37.8
	0	*7*	*9*	*1*	*1*	*18*
Drowning (fatal)	115.0	21.8	71.8	34.5	15.9	39.2
	2	*2*	*10*	*5*	*2*	*21*

Actual numbers of cases in italics

The Mekong River Delta had the highest rate of near-drowning in the country and the Central Coast had the highest fatal drowning rate. The North Central Region and Central Highland Region had the lowest rates of drowning/near-drowning respectively.

Figure 4.1. Drowning rate in children (/100,000/year) by regions

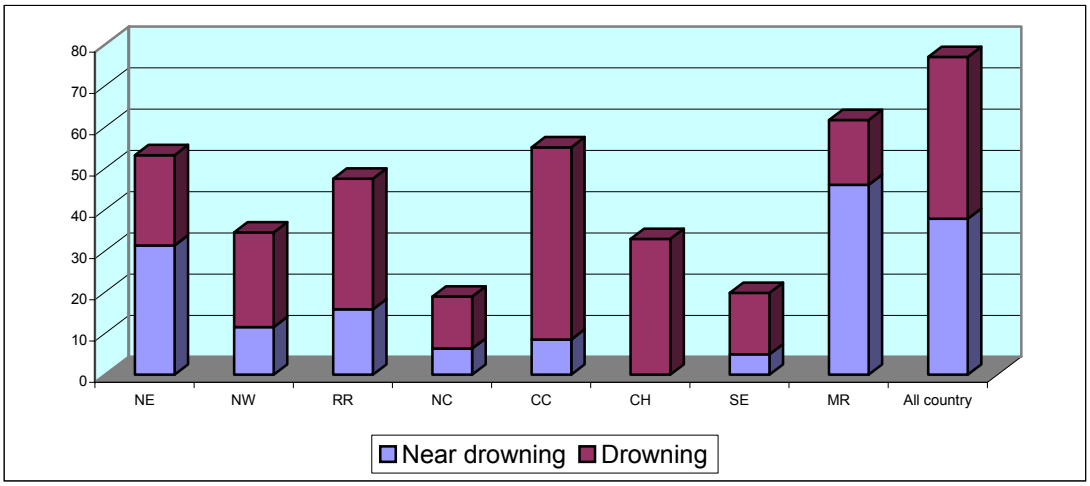


Table 4.2. Drowning/near-drowning rates (/100,000) by region

Region	Near-drowning	Drowning	Total
NE	31.3	21.9	53.2
NW	11.5	23.0	34.5
RR	15.8	31.7	47.5
NC	6.3	12.6	18.9
CC	8.5	46.6	55.1
CH	0.0	32.9	32.9
SE	4.9	14.9	19.8
MR	46.0	15.7	61.7
All country	37.8	39.2	77.0

Almost three quarters (71.8%) of fatal drowning or near-drowning injuries were in the 5-14 age groups. The age group 5-9 by itself accounted for almost half of drowning deaths. The 10-14 age group accounted for almost a quarter (23.8%) of drowning deaths. Near-drowning rates were highest in the 1-4 age groups followed by the 5-9 year age groups. The drowning rates correlated with the amount of water in the region. Those with a great deal of water (Mekong) had the highest rates. Those with little water (Central Highlands) had low rates. The fatality ratio (near-drowning:drowning) was highest in the two regions where the actual death rates due to drowning were the lowest; in the North Central and Central Highland regions. The fatality ratio was the lowest in the region that had the highest rate of drownings. In general, fatality ratios tended to be lower as total drowning rates increased. It is unclear why there is this tendency for increased survival of drowning as overall rates of drowning increase and this may be a subject for further operational research. The sole region with a very high overall drowning rate and a high fatality rate was the Central Coast region, where most of the drownings occur in the open sea due to the large proportion of the population employed as fishermen. Open ocean drowning may have inherently higher fatality rates due to the nature of the circumstances involved (falling from a boat or having the craft sink) as these events occur at a distance from land or any other place of self-rescue or safe-haven like a river bank or pond bank.

Figure 4.2. Near- drowning rates (/100,000) by age group and sex

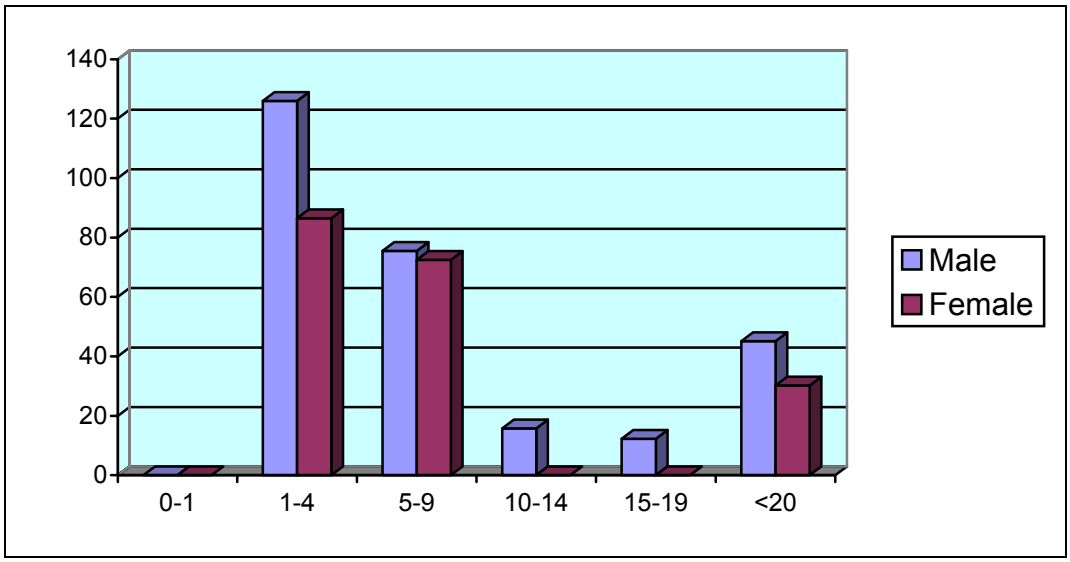
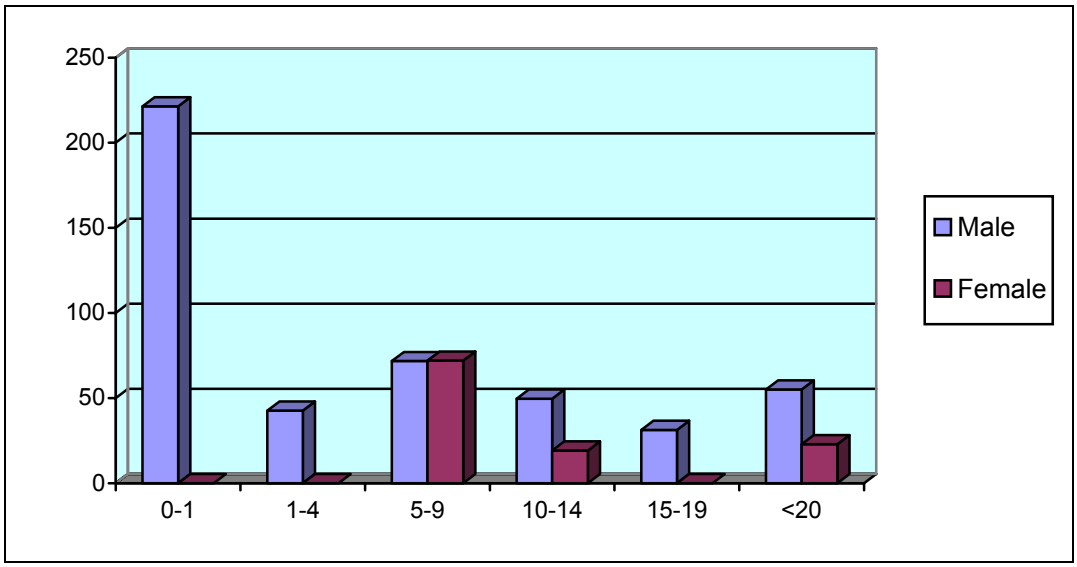


Table 4.3. Near- drowning rates (/100,000) by age group and sex

	Nonfatal			Fatal		
Age group	Male	Female	All	Male	Female	All
< 1	0	0	0	221.3	0	115
1-4	126	86.5	106.8	42.6	0	21.8
5-9	75.5	72.5	74	71.7.	72	71.8
10-14	15.8	0	8	49.6	19.2	34.5
15-19	12.3	0	6.2	31.3	0	15.9
<20	45.1	30.2	37.8	55.0	22.9	39.2

More than half (53.8%) of drowning/near-drowning events resulted in death. The overall child fatal drowning rate was 39.2/100,000.

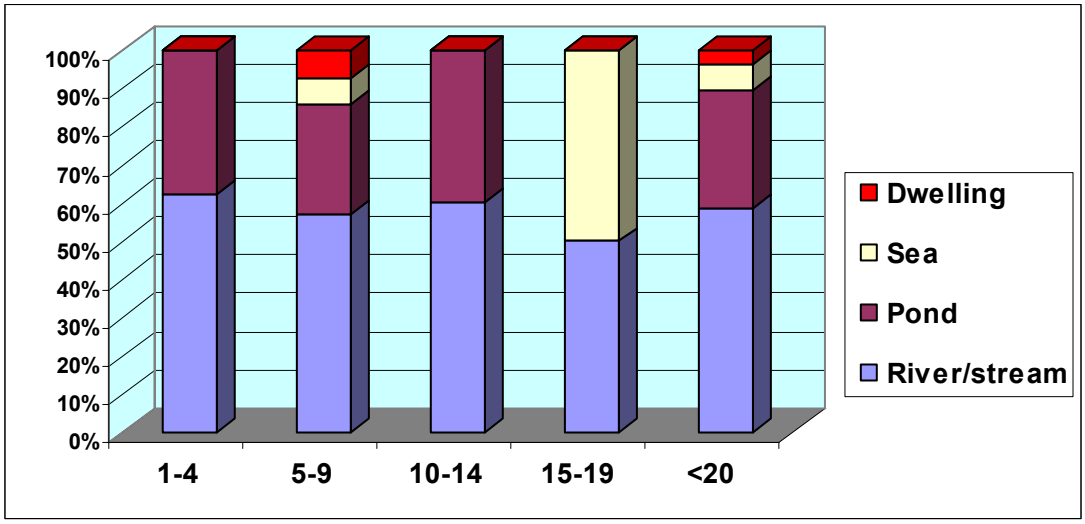
Figure 4.3. Drowning rates (/100,000) by age group and sex



Drowning rates were quite different across the age groups, and the < 1 group had the highest rate of drowning. Only males died in this group. Males and females were drowned in the 5-9 age group. This age group had the second highest drowning rate.

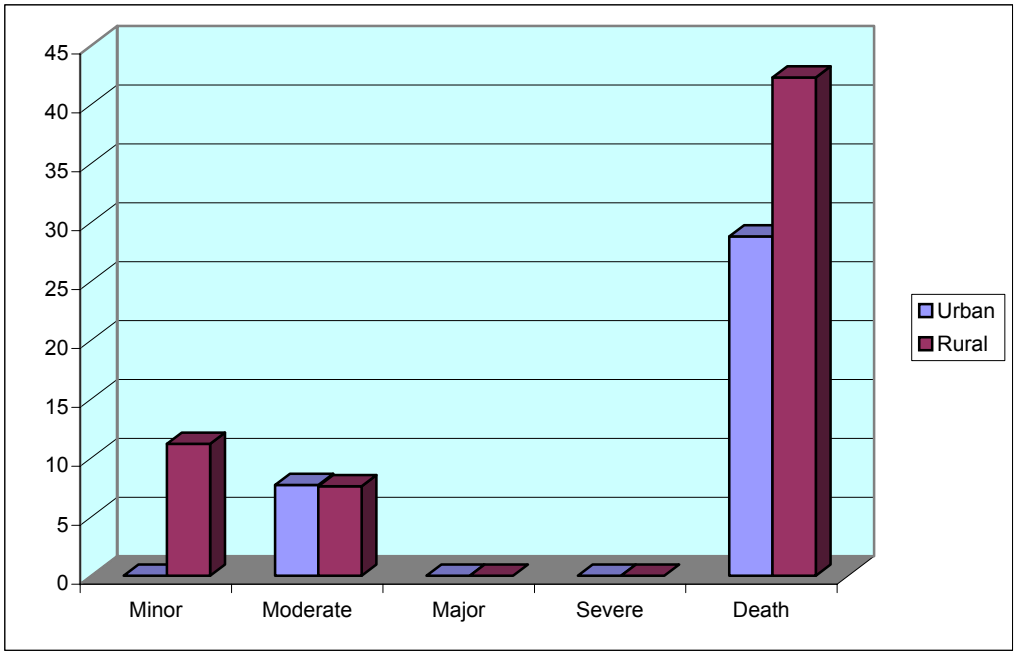
Drowning rates were higher for males than females in all age groups except the 5-9 age group where they were the same.

Figure 4.4. Locations where child drowning/near-drowning occurred



Fifty nine percent of drownings occurred in rivers/streams; 28.2% occurred in ponds, 7.7% occurred at sea and 5.1% occurred in dwellings. More than half (52.8%) of drownings occurred during outdoor activities while playing near the house. About one-sixth (16.7%) of victims were under the supervision of other children at the time they drowned.

Figure 4.5. Venue of drowning, urban vs. rural



Urban drownings were common, but occurred at rates approximately two-thirds of rural drownings. Drownings were more often in rural areas, in part due to the predominance of place of drowning being rivers, streams and ponds, which are mainly rural in location.

4.3. Consequences of drowning/near-drowning

Those sent to hospital had an average length of stay in hospital of slightly more than two days (2.3).

School children who were rescued from drowning missed on average 10 days of school (range from 3-30 days). Working children who suffered a near-drowning reported missing 10 days of work as a result.

There were no instances noted of permanent disability due to near-drowning and the survivors eventually returned to normal life. This is somewhat surprising, as in other studies, near-drowning frequently has relatively high rates of permanent disability, related to prolonged lack of oxygen to the brain.

More than a tenth (12.5%) of families were permanently moderately or strongly affected by the drowning, and more than a quarter (29%) of families reported a moderate or strong effect that was temporary.

4.4. Discussion

Drowning was the leading cause of death among children. The fatal drowning rate in children was 39.2/100,000. This rate means that there were over 12,500 child drowning deaths in Vietnam in 2001. This was about 35 drownings each day. The child-drowning rate in Vietnam is about 10 times higher than child drowning rates in developed countries. The fatality rate for drowning was quite high with over half being fatal. Because of the high rate of drowning as well as almost half not being fatal, near-drowning was the ninth most common cause of morbidity (37.8/100,000).

Males drowned and were involved in near-drowning at much higher rates than females. Fatal drowning rates for males were two and a half times those of females (55.0 vs. 22.9/100,000 respectively) and the difference was statistically significant. In other developing countries in the region (China, Thailand, Bangladesh) drowning is also the leading cause of child death and the same pattern of males predominating over females occurs. While infants near the age of one had the highest rate of drowning, almost half of all fatal drownings occurred in the 5-9 age group. It is not clear if the bimodal pattern of drowning seen in Vietnam-- with the highest rate in infants, then a decrease in the early children aged 1-4 and a second peak in the age group 5-9-- is real or an artifact of the sample size, since there was only one male drowning in the infant age group. Data from Bangladesh shows that drowning rates are highest in the early childhood age groups (peak age one year), but older age groups were not well studied. Thus, it is unclear if this difference in age patterns is an epidemiologic norm or is an artifact of the sample size. Continued data collection of child drownings should help provide information regarding this. It is a very important issue to define as prevention programs would be structured differently to address drownings in infancy versus drownings in middle childhood.

4.4.1. Place and severity of drowning

The place of drowning correlates with the presence of water sources. The highest drowning rates were in the Mekong River Region, where water is ubiquitous and over 90% of deaths were river drownings. The lowest rates were in the North Central Region with the fewest ponds and other water sources. In the Red River Delta, river tributaries are much less extensive than in the Mekong Delta, and thus about three-quarters of drownings occurred in ponds, and only a quarter of drownings occurred in

rivers. Drowning at sea is a common occurrence in the older child age groups, in North Central and Central Coast where people living near the coast are commonly fishermen. Drowning in these two areas in particular was associated with very high fatality rates, likely due to the open ocean drowning rather than closed and smaller water sources. Drowning within a dwelling was a relatively rare event in this survey, accounting for only 3.4% of fatal drownings. This contrasts sharply with another regional country, albeit one that is developed. In Japan, the most common place of early childhood drowning is in bathtubs. A separate survey of urban Vietnam will be a priority in the future, as anecdotally, child bathing practices are different in urban and rural Vietnam, with bathtubs or other large water containers common in urban areas, but uncommon indoors in rural areas.

4.4.2. A unique public health significance

As the most frequent cause of child death overall and as the leading cause of child death in every age group except the oldest group (15-19) where it was second,, drowning has a unique public health significance for children in Vietnam. The fact that about 74 children drowned each day in 2001 makes it a public health emergency. The death rate from drowning, one single cause of injury death was larger than for all infectious diseases and all chronic diseases combined. As such, drowning is an epidemic of major proportion in Vietnamese children and this demands a major response for institutions, programs and projects aiming to reduce childhood mortality and morbidity. Quite simply, child health programs are not complete unless they address this leading cause of child deaths.

Death from drowning is as preventable as death from infectious diseases. To create effective prevention programs, a great deal of detail is needed concerning how the drownings are occurring, the specifics regarding the water sources, the activities children were involved with at the time of drowning and information regarding supervision by adults or other responsible caregivers. This detailed research on the most common scenarios of child drowning will allow rational development of drowning prevention programs, for drowning can be prevented as the experience of developed countries clearly shows. The challenge for health, education and social sector policy-makers in Vietnam is to apply the lessons of developed countries to the situation in Vietnam in ways that are appropriate and effective in Vietnam. The principles are relatively simple: provide adult supervision for young children and decrease the reliance on siblings for supervision; identify drowning hazards within and nearby homes and place barriers or restrict access to these hazards; for children with constant water exposure (such as fishermen's families) consider training in swimming; provide focused and practical water safety knowledge using the institutions and mechanisms directly related to children, such as school, youth groups, cartoons and other appropriate mass media and work to develop safe peer group behaviors. Certainly, if Vietnam can follow a similar set of principles tailored for the situation in of infectious diseases and dramatically reduce them, it can accomplish the same thing for drowning.

Chapter
5

5. Road traffic accidents

5.1. Introduction

Vietnam has a total road network of over 2,000,000 km as of 1999. National roads, however, account for only 15,250 km and provincial and district roads accounts for 17,449 km and 36,372 km respectively. Village roads, comprising 131,000 km, are considered rural roads. The entire road network is relatively well developed but poor in quality. Only 60% of national roads and 27% of provincial roads are paved. Road transport provides about 75% of all passenger transport, with the rest by rail, water and air but in most areas, road transport amounts to 90%.

Motorization has increased in Vietnam during the past 10 years along with economic and social development. While cars have increased at an annual average rate of 12%, motorcycles have increased at an annual average rate of over 40% per year. This has resulted in a 16.5 fold ratio between 2 wheel motor vehicles and 4 wheel motor vehicles.

During the last ten years, the number of road accidents has increased four fold. According to National Transportation Safety Committee (NTSC) data, the national mortality rate is about 11 deaths per 10,000 motor vehicles, which is similar to other Southeast Asian countries. There has been an average annual increase of 38% in the number of traffic crashes, 52% in the number of injured as well as 37% in the number of deaths during the last 10 years. Traffic crashes occur more frequently in urban areas than in rural areas. Other Ministry of Transport data have suggested that while urban crashes are more frequent, rural crashes are more severe. The NTSC estimates that the cost of road accidents in Vietnam is at least 2% of gross domestic product (GDP).

5.2. Road traffic accidents pattern

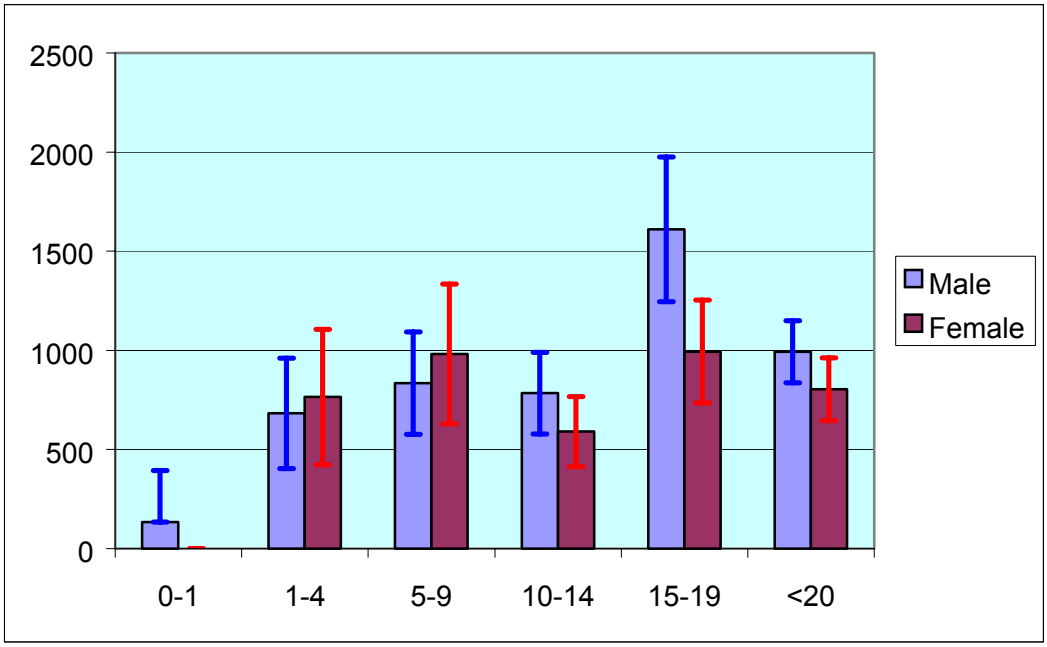
Table 5.1. Nonfatal and fatal rates of RTA by age group

Age group	Male		Female		Both sexes	
	Morbidity	Mortality	Morbidity	Mortality	Morbidity	Mortality
< 1	133.3	95	0	0	69.3	49.4
	1	*1*	*0*	*0*	*1*	*1*
1-4	682.4	0	765	0	722.7	0
	26	*0*	*26*	*0*	*53*	*0*
5-9	835.4	0	981.5	17.6	907.3	8.7
	55	*0*	*55*	*1*	*111*	*1*
10-14	784.6	11.7	590.8	16.1	688.3	13.9
	62	*1*	*42*	*1*	*104*	*2*
15-19	1610.3	33	993.8	0	1307.4	16.8
	120	*3*	*74*	*0*	*194*	*3*
All children	993.2	16.3	804.3	8.9	900.2	12.7
	264	*5*	*199*	*2*	*463*	*7*

Actual number of cases is listed in italics

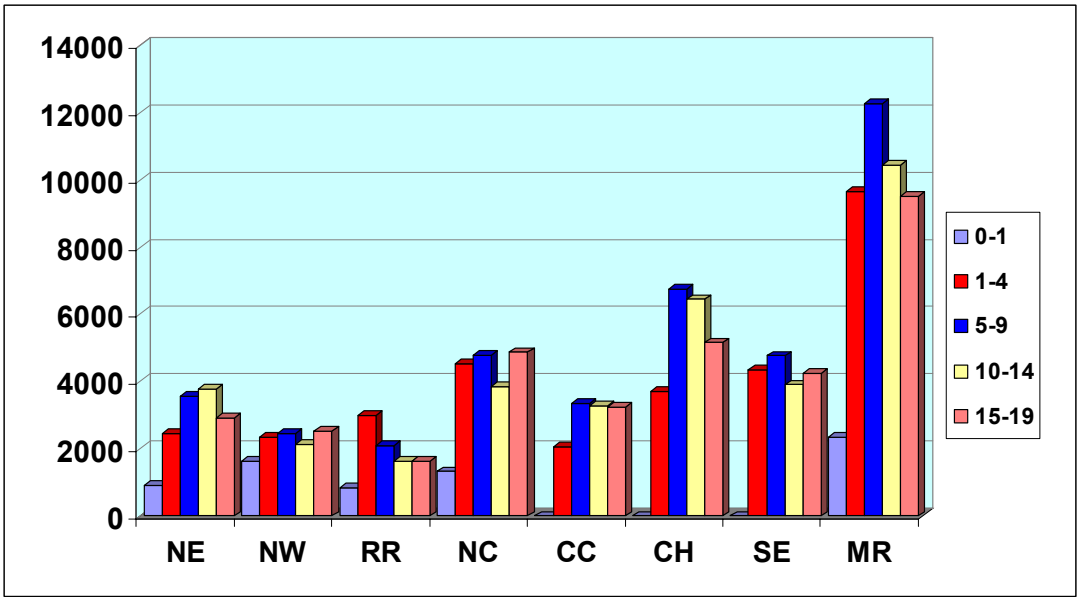
For children, road traffic injury was the second leading cause of mortality with a fatal injury rate of 12.7/100,000 and the third leading cause of child morbidity with a nonfatal rate of 900.2/100,000.

Figure 5.1. Nonfatal road traffic accident rate by sex and age group



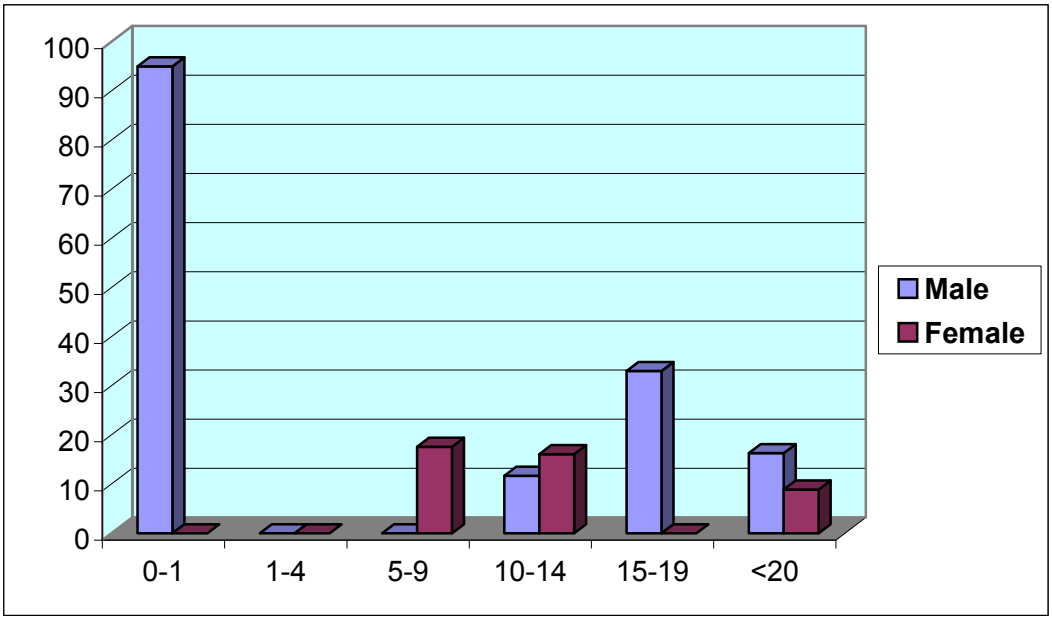
Children 15-19 had the highest rate of nonfatal injury caused by road traffic. There were no significant differences in rates on nonfatal RTA in males or females.

Figure 5.2. Nonfatal road traffic accident rate by region and age group



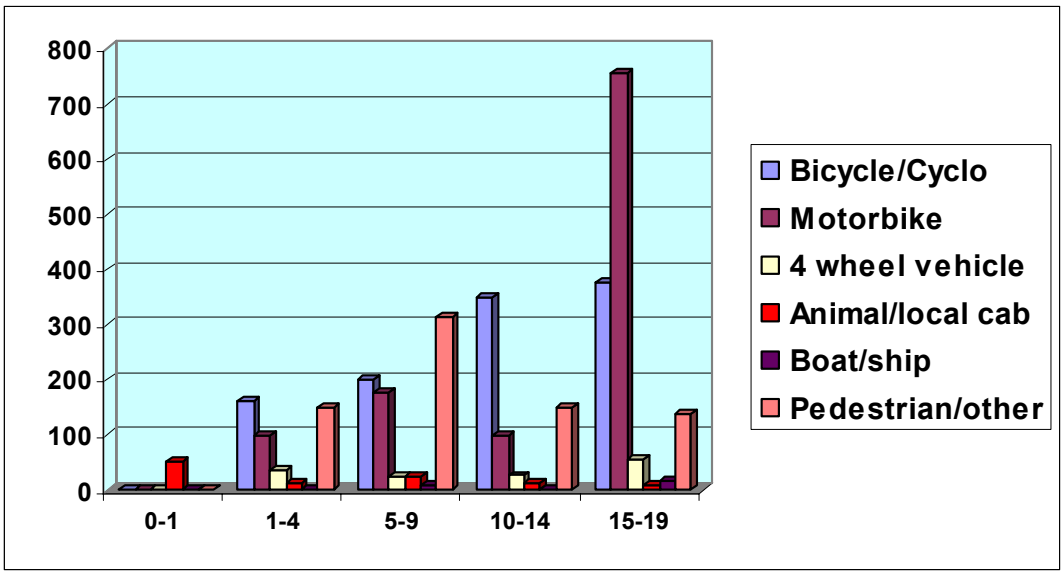
The Mekong River region had the highest nonfatal RTA rate and the North East region had the lowest. In general, the RTA rates correlated with the motorization rates with the exception of the Red River region being somewhat low as compared to its motorization rate. The pattern of increasing RTA with increasing age generally held as well throughout the regions.

Figure 5.3. Fatal road traffic accident rate by sex and age group



The rate of childhood fatal road traffic accidents was 12.7/100,000 (male 16.3 and female 8.9). There was a significant difference between males and females in the 15 -19 age group and the 15 -19 age group had the highest rate of morbid injury and fatal injury. (The very high rate in infants is almost certainly due to small numbers and random chance). Most fatal RTA in the very young and young child age groups (0-9) were as pedestrians, in the 10-14 age group two-thirds were bicyclists and one-third were motorcyclists and for the 15-19 age group, all were motorcyclists.

Figure 5.4. Type of transport involved in nonfatal RTA by age group



For nonfatal road traffic injury, there were different patterns of causation in each age group. For infant and young child victims (aged 0-4), the largest proportion was pedestrian injury (35%), then bicycle injury (34%), then motorcycles (20%) with very few cases in other types. For older children and adolescents (age 5-14), bicycles were the largest proportion at 42% followed by pedestrians at 31% and then motorcycles at 21%.

For the age group 15-19, motorcycles accounted for the majority of injury cases for both males and females (66.4% and 67.1% respectively) and the second largest portion was caused by bicycles (19.8% male and 17.8% female). The differing patterns can clearly be seen also by looking specifically at RTA caused by motorcycles: while motorcycles caused two-thirds of RTA in the 15-19 age group, they only caused one fifth of RTA for all children under 15 years of age (entire 0-14 age group).

For the aggregate child age group (<20), motorcycle-related injury accounted for the largest number of road injuries (57%), followed by bicycles (22%) and pedestrians (11.8%). Automobiles were only involved in small numbers (4%).

Overall, for person and place of injury, the driver was victim in more than 60% of injury cases, in 17% of cases it was the accompanying person and in 21% of cases it was pedestrians. About 94% of traffic injury occurred on the highway or other main roads, and the majority of these cases involved motorcycles (62%) as the means of transportation.

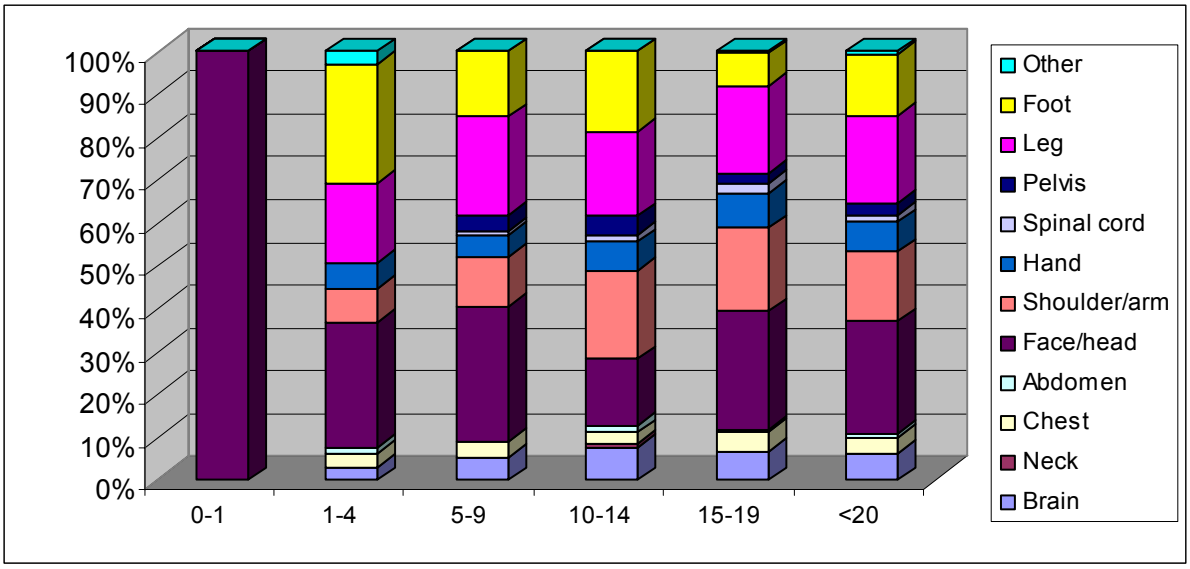
5.3. Consequences of road traffic accidents

5.3.1. Hospitalization and severity:

The severity varied according to the age group and vehicle involved. The younger children were involved mainly as pedestrians and bicyclists and these crashes tended to be low velocity and not associated with serious injury. Older adolescents, particularly in the age group 15-19 were riding motorcycles so crash velocities were higher, with subsequent increases in severity. The distribution of mainly 15-19 year olds being responsible for most serious injury caused a skewing of results for the aggregate ages.

Of all road traffic injuries in children, 33.4% were hospitalized for at least one day. For those hospitalized, the average length of stay at the medical facility was 8.1 days (range 1-120). Almost half (45%) of the victims were hospitalized from 2-7 days, and about a quarter (28.5%) were hospitalized for more than one week (7+ days).

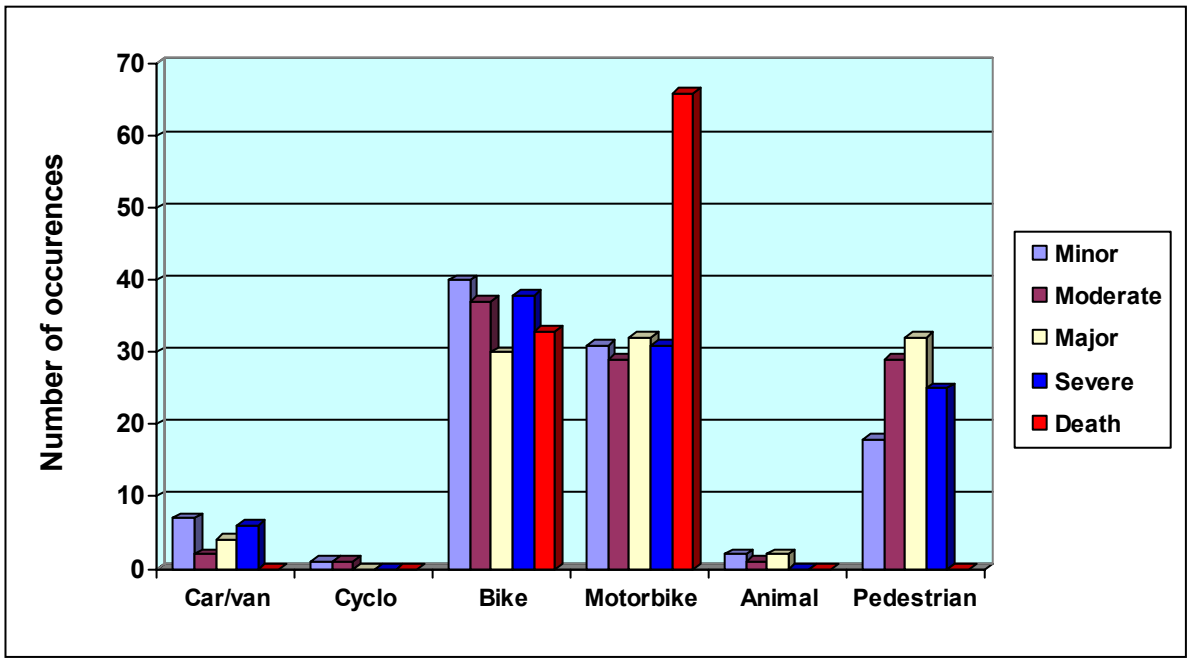
Figure 5.5. Injury location on victims



Concerning body location of injury, about one-quarter (26.2%) of the victims were injured on the face and head. Lacerations and bruises were the most common type. Leg, shoulder and foot were the next most frequently injured body parts, also by cuts and

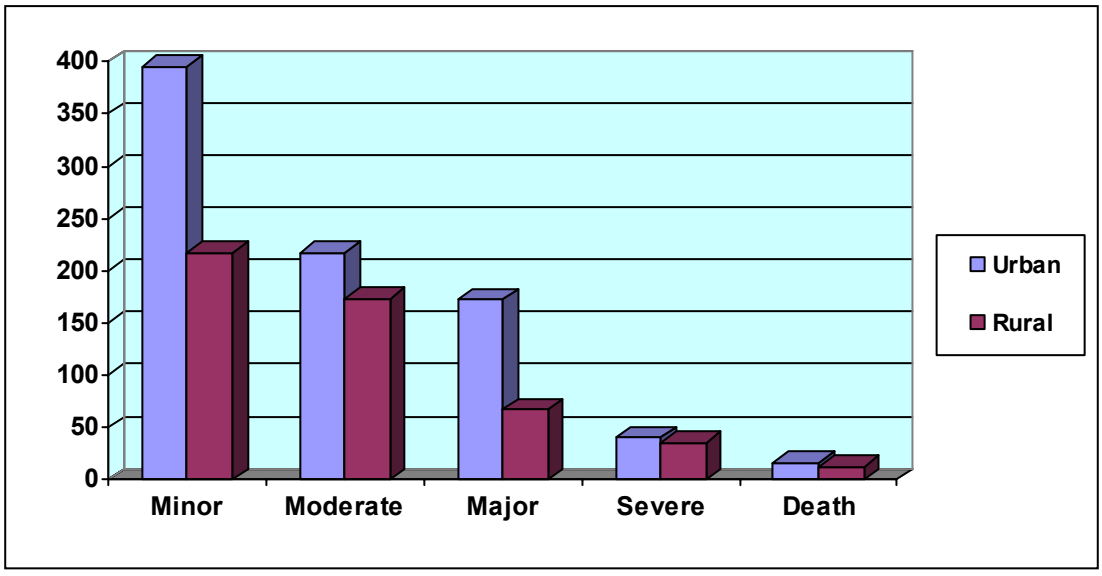
bruises. Together, these four regions accounted for more than half (51.3%) of body locations of injuries. Brain and spinal cord injuries accounted for 6.2% of cases.

Figure 5.6. Type of transportation involved by severity levels



The highest risk of serious injury was clearly for motorcyclists, bicyclists and pedestrians. Pedestrians suffered mainly nonfatal injury, with about one-quarter minor, one-quarter moderate, one-quarter major and one-quarter severe. Bicyclists had a similar equality of distribution of severity across the categories, with about one-fifth in each, including deaths. Motorcycles had a much higher proportion of fatal injury, about twice that of the other categories. The lower risks of injury from 4-wheel vehicles, cyclos and animal carts mainly reflect lower ridership rates and thus exposure rates. Figure 5.7 below shows the rates for different severity levels by place of occurrence, rural versus urban.

Figure 5.7. Place of occurrence by severity level



5.3.2. The impact of injury on individuals and families

RTA injury, especially the high velocity RTA occurring in the older child age groups caused significant impact in terms of costs, school and work missed and disability. More than fifty percent of children missed school for almost two weeks due to the injury (mean 12.7 days).. Among the injury victims, about one-sixth (14%) had temporary or permanent disability after the injury. Almost half (49.3%) of child victims needed an average of 9.4 days (range 1-90) of daily care (assistance with eating, bathing, etc.); 2% needed more than 90 days of care; and about 1% needed permanent care. More than 44% of those injured needed help in their activities of daily life (ADL- cooking, shopping, cleaning, dressing, etc). Of these, 4.2% needed help for more than three months. The average duration of time they needed help was 23 days.

Since the childhood age group included those 15-19, a number of these were economically very important to their families. About 4% of the child victims were the main source of income for their families. VMIS socio-economic status data suggests that 88.6% of the households with RTA victims who were breadwinners had household monthly incomes of less than US$130 and the injury caused significant economic impacts on the household. Overall, for all children and families involved, there was a permanent and dramatic effect for 1.5% of the families; 7.75% of the families were moderately affected and 33% of the families were moderately to strongly effected temporarily, but not permanently effected.

5.4. Discussion

Road traffic accidents were the second leading cause of death for children nationally with a fatality rate of 12.7/100,000. This rate means that over 4,100 children died from RTA in 2001, or about 11 children each day. RTA also ranked as the third cause of morbidity among children with a rate of 900.2/100,000. This is a very alarming finding, in that almost 1% of children are injured each year from transport related causes. This rate means over 290,000 children are injured each year by RTA, or about 800 each day. This is an average of 33 per hour.

It is important to note that there were different causes in the early and middle child age groups compared with the adolescent age groups. In younger children, most of the serious injuries were suffered as pedestrians or bicycle riders, and not passengers or drivers of motor vehicles. In contrast, adolescents were largely on motorbikes. Prevention programs are different for these two different causes of RTA.

While RTA was the number two cause of fatalities in children, it was a distant number two at a rate one-third that of the leading cause, drowning. RTA is a very visible cause of death due to the recent attention focused on the dramatically increasing traffic in Vietnam over the last three years. However, simply due to the numbers alone, in order to make an appreciable decrement in overall child injury rates, child drowning will have to be the major target of prevention efforts.

The RTA fatal injury rate in males is significantly higher than in females. Traffic injury was the second largest contributor to the burden of injury among all injury types and it affects the most productive and economically active portion of the population. As a result, there is a major social burden of traffic injury due to lost workdays, school days and residual disability. In fact, VMIS data show that for Vietnamese children in the 15-19 age group, RTA is the leading killer.

5.4.1. A characteristic pattern by age

Traffic injury in Vietnam has distinct patterns for each age group as well as for each region. In general, areas of higher development, with subsequently higher motorization rates had higher rates of RTA. Within each area, the pattern of injury cause and severity was dependent on the age group involved. For very young infants and children, there were no differences in rates as both male and female children have the same exposures to risk of RTA and in this age group the exposure is as a pedestrian, passenger or bicyclist. Children in these age groups were mainly involved in low velocity crashes and thus severity rates were relatively low. Once children began riding and driving motorcycles in large numbers, predominantly in the 15-19 age group, crash velocity and severity went up, particularly in males.

5.4.2. Policy implications of the pattern

VMIS results suggest that there must be significant policy changes at national level needed to cope with the epidemic of road traffic injury. Among these policy changes are educational curricula in schools, hazard and risk awareness education, better driver training, more enforcement, and since the primary transport vehicle in Vietnam is the motorcycle, a national helmet use policy is urgently needed. Vietnam is unique among developing countries in that it already has a child motorcycle helmet standard already adopted. It just needs to widely enforce its use.

The issue of helmet use by children as a national prevention strategy is a complex one, greatly driven by the issue of cost and feasibility of large-scale use. Helmets only protect against head trauma; they have no impact on other sites of injury and serious head trauma occurred in less than 5% of all incidents of RTA. The rates of serious child head trauma were directly related to age with very low head trauma rates in the early and middle child age groups, rising to significant rates after adolescence. For the younger child age groups, most traffic injury was as pedestrians or bicyclists. Pedestrian injury is not prevented by helmets and while bicycle helmets are a very effective way of preventing serious brain injury, it is not clear that Vietnam is ready to mandate and enforce a bicycle helmet law for children. Other countries in the Asian region are beginning to promote helmet use for bicyclists (most notably Malaysia) but they are at significantly higher levels of development. For children of all ages the leading cause of paralysis from motorcycle crashes was spinal cord injury, and helmets do not prevent this. Therefore, while helmets are an obvious prevention technology, it is important to recognize that the preventable fraction of head injury from RTA in children is actually quite small, and the younger the child, the smaller the helmet-preventable fraction is.

Finally, and from a national policy perspective, the most important issue is that child RTA deaths due to head trauma before the teenage years are rare, but to prevent those few rare deaths every child must wear a helmet at all times when in transit. This requires extraordinary numbers of helmets and very high use rates in order to prevent the few head trauma deaths in these younger age groups. This mandates that helmets must be very cheap if they are to be used as part of a national strategy for universal use by children. With almost 10 million children in the 5-9 age groups, even a helmet cost of 5 USD for each helmet means a program cost of 50 million dollars for these age groups, and there is an annual recurrent cost as each year a new cohort of children enter the program. With only one death in this age group attributable to RTA, the national rate of young child deaths that helmets would prevent is extremely low. Deaths due to head trauma did not rise to significant levels until the age group 15-19 and were mainly males. The VMIS RTA data were confirmed by an

independent study done on 9,000 randomly selected children 14 years or younger in 2000 in Haiphong as well. All available data indicate that pre-school and primary school children are at very low risk of serious head trauma. The real risk for brain injury begins with secondary school students and increases through the mid and late teenage years. The most efficient and effective programs will target this older age group. Younger age groups can be targets of programs that promote helmet use in the broader sense of traffic safety and support safe peer-group behavioral norms, but the challenge will be to find ways to implement these programs so that the cost of putting helmets on children's heads in these groups is very low. Costs above 1 USD per helmeted head are unlikely to be sustainable or cost-effective given the low rates of serious head trauma in children less than 15 years old. RTA prevention in the young child groups will need to focus on pedestrian safety, and in the middle child groups on safe bicycle riding when sharing the road with motor vehicles.

Chapter
6

6. Fall injury

6.1. Introduction

Falls are a common cause of severe injuries and hospitalizations, often causing permanent disabilities, and resulting in many minor injuries. Falls account for the majority of all bone fractures and are a significant cause of spinal cord and brain injury. Many factors contribute to falls including physiological factors, medication and environmental hazards.

6.2. Fall injury in Vietnam

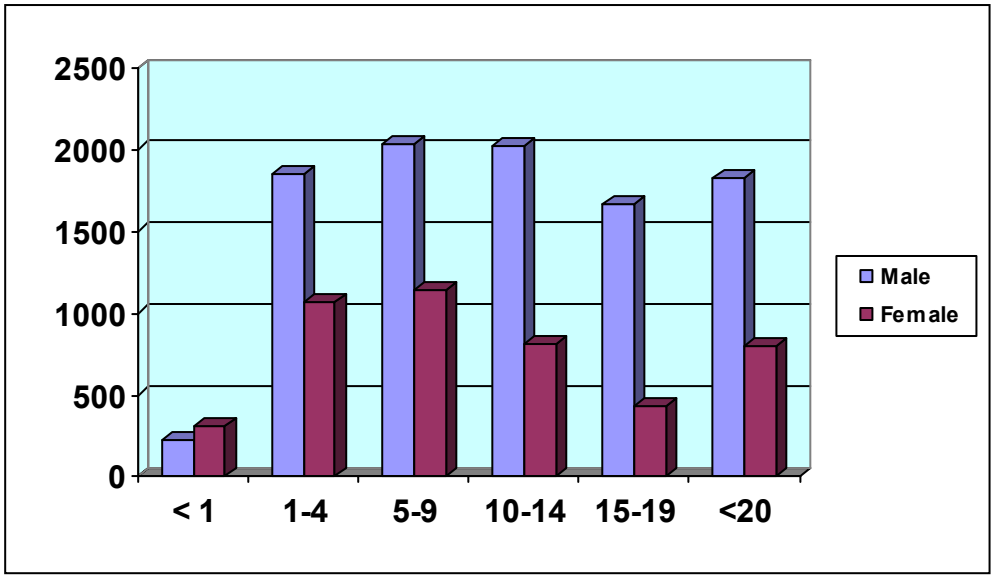
Falls were the leading cause of nonfatal injury in children with the rate of 1,322.1/100,000. This is about 430,000 children per year, or almost 1,200 per day. The fatality rate from falls was much lower in sixth place at 4.7/100,000. Even so, this means that over 1,500 children died of falls in 2001, over four children each day.

Table 6.1. Nonfatal and fatal fall injury by age group

Cause/age group	< 1	1-4	5-9	10-14	15-19	<20
Fall (nonfatal)	265.2	1,469.2	1,591.1	1,416.4	1,057.7	1,322.1
	5	*116*	*212*	*220*	*166*	*719*
Fall (fatal)	0	17.9	0	0	7.1	4.7
	0	*1*	*0*	*0*	*1*	*2*

** actual number of cases in italics*

Figure 6.1. Nonfatal fall injury rates (/100,000) by age group



Fall injury had a strong sex predominance with males suffering fall injuries at significantly higher rates than females. Falls in the infant age group (< 1) are at much lower rates than older age groups as children are not yet walking, and are more likely to be carried or are crawling and are closely monitored by their mothers.

6.2.1. Causes of fall injury

Falls on the same level (e.g. on street, ground, sport ground, etc.) caused most (59%) fall injury in this survey; fall from higher levels (building, tree, ladders, etc.) accounted for 28%; falls within a house (e.g. furniture, toilet, etc.) accounted for 7% of fall injury.

Figure 6.2. Causes of child fall injury

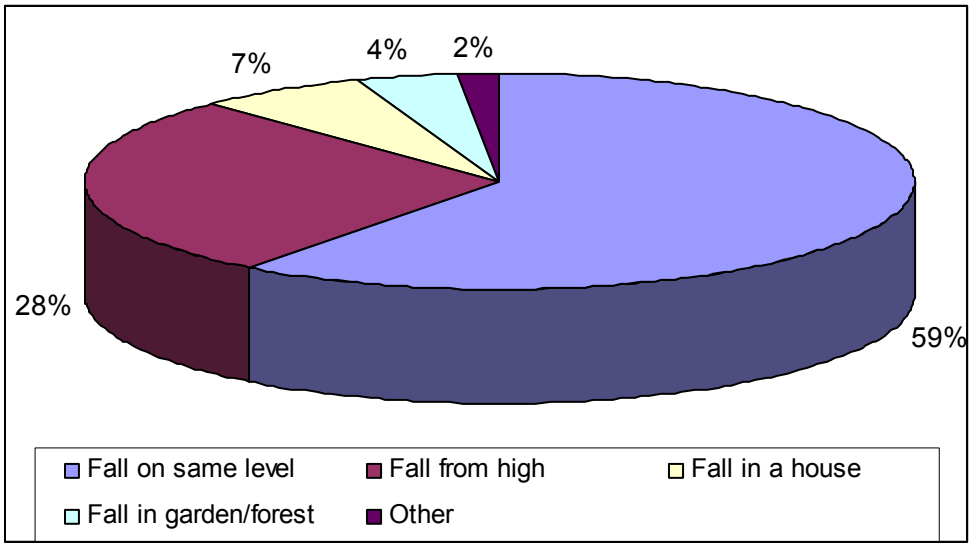
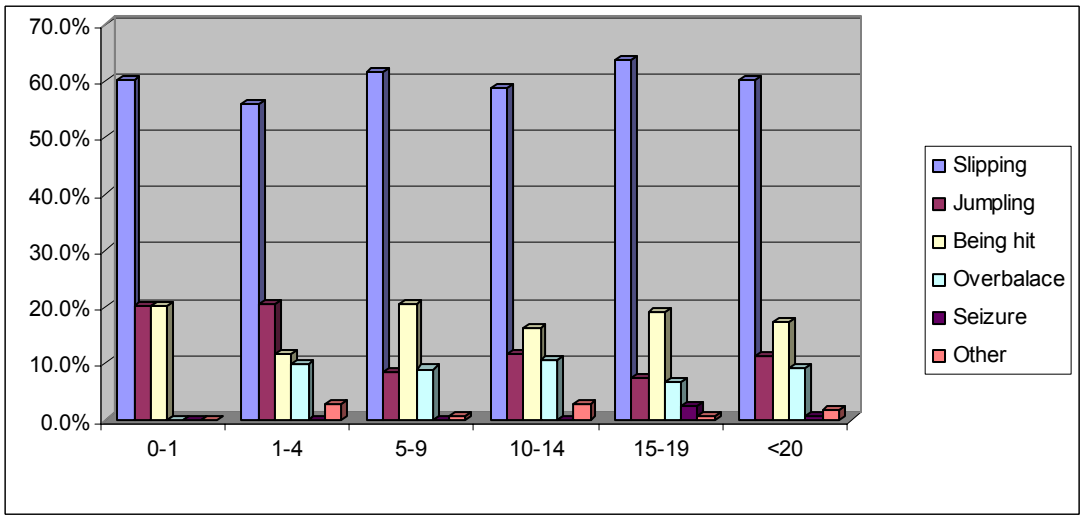
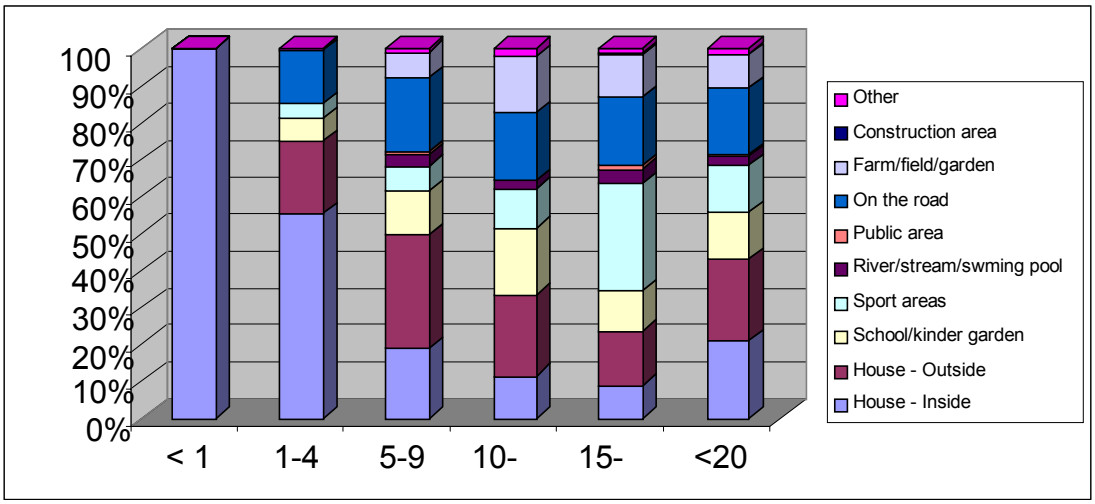


Figure 6.3. Determinants of fall injury



Almost two-thirds (60.2%) of falls happened because of slipping. In every age group, slipping was by far the leading cause of fall injury and was followed at a distant second by jumping and being hit, according to age group. Overbalancing was almost as common. Epileptic seizures were noted as a cause in the 15-19 age group.

Figure 6.4. Location where injury happened



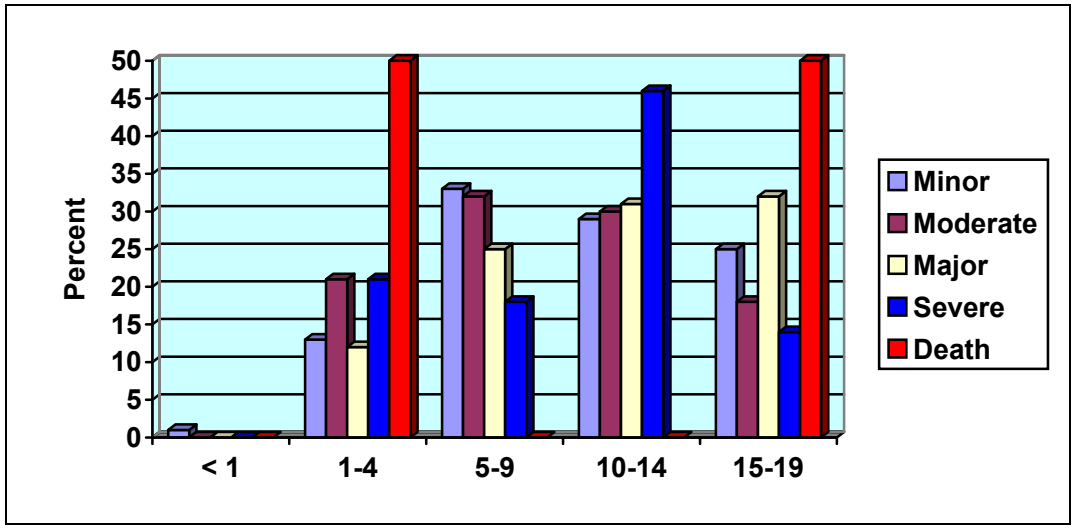
The place where falls occur was very dependent on the age of the child involved. The younger children spend more time in or near the house, and most of the falls in this age group (1-4) occurred in or directly outside the house. As children get older, they spend more time away from the house, and falls occur in those areas that they are spending time at school, or in sports areas. Overall, for all children about 40% of fall injury happened in or directly outside the house and almost a fifth (17.8%) occurred in the road.

6.3. Consequences of fall injury

6.3.1. Hospitalization and severity

Over half of fall injuries resulted in hospitalization with a mean of 8.4 days in hospital. Almost two-thirds of fall injury was serious enough to cause missed school for more than two weeks (average 14.7 days). Over half of fall injuries were serious injuries requiring hospitalization, and fatal falls accounted for almost one percent of fall injury.

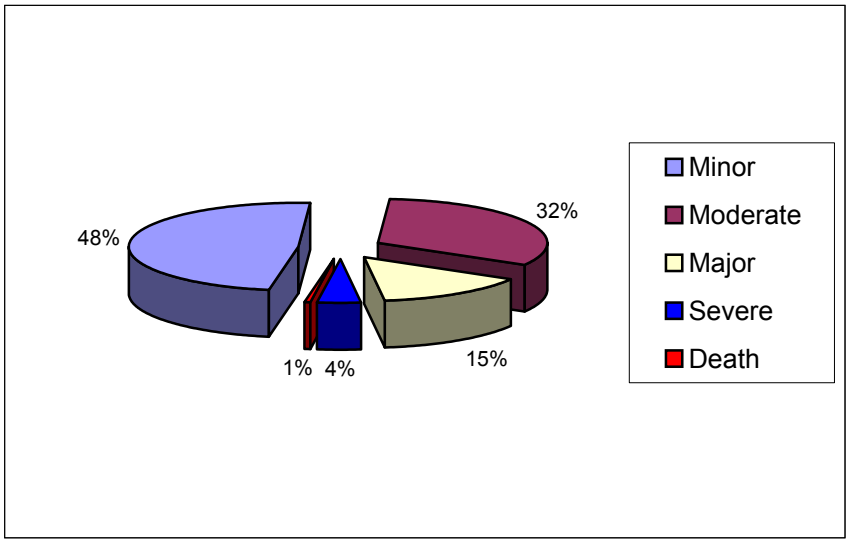
Figure 6.5. Severity levels of fall injury by age group



Falls caused a large proportion of injury across all age groups in children. While falls were not a leading cause of death in children they were a leading cause of serious injury responsible for severe injury and death in older child age groups.

Males had more severe falls than females. Major injury occurred in males of all age groups, at significantly higher rates than females.

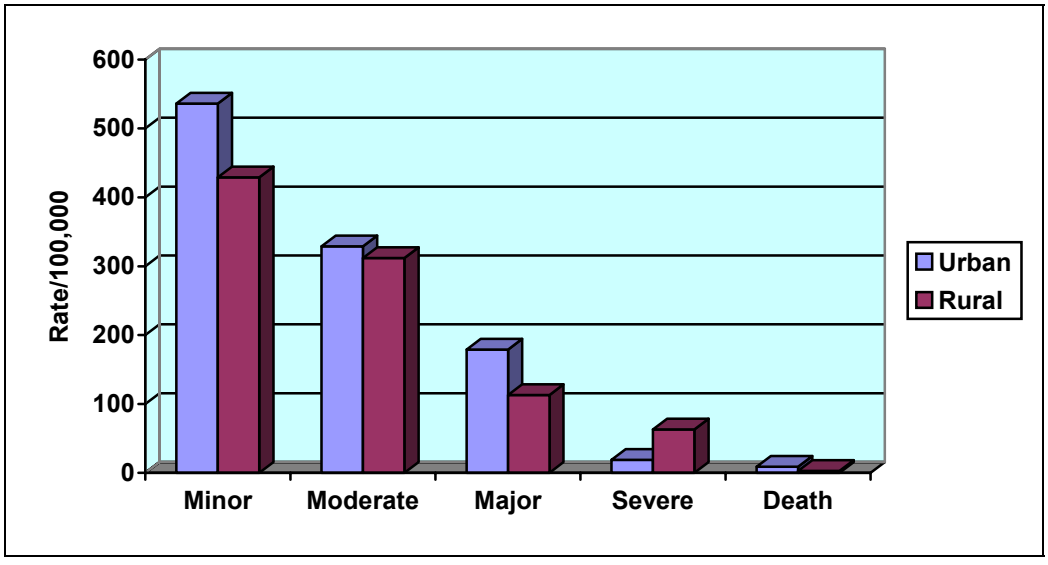
Figure 6.6. Overall severity level of falls for children



Four percent of fall victims were permanently disabled as a result. Almost one-third of falls caused hospitalization, and 20% of falls were severe enough to either cause lengthy hospitalization (10 days or more), permanent disability, or death.

More than 60% of the families interviewed had children injured by falls in the preceding year. Slightly under 1% of the families said the fall injury of the child resulted in a permanent economic impact on the family; 5.6% had a child who fell with a moderate economic result which was still affecting the family at the time of interview. More than 24% of families described the economic effect of the child falling as temporary, but moderate or strong.

Figure 6.7. Severity of fall by venue, urban vs. rural



There were no differences in severity of falls by urban/rural place of residence. The trend of severe falls being more common in rural areas was not significant.

6.4. Discussion

Fall injury is the number one cause of nonfatal injury in children of Vietnam with about 1.3% of children suffering a fall in the previous year. While this number may not seem large it must be remembered that these were not minor falls. To be enumerated in VMIS, the falls had to be of sufficient seriousness to warrant medical attention or cause loss of schooling or work. There were almost half a million of these, which equals almost 1,300 medically significant falls each day, with 47 children permanently disabled and four child deaths from falls. Thus, falls are a serious public health issue given the medical and social costs.

The annual rate of falls is very high; however the fatality rate was relatively low. Falls were the sixth leading cause of death in children with a fatal fall injury rate of 4.7/100,000. Males tended to have higher rates of falling, and the severity of male falls was higher than those of females.

The fall rates were very low in infancy, and this correlates with the fact that most children fall after they have begun walking, which usually occurs around the end of the first year of life. Thereafter, for children from one to nineteen, the rates were about the same in each age group, with a pronounced sex difference of males having fall rates about twice that of females.

The causes of fall injury showed the same consistency across age and sex. Slipping was by far the leading cause, followed a distant second by jumping and being hit. One unusual cause documented was seizure, but the most likely reason for this was random chance interacting with the small sample size. It is unlikely that seizures are a nationally significant cause of falls.

The place where falls occurred varied with where the child spent time. Young children spend most of their time in or near their houses, and thus most of the falls were in or near the houses. Older children were more active and had higher rates of falls, and their falls occurred at school, in sporting areas or while walking along roads. Slipping was the most common cause in all age groups.

Falls had significant economic consequences for the fall victims as well as for their families, with hospitalization, and missed school days. Hospitalizations due to falls were lengthy (average 8.4 days) and the majority of victims of severe falls missed over two weeks of school.

Chapter
7

7. Injury caused by sharp objects

7.1. Introduction

In developing countries, traumatic wounds of the skin are generally the most common cause of morbidity from injuries, and are among the leading causes of morbidity from all diseases and injuries.

In Vietnam, cutting tools such as knives, axes, sickles and hoes are common in agricultural or home use. People often use them for their daily work, and very small children often play with sharp and dangerous objects. Interpersonal conflict in adolescents can also lead to intentional injuries from sharp objects.

7.2. Injury pattern

Injury caused by sharp objects ranked as the third leading cause of fatal injury in Vietnam.

Table 7.1. Rate of injury caused by sharp objects (/100,000) by sex and age group

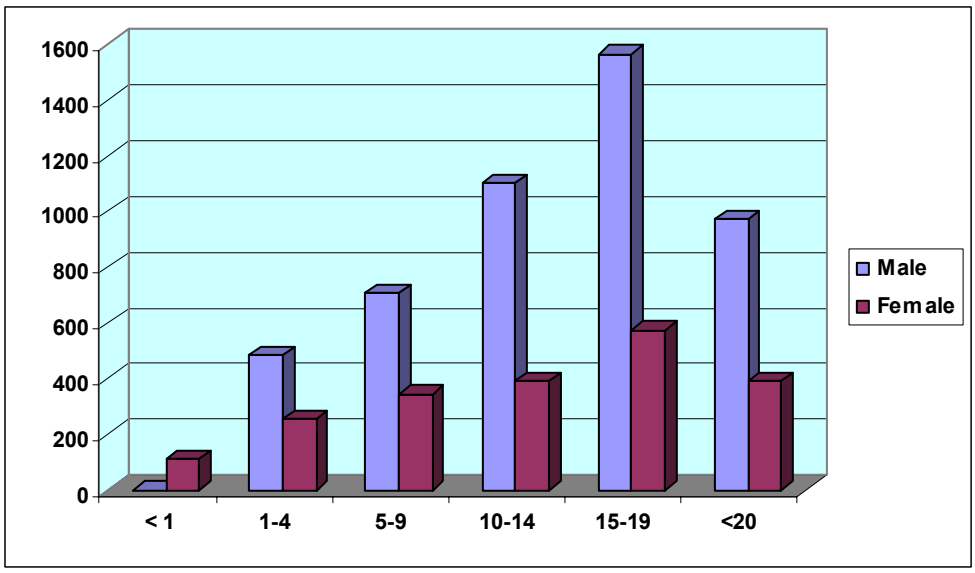
	Nonfatal			Fatal		
Age group	Male	Female	Both	Male	Female	Both
< 1	0	46.1	22.1	60.8	0	31.6
	0	*1*	*1*	*1*	*0*	*1*
1-4	540	268	407.4	0	0	0
	20	*10*	*30*	*0*	*0*	*0*
5-9	752.8	358.9	558.8	0	22.5	11.1
	47	*22*	*67*	*0*	*1*	*1*
10-14	1,232.4	436	836.8	0	0	0
	86	*30*	*116*	*0*	*0*	*0*
15-19	1,451.4	510.4	989.1	13.9	0	7
	99	*35*	*134*	*1*	*0*	*1*
<20	1,030.0	400.0	719.9	6.2	5.4	5.8
	252	*98*	*350*	*1*	*1*	*3*

** actual number of cases is in italics*

For children, the nonfatal rate was 719.9/100,000 and there was a significant difference between males and females. There was an increasing trend in the rates of nonfatal injury from young to older child age groups, especially in males.

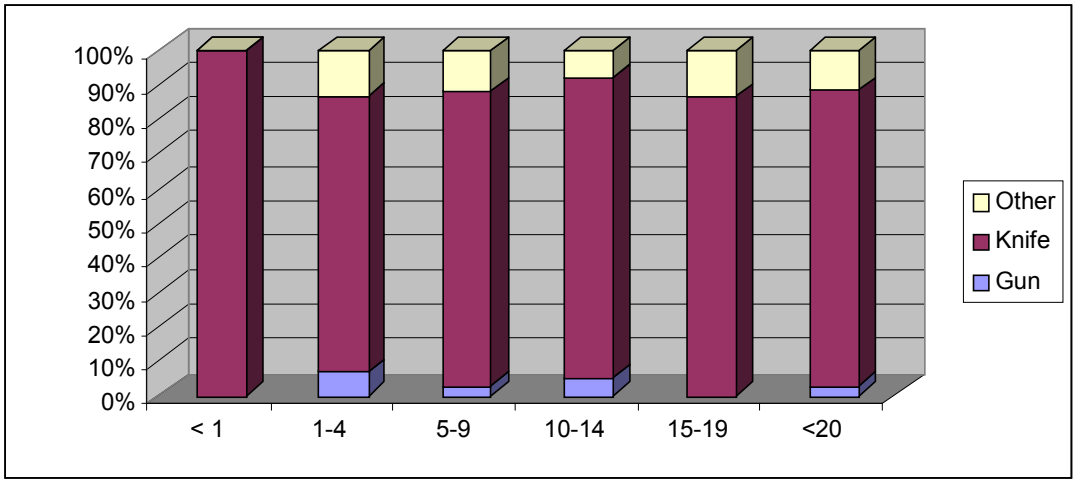
Fatal injury from sharp objects was relatively rare in comparison with other types of injury in children. The rate of fatal injury caused by sharp objects for children was 5.8/100,000 for both sexes, and the male rate was significantly higher than the female rate.

Figure 7.1. Injury caused by sharp objects (/100,000) by sex and age group



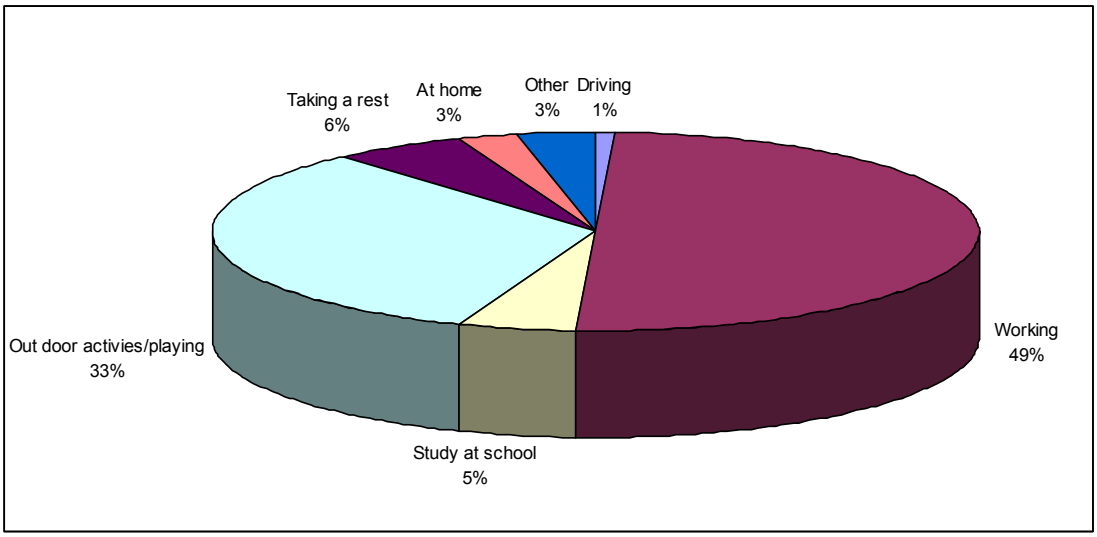
Almost 96% of sharp object injury was caused by knives or knife-like objects, and 2.3% was caused by firearms/guns and less than 1% of injuries were caused by explosives. The explosive injuries were caused by use of explosives in attempting to catch fish.

Figure 7.2. Causes of sharp object injuries



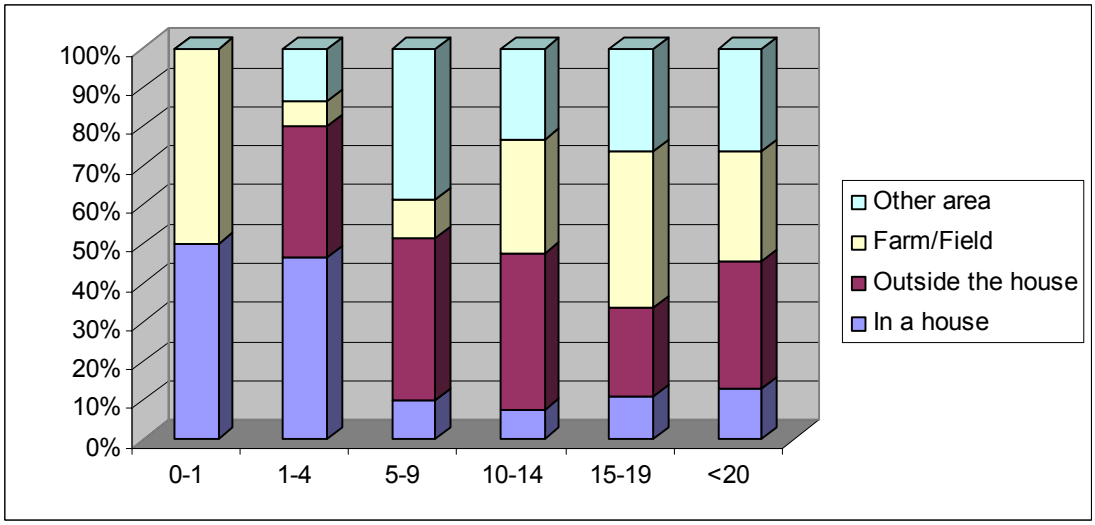
More than 95% (95.6%) of injury caused by sharp objects in children was unintentional injury. About 3% was intentional injury, and in the remaining injuries from sharp objects (less than 1%) intent was unable to be determined.

Figure 7.3. Activities when injury occurred



Almost 50% of injuries occurred as occupational related injury of children while working, mainly in the higher age groups (older than 10). More than 30% of injuries happened when children were playing and involved in outdoor activities. Sharp injury occurring at school accounted for 5% of injury in children.

Figure 7.4. Location where injury happened

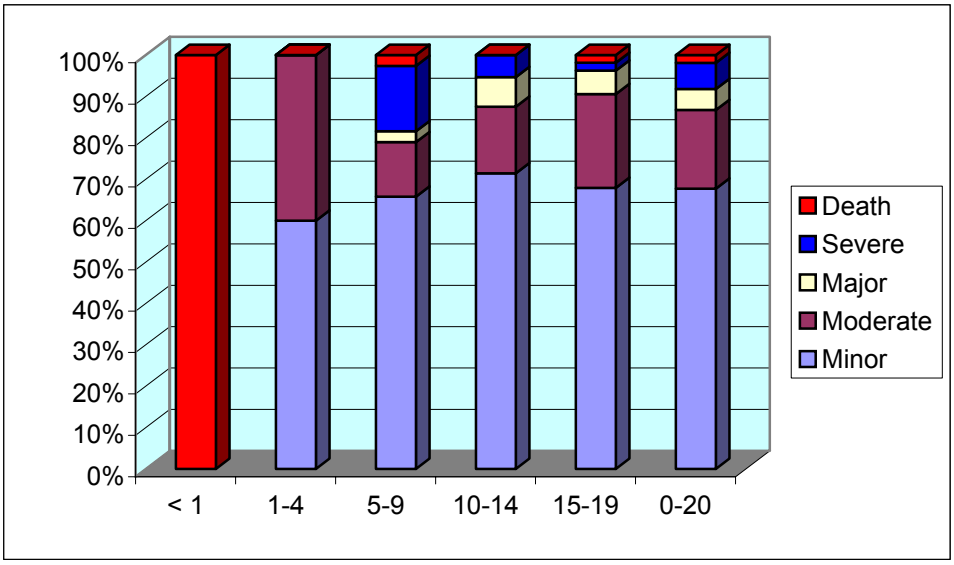


Almost half (44%) of injury caused by sharp objects happened in/or near the house, and about 28% happened in the farm/field.

7.3. Consequences of injury caused by sharp objects

Although the rate of injury caused by sharp objects was quite high, the mortality to morbidity ratio was low at one death per 1000 injuries. Over half of sharp object injuries were minor; about a fifth were classified as moderate; and about 6% each were rated as major or severe. This meant over 1,800 child deaths and 14,000 permanent disabilities due to sharp objects in 2001. Death because of sharp injury accounted for almost 4% of injury deaths in children.

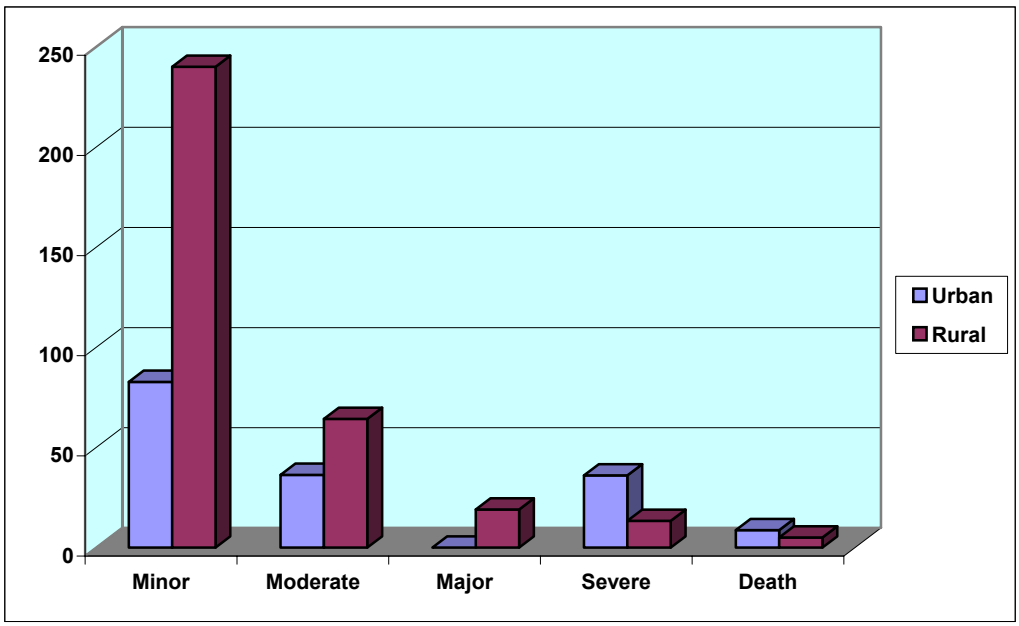
Figure 7.5. Severity levels of injury caused by sharp objects



Almost a fifth (17%) of injuries required hospitalization with the average length of stay 7.5 days (range: 1-90 days).

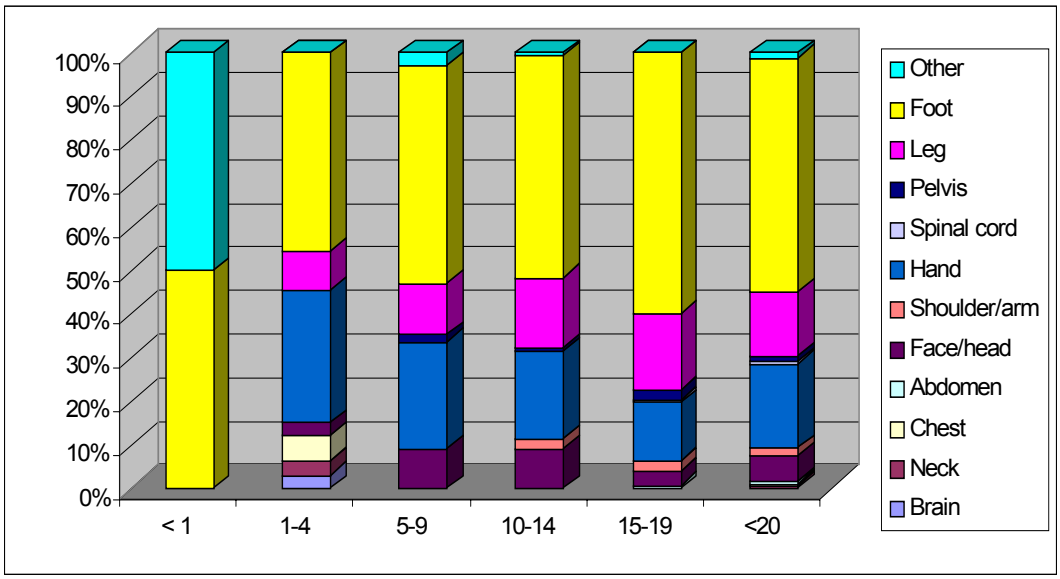
Over half of school aged children missed an average of nine school days due to injury from sharp objects.

Figure 7.6. Severity of injury caused by sharp objects by venue, urban vs. rural



There was a large difference in minor and moderate injury by place of residence with rural outstripping urban, in large part due to the frequency of use of sharp objects by children helping in farming (hoes, sickles, scythes, etc).

Figure 7.7. Body locations of injury



Almost 90% of the victims (88.5%) were injured in the extremities (arm, hand, leg and feet). About 6% were injured in the face/head region and 6% of victims were permanently disabled due to loss of use of extremities (2.4%) and blindness (3.6%).

More than half of the families with children injured from sharp objects reported being affected temporarily. Moderate or strong effects were reported by one percent and permanent effects were reported by almost two percent.

7.4. Discussion

Injuries from sharp objects are a major public health problem for children. The morbidity rate of 719.9/100,000 means over 230,000 children suffered these injuries in 2001, or over 600 children per day. The fatality rate of 5.8/100,000 means over 1,800 children died in the year from sharp objects; this is over four children per day.

Children 15-19 were the age group that were most affected by injury caused by sharp objects, although children under one year of age had the highest fatal cut injury rate. This is most likely an artifact due to the sample size and sampling error.

About 50% of these injuries happened when older children were working. This is an alarming issue for parents and employers who have children involved in working and this finding needs to receive the attention of policymakers. Currently, most occupational safety campaigns are solely targeted at adults. It is very common for children to work in rural areas of Vietnam. Children are often involved in farm work and are exposed to a great deal of risk from the sharp tools and implements involved. Sickles were especially common as causes of cutting injury to children. About 30% of child injury occurred when children were involved in non-working outdoor activities such as sports.

Electricity and explosives are occasionally used to stun fish in order to capture them. This is a very risky practice as demonstrated by the fact that even with small sample sizes, VMIS still found children who died as a result of these practices.

Most of the injury caused by sharp objects in children was unintentional injury, however about 3% of all injury caused by sharp objects was intentional injury as part of an assault. There were no deaths recorded as a result of this.

Chapter
8

8. Poisoning

8.1. Introduction

Acute poisonings are classified with injury as external causes of death or illness. Many poisonings result from chemical products, toxins and poisons in food plants, ornamental plants, seafood and envenomations from poisonous animals and insects. Pesticides are widely used in Vietnam for agriculture and for control of insect vectors of disease such as malaria. Pharmaceuticals and drugs are increasingly used in Vietnam, are not stored in locked cabinets in households, and are often responsible for poisoning.

8.2. Injury pattern

The nonfatal rate of poisoning in children was 168.1/100,000 and the fatal rate of poisoning was 5.4/100,000. There were no significant differences in rates for males and females in both morbidity and mortality when looking at all child age groups.

Table 8.1. Fatal and nonfatal poisoning rates (/100,000) by age group

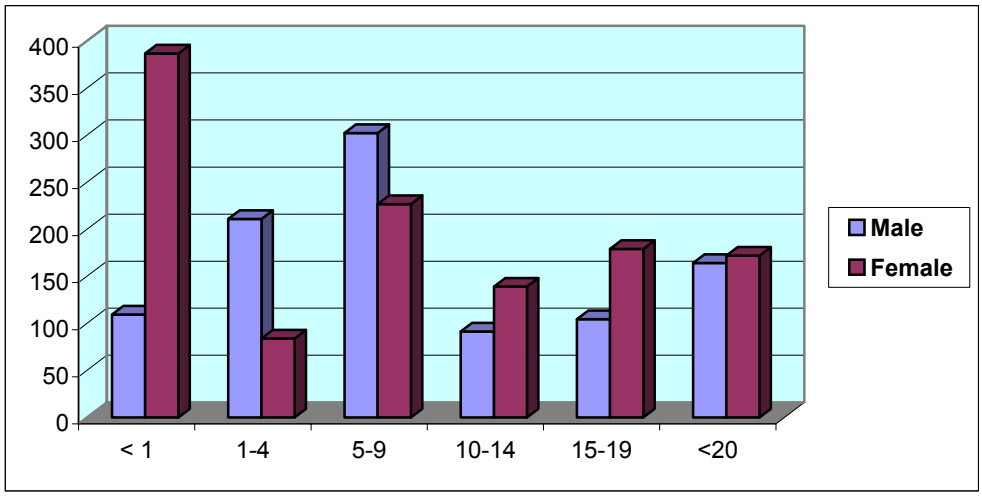
Cause	< 1	1-4	5-9	10-14	15-19	<20
Poisoning (nonfatal)	242.4	148.8	265.0	114.8	141.1	168.1
	4	*11*	*35*	*22*	*23*	*95*
Poisoning (fatal)	0	5.4	9.6	0	8.1	5.4
	0	*1*	*1*	*0*	*1*	*3*

** actual number of cases in italics*

Table 8.2. Poisoning rates (/100,000) by sex, and age group

	Nonfatal			**Fatal**		
Age group	Male	Female	Both	Male	Female	Both
< 1	109.2	386.6	242.4	0	0	0
1-4	210.9	83.7	148.8	10.5	0	5.4
5-9	302.2	226.7	265.0	0	19.4	9.6
10-14	91.2	138.9	114.8	0	0	0
15-19	104.3	179.1	141.1	0	16.4	8.1
<20	164.2	172.0	168.1	1.6	9.3	5.4

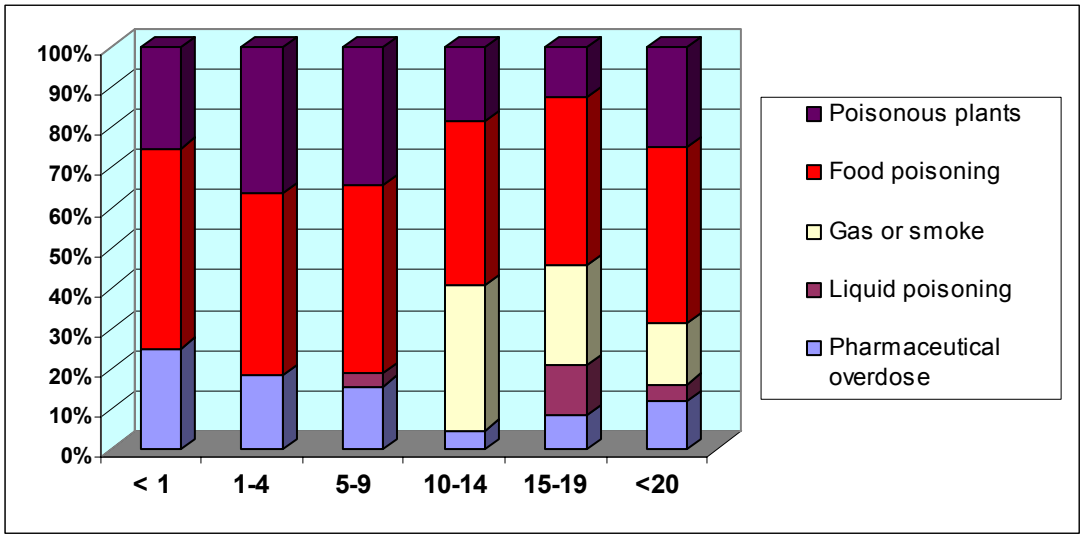
Figure 8.1. Nonfatal poisoning by sex and age group



Poisoning rates were highest in infants and the causes of poisoning varied with age group. Food poisoning accounted for more than two-fifths of poisoning cases (44.1%), poisoning from poisonous fruits/vegetables accounted for almost a quarter (24.7%); and gas or smoke accounted for more than 15% of poisoning in children. Pharmaceutical overdoses accounted for about a tenth (11.8%), and liquid poisons accounted for 4.3% of poisonings.

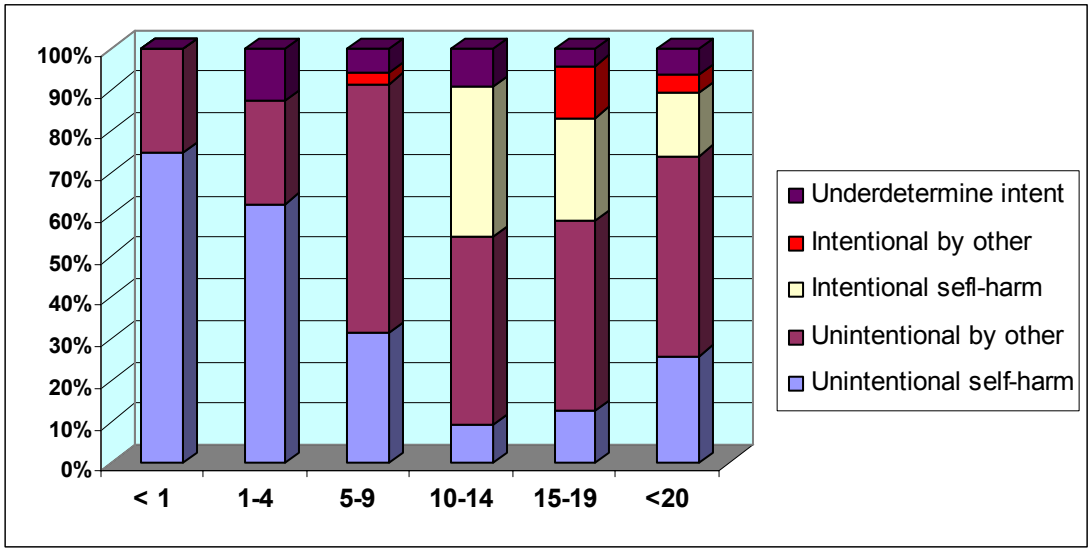
Poisoning from plants occurred mostly in children under 10; gas or smoke occurred only in children more than 10 years old. While smoke and gas poisonings are usually classified under asphyxiation, VMIS planners desired it classified as poisoning. Pharmaceutical poisonings happened at highest rates in the young and very young groups.

Figure 8.2. Poisoning causes by age group



Almost three-quarters (74.2%) of poisoning cases were unintentional. Intentional poisoning was responsible for 19% of cases, and of these, over three-quarters (77.7%) were intentional self-harm (suicide).

Figure 8.3. Intentional vs. unintentional poisoning by age group

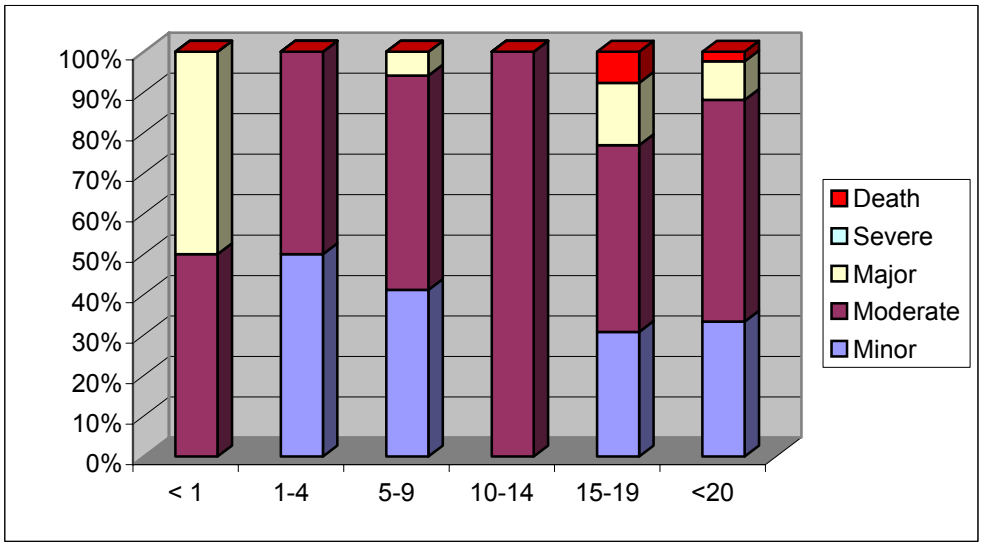


Intentional self-harm poisoning (suicide attempts) occurred in the higher age groups (10-19). There were no successful suicide attempts reported to interviewers. Within all age groups, unintentional poisoning accounted for most cases of poisoning

8.3. Consequences of poisoning

About one-third of poisonings were rated as minor, almost two-thirds resulted in moderate injury and about a fifth resulted in major injury or death. Fatal poisoning accounted for 4.6% of poisonings (rate 5.4/100,000)

Figure 8.4. Severity level of poisoning by age group



More than 60% of poisoned children were hospitalized with an average length of stay of 5.2 days, (range 1-30 days). Over two-thirds (68.2%) of poisoned children missed school for an average of 6.2 days. There were no permanent disabilities resulting from poisoning

in children. About 7% of families with poisoned children reported being moderately affected but on a temporary basis.

8.4. Discussion

Poisoning was the fourth leading cause of death with a fatal rate of 5.4/100,000. Poisoning victims were mainly children aged 1-9 and over 15. Poisoning also was a significant cause of morbidity with a rate of 168.1/100,000. The fatal poisoning rate of 5.4/100,000 means that over 1,750 children were fatally poisoned in 2001; or almost five children fatally poisoned each day.

There was no difference between the rate of poisoning in males and females. Food poisoning accounted for 44% of poisoning cases, but there were no deaths among food poisoning victims. Gas/smoke poisoning accounted for more than 15% of poisoning in children and occurred mainly in the over 10 years age group. While gas/smoke poisonings are usually classified as asphyxiation, policy-makers assisting with this study felt they were better classified under the category of poisoning for this report. As a result, it elevates poisoning rates by about 15%, and asphyxiation rates (mainly suffocation) are somewhat lower as a result. Another caveat that must be noted is the lack of successful suicide attempts through poisoning. This is a common route of suicidal death, especially in adolescent females and the attempted suicide rates reported are substantial in this group. It is unclear if the lack of documented fatalities is due to the sample size issue, or to a failure to report what is often viewed as sensitive information in the setting of a household survey being conducted by relative strangers.

Poisoning from various plants accounted for almost a quarter (24.7%) of poisoning injuries. Plant poisoning did cause fatal poisonings. Plant poisoning affected mostly the young child group (1-4). Pharmaceutical poisons accounted for 11.8% of the poisoning cases and had the highest rates in the very young and young child age groups. There were almost 6,500 child poisonings due to pharmaceuticals found by VMIS. Along with poisonous plants, these substances are encountered by infants and small children when they are exploring their environment.

Vietnamese mothers are currently unaware of the dangers these substances pose for their children, and the concept of “child proofing” a house is a foreign one for Vietnamese mothers. Hence, families with newly arrived babies do not normally seek out all poisons and dangerous chemicals and lock them up. Most rural homes lack lockable boxes suitable for containing dangerous chemicals or poisons. This would seem to be a very obvious route for intervention in that programs to provide or encourage the use of these would be very low cost and low technology. If implemented as part of a micro-enterprise activity (community-based for-profit production activity) it would be sustainable. Additionally, storing poisonous chemicals in empty food containers and beverage bottles is extremely common practice in households in Vietnam and this is also a potential target for intervention. Neither mothers nor fathers understand the danger this poses to their children. Developing a low-cost, durable and reusable child-safe container and educating mothers and fathers to the importance of their use would probably yield substantial reductions in child poisoning. Finally, pharmaceuticals and drugs do not come in childproof containers, as is common practice in developed countries. Given that there are few factories and manufacturers of pharmaceuticals in Vietnam, this provides an efficient way to deal with this issue through regulations to require child-safe packaging for drugs produced or imported. All of these approaches (low cost safety technology, parental education and a regulatory framework that supports child safety) are potentially needed as part of a comprehensive domestic child injury prevention program.

Chapter
9

9. Animal bites

9.1. Introduction

Animal bites can cause severe physical damage, internal injuries, and serious or fatal infections including rabies. Injuries from animal bites are an important public health problem in Vietnam where the economy is agriculturally oriented. People living in rural areas frequently own or use animals for agricultural work, or for trade. With the beginning of Doi Moi, the economic renovation, the economic development process in Vietnam has rapidly increased and led to many families in the rural areas raising animals for trade and to supply the market with special animals for restaurants. Raising snakes, tortoises, as well as dogs and cats is an increasing trend in rural areas as a way to increase the economic status of the family and these animals have a propensity to bite.

9.2. Animal bite injury

The overall rate of animal bite injury for children was 1,105.2/100,000. The rate for males was significantly higher than for females.

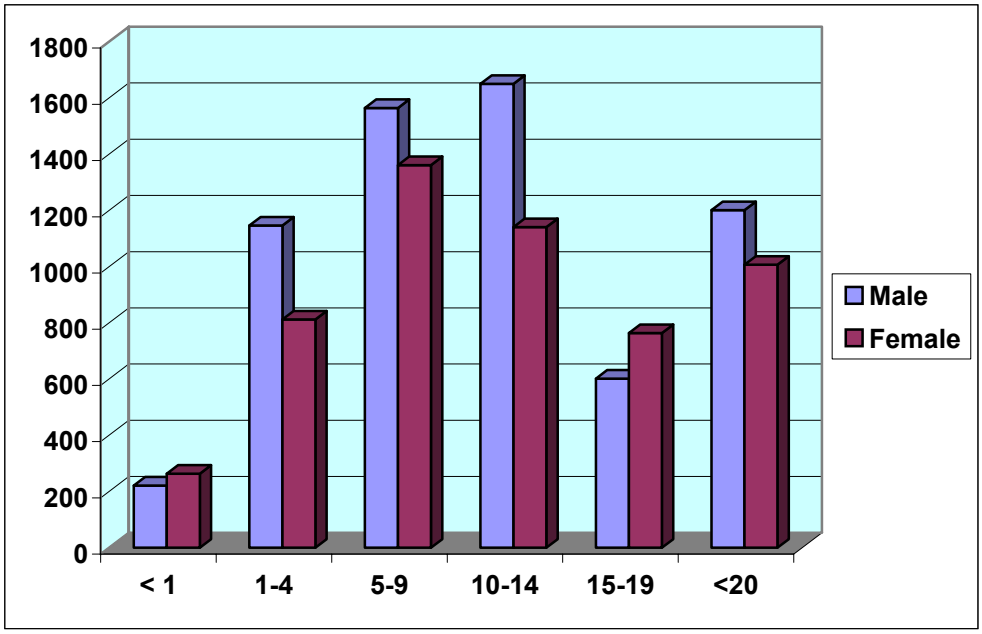
Table 9.1. Nonfatal animal bite rates (/100,000) by sex and age group

Age group	Male	Female	Both
< 1	221.1	263.2	241.3
	2	*2*	*4*
1-4	1146.0	812.2	983.3
	42	*29*	*71*
5-9	1,564.2	1,360.9	1,464.0
	99	*81*	*180*
10-14	1,649.7	1,140.5	1,396.9
	180	*83*	*203*
15-19	601.3	763.8	681.1
	44	*52*	*96*
<20	1,200.7	1,006.6	1,105.2
	560	*483*	*1,043*

** actual number of cases in italics*

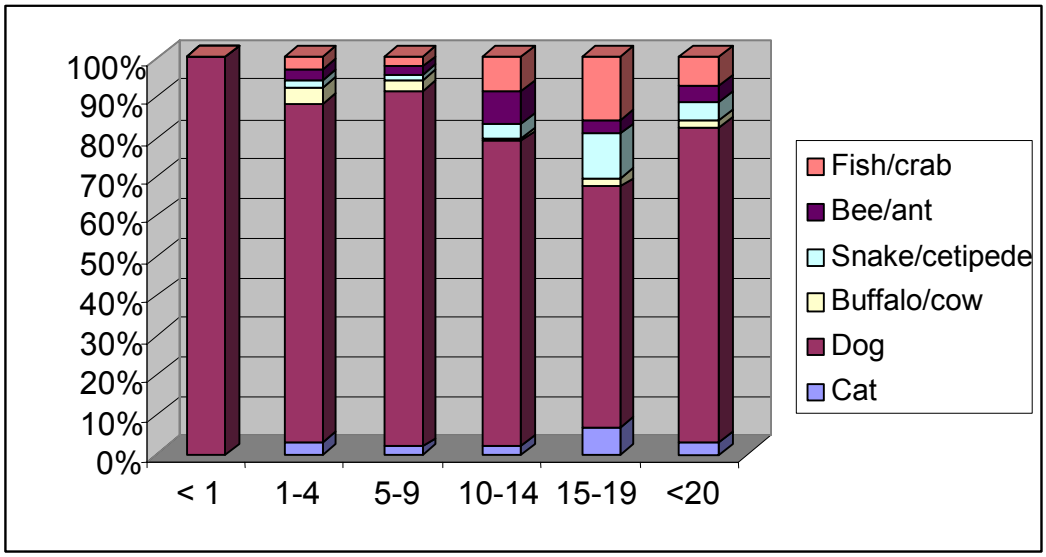
There were no animal bite fatalities in children. The 5-14 age groups had the highest nonfatal animal bite rates, and the group < 1 had the lowest rate of animal bites. This is likely a result of the actual exposure rates of these two groups; children in the 5-14 age group have the highest daily exposures to animals either feeding and grooming pets or assisting with feeding and raising farm animals; and the < 1 group had the lowest exposure to animals.

Figure 9.1. Animal bite injury rates (/100,000) by sex and age group



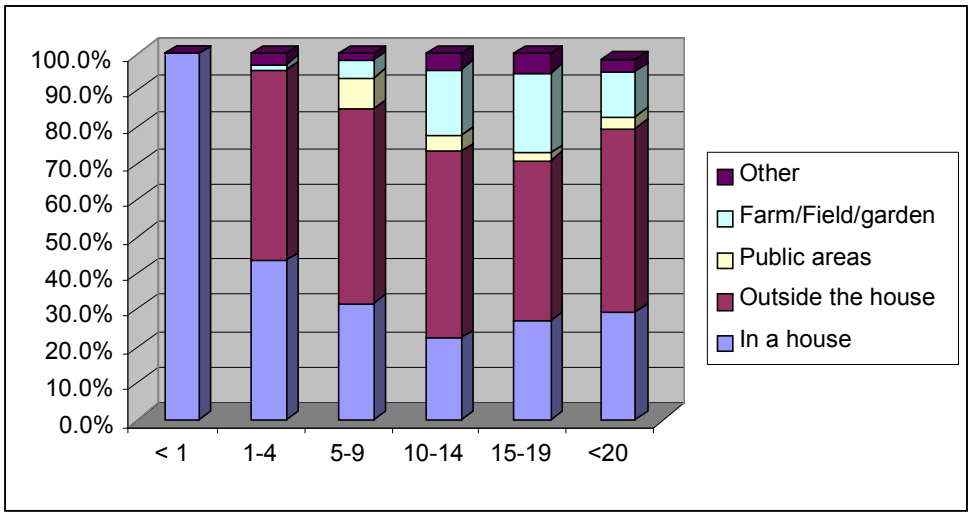
Over four-fifths (83.3%) of animal bite injuries occurred when animals were being fed. Almost four-fifths (79.5%) of animal bite injuries were caused by dogs. Snakes, cats fish and bees accounted for most of the rest.

Figure 9.2. Animal causing injury



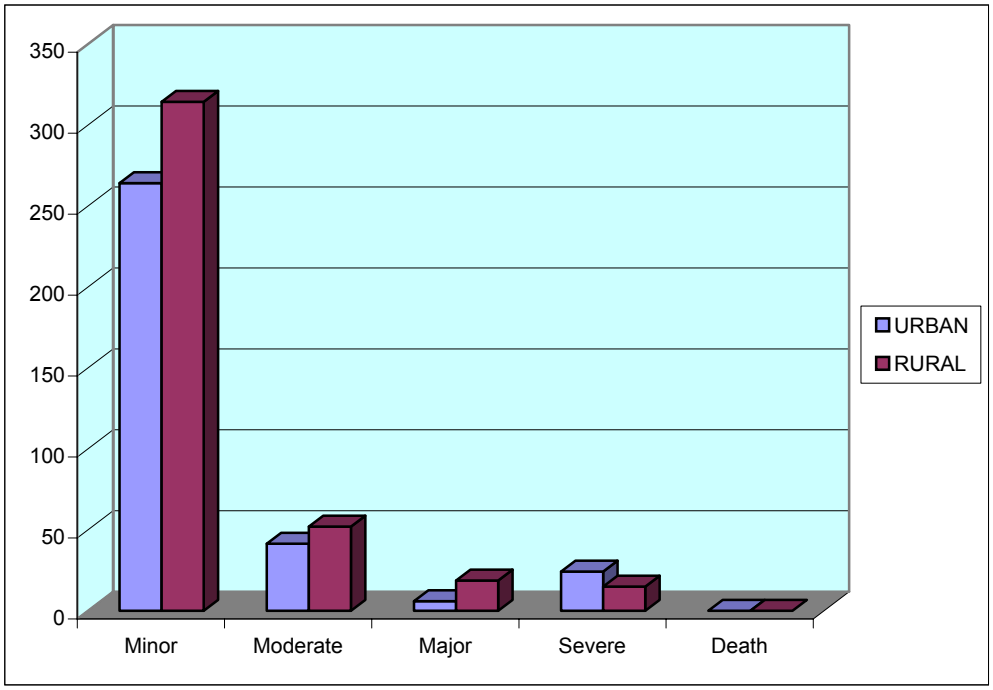
About 55% of victims were injured when they were involved in outdoor activities, about 20% of animal bite injury happened when people were working in the farm or field. A minority of bite injuries occurred from playing with animals. Almost a third (29.5%) of animal bite injuries happened in the house caused by feeding dogs and cats.

Figure 9.3. Location where injury happened



9.3. Consequences of animal bite injury

Figure 9.4. Severity of bite by place of residence, urban vs. rural, (1-19)



There was no significant difference in severity of injury by whether the bite occurred in an urban versus rural area. Urban children have almost the same frequency of exposure to animals as rural children. The types of animals to which children are exposed differ with large farm animals being more common in rural areas and smaller domestic animals and pets being the most common animals in urban areas. However, severity of bites was not significantly different for the types of animals.

Figure 9.5. Bite severity by age group

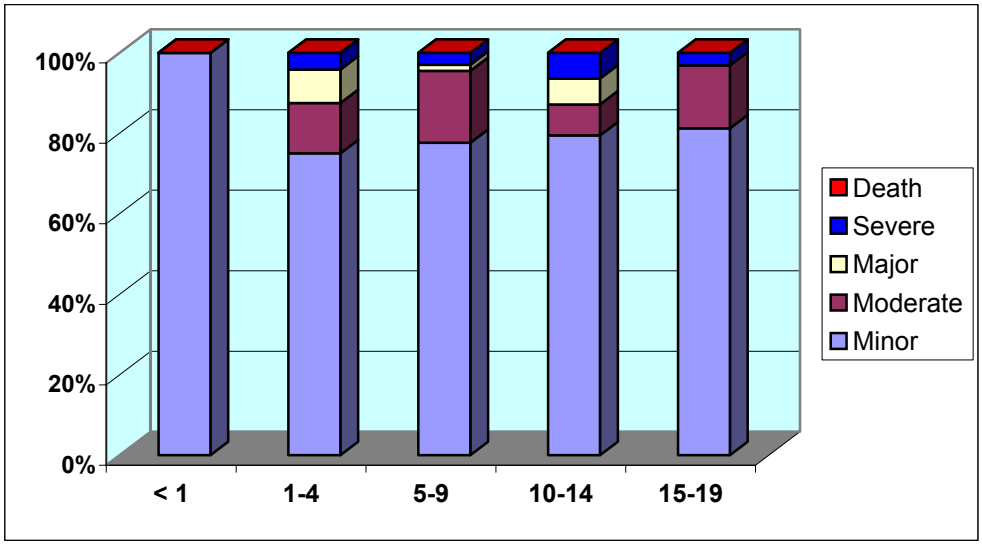
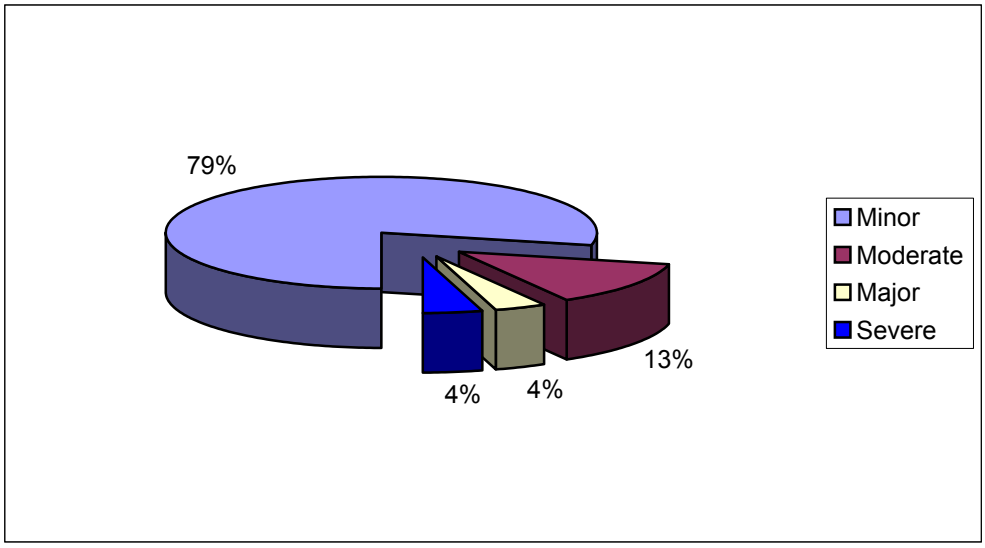


Figure 9.6. Severity levels of animal bite injury in children



The bites were serious bites. Almost four fifths of them required medical treatment; almost a firth required hospitalization, and 4% resulted in permanent disability to the child bitten. This skewing towards serious bites is due to the screening definition of injury used where the injury was only reported if it led to either a visit to a medical facility, or loss of at least one day of school or work. As a result, it is likely that many more bites were experienced that did not require attention, and were not reported.

Not surprisingly, the extremities were the sites of the bites in 80% of cases. Bites to the legs accounted for 45% of bites, bites on the hand and foot accounted for 19% and the body was the site of 17.2% of bites

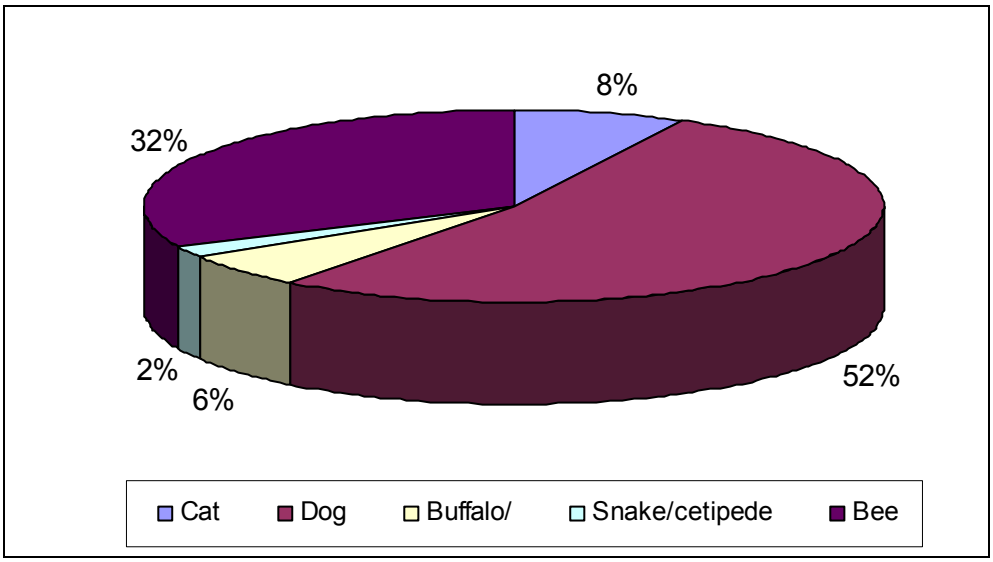
The children bitten and hospitalized spent an average of 4.3 days in the hospital. Almost two-thirds (61%) of these were caused by dogs and about a fifth (21%) were

caused by snakes/centipedes. Buffalo bites led to 7% of the hospitalizations, and bee stings caused 6%.

Over a quarter (26.5%) of children injured by bites were students and missed an average of 7.7 school days due to the bite.

Approximately 40% of families reported an impact on their socio-economic status as a result of the animal bite injury to the child. Most were minor, but 7% reported moderate effects and 1% reported severe effects.

Figure 9.7. Animals causing bite injuries



Dogs caused the majority of bites that were rated as severe, followed by bee stings, cat bites and buffalo bites.

9.4. Discussion

Injury from animal bites was the second leading cause of child morbidity in Vietnam at a rate of 1,105.2/100,000. Children in the 5-9 and 10-14 year age groups had the highest bite rates of 1464.0 and 1,396.9/100,000 respectively. Males were more likely to be bitten than females, the animal most commonly involved was the dog, and feeding was the most common activity being undertaken when bitten. While animal bites were very common, and the reported bites were serious, there were no deaths resulting.

There was also a geographic distribution for the bites that reflected the physical environment of the region. Snake bites were most common in the Central Highland region and fish bites were highest in the Mekong River Delta.

The average length of stay in the hospital due to animal bite injury was four days and this length of stay increased with the age of the victim.

Families did not suffer large SES effects from animals biting children. This most likely reflects the fact that children in the age ranges most commonly bitten were not the major income producers for the family, and there were no direct fatalities reported from the bites. Nonetheless, due to the frequency of occurrence as well as the tendency to be serious, animal bites are a significant source of morbidity for Vietnamese children. At the rate of 1,105.2/100,000, there were almost 360,000 children bitten in 2001, or almost 1,000 each day. With almost four-fifths of these requiring hospitalization, this is almost 800 children

per day. With 4% resulting in permanent disability, this is over 14,000 children a year; or almost 40 children each day. These 360,000 children endured significant pain and suffering and generated enormous medical costs. This is a very significant public health problem. The cost associated with rabies prophylaxis of a significant number of these bites is quite large. Vietnam currently is unable to produce sufficient quantities of rabies vaccine domestically and imports substantial stocks of vaccine as a result of the magnitude of the animal bite problem in the country.

Prevention approaches will depend in large part on the circumstances of the bites. In populations of very high risk (older children engaged in feeding and caring for dogs being raised for food purposes) the same approach used in meat packing trades may be feasible with the handlers wearing cut-proof and bite proof clothing (lightweight chain-mail gloves, gauntlets and leggings). At the very least, these children should have prophylactic rabies immunizations. For other children who are at less predictable individual risk, prevention approaches will have to involve educating caretakers to the risks of exposing children to biting animals and teaching children how to play safely with animals.

Chapter
10

10. Burns

10.1. Introduction

According to the WHO, throughout the world, fire-related burns are responsible for nearly 300,000 deaths annually and rank ninth among the leading causes of the global burden of disease and injury (based on deaths and disability) among children aged 5-14 years. These figures do not, however, represent burns due to other causes such as scalds, chemicals, and electricity, and others, and are thus an under-representation of the true magnitude of all burns. The majority of the fire-related burn deaths occur in developing countries. Burns affect mainly children and the elderly and occur most frequently in the home and the workplace. Most burn injuries, particularly among children and women, occur in the domestic environment.

10.2. Burn injury in Vietnam

The both sex burn injury rate for children was 201.0/100,000. Infants had relatively low rates, very young children had the highest rates and the age-specific rates fell with increasing age.

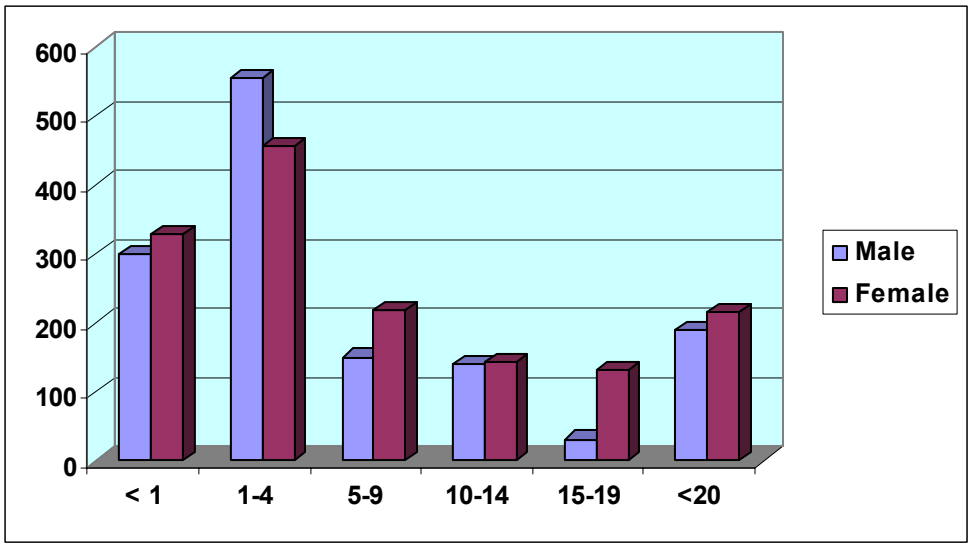
Table 10.1. Nonfatal burn injury in children (/100,000)

Age group	Male	Female	Both
< 1	378.0	419.9	398.2
	3	*3*	*6*
1-4	529.9	477.1	504.2
	23	*18*	*41*
5-9	133.9	217.5	175.1
	10	*14*	*24*
10-14	167.3	165.2	166.2
	11	*11*	*22*
15-19	25.2	125.2	74.4
	2	*8*	*10*
<20	181.1	221.5	201.0
	49	*54*	*103*

** actual numbers of cases in italics*

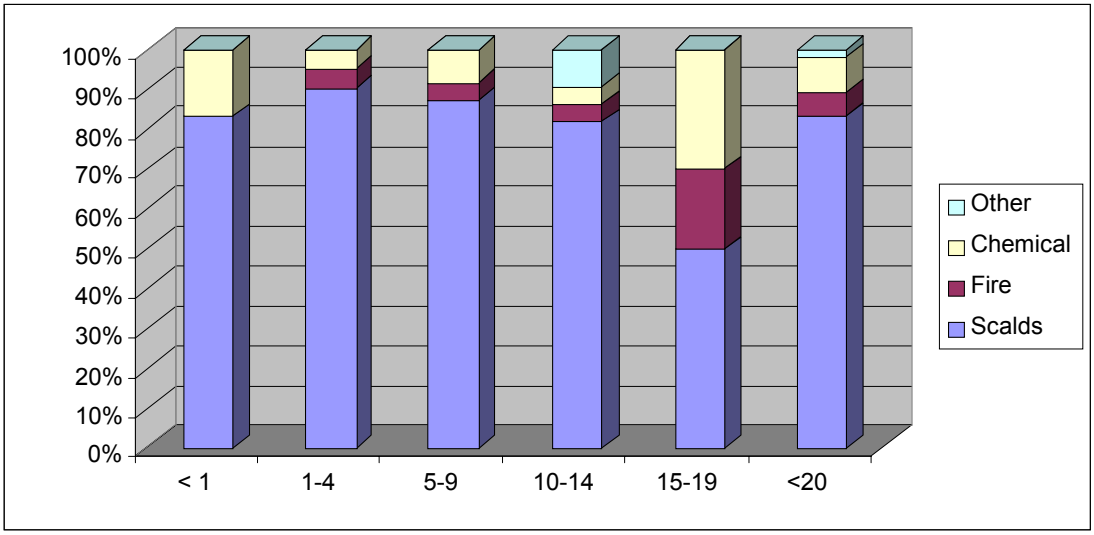
The age and sex distribution of the burns and the cause of them are classic for children in developing countries, and can be seen in detail in the following sections.

Figure 10.1. Burn injury by sex and age group



There was little difference in the male-female burn rates in infancy as exposure rates are usually the same (being carried by their mothers). Burn rates almost double to the highest rate of occurrence in early childhood as the young toddlers of both ages pull hot objects and liquids off tables and stoves while exploring their environments. The rates fall in middle childhood due to lower exposures and better understanding of the hazards by older children. The dramatic difference in the sexes in the 15-19 age groups reflects the different roles of the sexes and thus the exposures: males typically are working outside the house with high rates of exposure to burning in agricultural practices, and females are typically working in a domestic role with high rates of exposure through cooking, ironing, etc. The difference in rates at this age group was significant at the P <0.10 level.

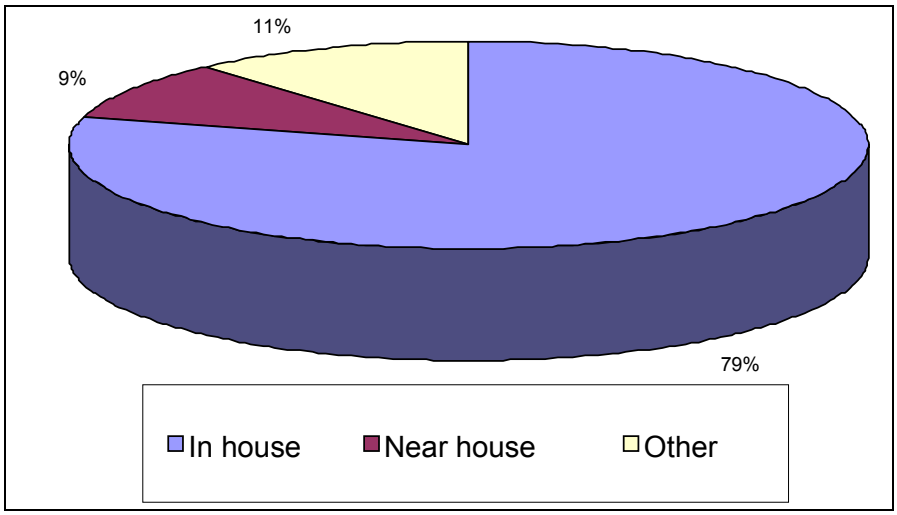
Figure 10.2. Factors causing burn injuries



Hot water was the main scalding agent, and was responsible for the most burns in each age group. Scalds accounted for 83.5% of burn injuries, burns from open flames accounted for 8.7%; large open fires accounted for 5.8% of child burns.

Children aged 1-4 suffered most from burn injury. The overall rate for this group was 504.2/100,000 and the rate decreased as children grew older. This is consistent with child behavior. Infants are very vulnerable to scalds, especially when they begin to crawl unsupervised and grasp things to attempt to stand up. When they turn one and begin to walk, they expand their exploration of their environment, oblivious to the risks and hazards. Most Vietnamese homes have very hot water constantly present for the making of tea. The water is often in thermoses, which are tall, easily tippable containers, and these two factors-- very young children exploring the environment, and scalding water in easily tippable containers-- interact to create the serious scald outcome for the young children.

Figure 10.3. Location where injury happened



Almost 80% of burn injuries happened at home (79.4%) and about a tenth (9.1%) happened near the home.

10.3. Consequences of burn injury

About half of child burns were rated as minor and the rest required hospitalization. There were no child deaths as a result of burns.

Figure 10.4. Severity levels of burn injury by age group

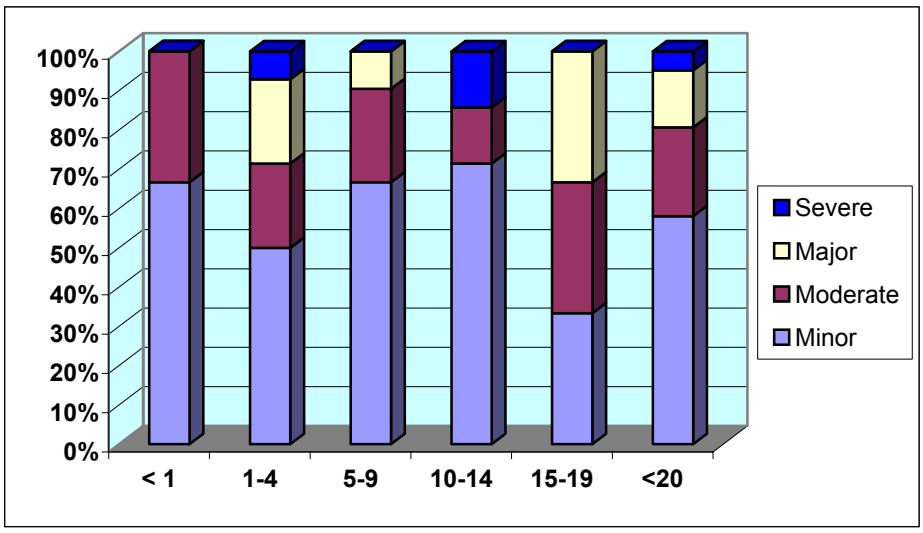
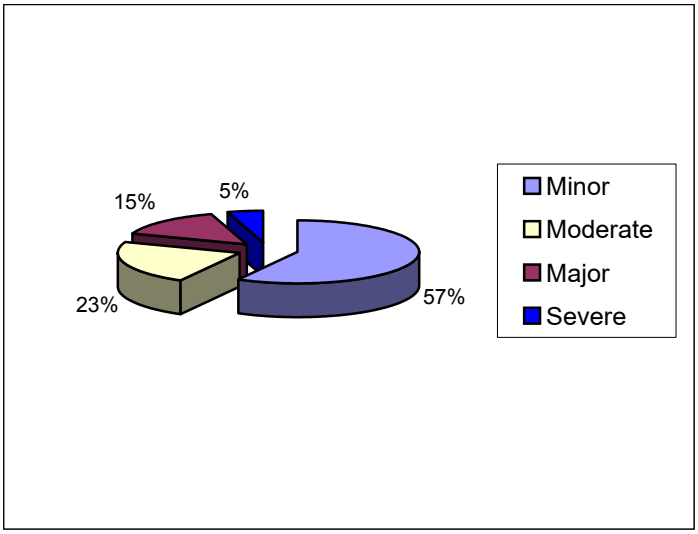
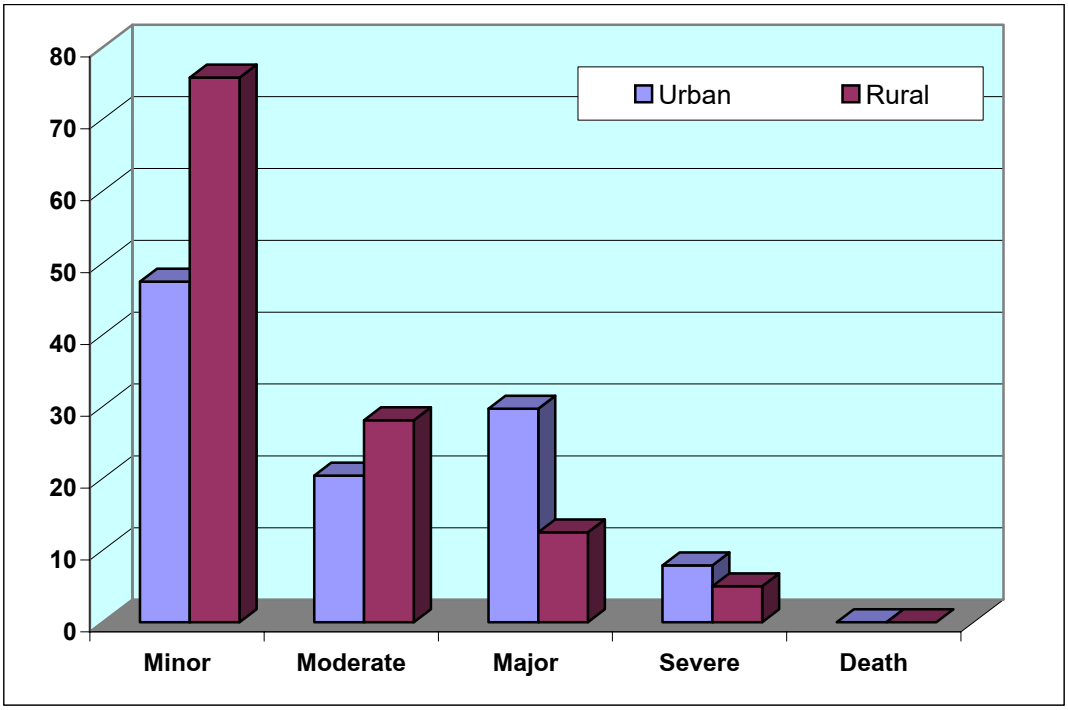


Figure 10.5. Severity level of burns for children



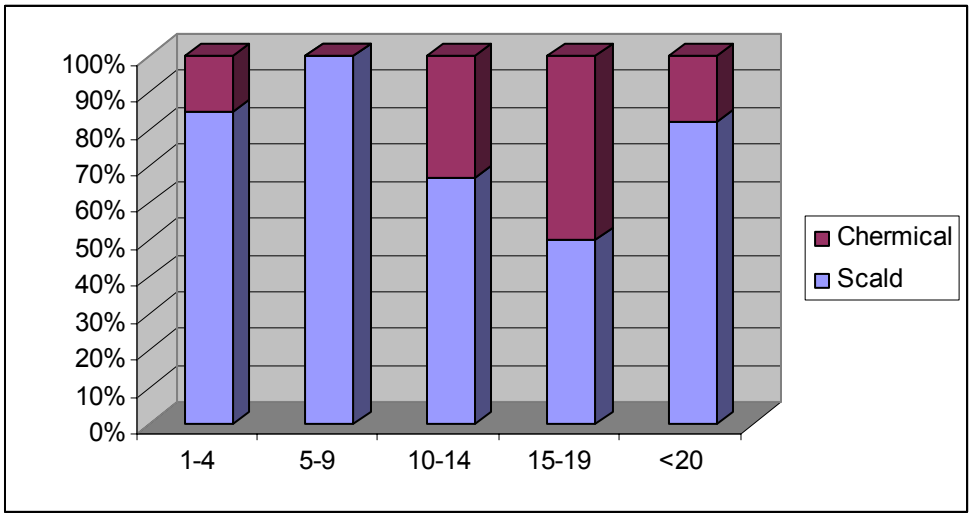
Major burns were significant in all age groups except infancy. The majority of burns were scalds (over 80%) and this skewed the severity of the burns. Scalds in young children characteristically have high severity rates due to the nature of the exposure and the large areas of the body involved (children often pull scalding liquids onto themselves and scald their face, arms and torso simultaneously).

Figure 10.6. Severity of child burn injury by venue, urban vs. rural



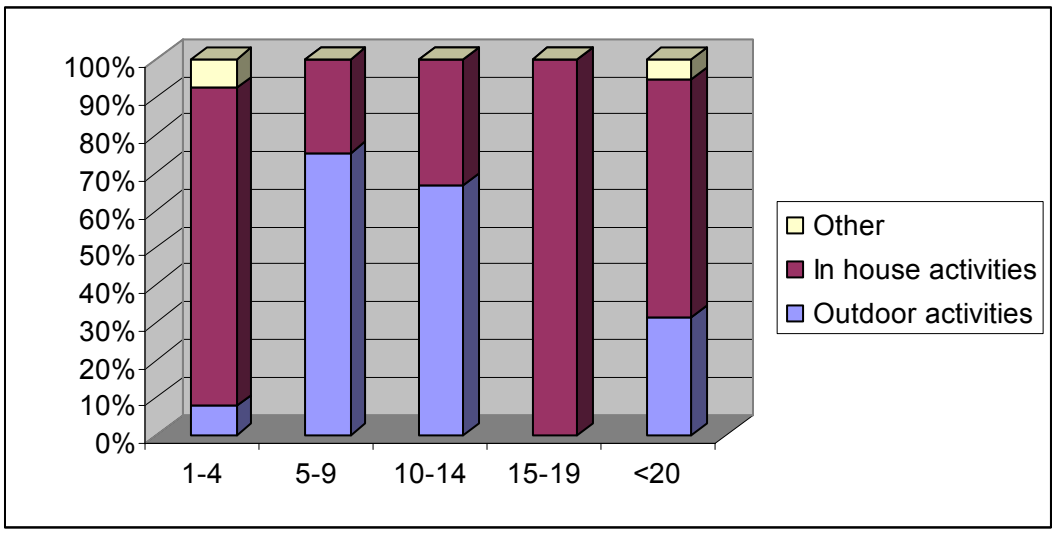
There was a tendency for minor burns to be more common in rural areas and major burns to be more common in urban areas, but the differences were not significant. Thus, statistically, children in both urban and rural areas are at a similar risk of burn injury.

Figure 10.7. Major burns injury among children by age group



Looking only at major burns, the vast majority were due to scalds. Extremities (upper mainly) accounted for the largest proportion of body locations.

Figure 10.8. Activities when children were burned



Most burns in children occurred in the locations associated with the child age groups: young children were burned indoors and older children were burned outdoors. The oldest age group was mainly indoors due to the large predominance of females in this group, and they were engaged indoors in domestic activities.

One-third of burn cases were in hospital an average of 12 days; and two-thirds of burned children missed an average of 16 school days.

About 5% of child victims from burns suffered permanent disability. Most of this was due to dysfunction in walking or handling as a result of the severe and extensive scarring that typically accompanies scald injuries in young children. The remainder was as a result of blindness caused by corneal scarring from the scalding liquid.

About 60% of families with a burned or scalded child experienced an impact on their SES. About three percent of families had a permanent impact that was rated as strong (2%) or moderate (1%). Almost one-quarter (22%) were strongly or moderately affected, but the economic impact was not permanent.

10.4. Discussion

Burn ranked as the fifth leading cause of morbidity in Vietnam, and there were no deaths. However, over 65,000 children were burned in the year 2001, significantly enough to require medical attention or suffer serious consequences, including permanent disability. This is almost 180 children each day. Burns were a major cause of permanent severe disability in children. Even in cases of non-permanence, it was a significant cause of loss of school, hospitalization days, and medical expense for families at a point where they are usually not in their peak earning years. There is also the very real social burden incurred through burn injury: the scarring and disfigurement associated with burns of young children have major effects on their lives as adults.

While fires and burns did not account for any child deaths, this is likely due to the fact that fire deaths from flames are relatively uncommon given the nature of house construction in most rural areas. Children and other occupants of one-room rural houses may be at higher risk of fire as cooking and heating is often done with an open flame, but they are easily escaped from when on fire. Multistory dwellings, much more likely to lead to entrapment are relatively infrequent in rural areas. These physical environment issues, coupled with the sample size issue, are most likely the reason that there were no child fatalities found from fire in VMIS.

However, the lack of child fatalities does not mean that fire is not a major public health and safety issue for Vietnamese children. It is important to understand that the most common fire injury in children is scalding which causes severe morbidity, but is not usually fatal. Scalding, as a cause of serious morbidity is an extremely serious child health problem of a magnitude that can only be described as epidemic in Vietnam. Considering only scalds in children that were rated as major or severe, the numbers are enormous: over 13,000 children in 2001, or over 35 children each day. As a result, the significance of burns in children is greatly underestimated if only looking at fatality rates. From a public health perspective, scalding is one of the largest child health problems due to the enormous burden in direct medical costs as well as later, the high social costs from the disfigurement and permanent disability. These are preventable.

In Vietnam, most homes in rural areas do not have separate rooms for kitchens, and thus young children are in very close proximity to cooking fires, which often have pots filled with hot or boiling water. In urban areas, kitchens typically have a raised platform at one-meter height for stoves and pots, pans and thermos jugs. This height is a deadly height as it is just at arm's length for toddlers and very young children. When left unsupervised and when pots are simmering, very young children often pull the contents of the pans directly on to themselves. This results in severe injury as large areas of the body are scalded when this happens. Since the toddler is looking up when pulling the pot down, severe facial burns accompanied by blindness often occur. Relocation of the cooking surface at a different height or place, isolation of the cooking area from the place where the toddler is active, and increased supervision of the child by other caretakers while cooking is taking place are all potentially appropriate, cheap and effective prevention measures.

Whether urban or rural, Vietnamese families have a habit of keeping very hot water always nearby in electric kettles or thermoses to allow the ready making of tea. Many of the thermoses are quite large, and being tall and thin, with a narrow base, and capped with a simple cork, they are easy to tip over and spill scalding hot liquids on young children. Simple and cheap prevention methods are available such as wide-based thermos bottle holders, or even more simply and cheaply, large rings cut from bamboo and attached to table legs to serve as secure thermos holders. The average Vietnamese mother or father does not understand the need for these. Habits, customs and low levels of economic development as well as a lack of safety awareness in parents all make most Vietnamese homes high-risk environments for burn injuries. Infants and young children are especially at risk in this environment. They will remain so without intensive education and social marketing efforts focused on their parents.

Developed countries have recognized the enormous toll associated with scald injury and other burns in children. Most countries have building codes that specify safe counter heights for kitchens, legislate maximum temperatures for hot water heaters, and mandate that sleeping clothes for children be resistant to fire. As a result, burn injuries in children are several orders of magnitude less than those seen here in the VMIS survey. There are cheap and low-technology alternatives to the prevention practices in developed countries that could be easily and effectively adopted and the resulting social, behavioral and environmental effects would have a major impact on burn rates in children in Vietnam. Many of these would be opportunities for micro-enterprise development as part of village-based sustainable child safety programs (bamboo room gates, wide-based wooden thermos holders, or bamboo retainers, etc.), and when combined with parental education and care-taker behavioral modification programs would likely produce sustainable reductions in child scalding rates.

Chapter
11

11. Other injuries

11.1. Injury caused by machinery

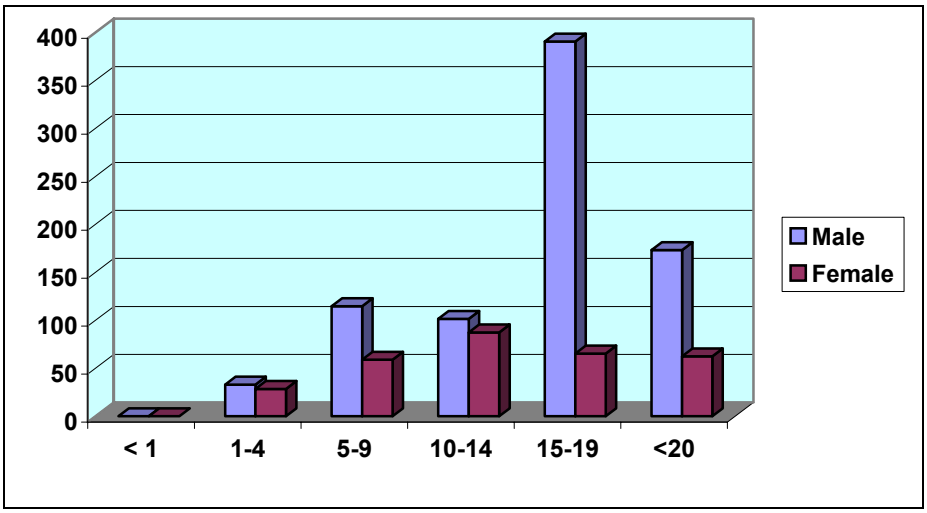
With economic development progressing quickly in Vietnam, powered machinery is increasingly used in many working activities. While this leads to increases in productivity it also leads to increasing injury from the machines. Given the exposure that children have to this machinery, especially the rural areas where farmers use machines for their work on the farm for such things as brick making and processing rice, and women and children use power looms and sewing machines for weaving and sewing; there are consequently high rates of child injury caused by the machinery. Most of the machinery that children are exposed to does not have protective guards or the most basic safety features.

11.1.1. Machinery injury pattern

Injury caused by machines ranked as the eighth leading cause of nonfatal child injury in Vietnam: the overall rate of injury being 118.6/100,000. There was a significant difference between the rate in males and females (173.1 vs. 62.3/100,000). This is due to the differing exposure rates to machinery for males and females.

Males in the age group 15-19 were the most affected by injury from machinery (nonfatal rate of 390.5/100,000). This rate was over six times higher than for females. Overall, this age group had the highest rate of machine injury among children.

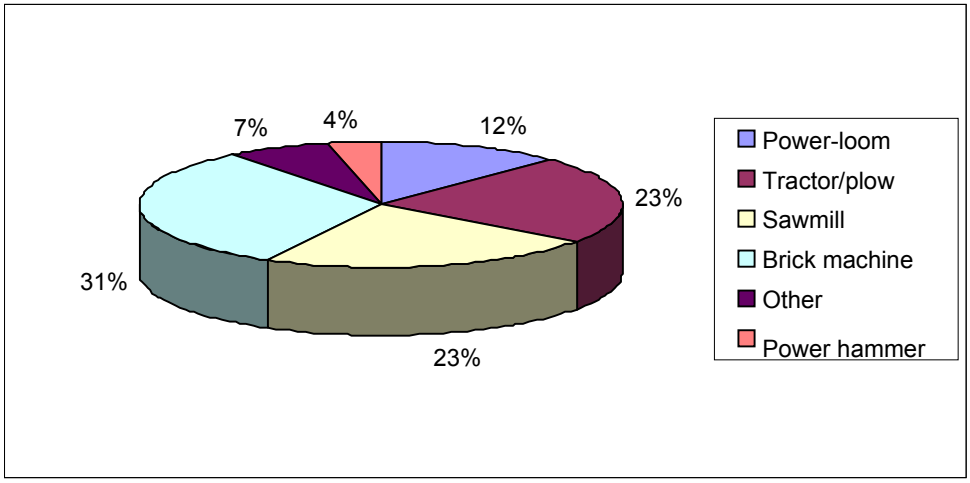
Figure 11.1. Machinery caused nonfatal injury rate (/100,000) by sex and age group



Agricultural machines and tools accounted for most of machinery involved in injuries, Small industrial machines accounted for more than three-quarters of the injuries: brick

machines accounted for 31%, tractor/plows accounted for 23%; and sawmills accounted for 23%.

Figure 11.2. Type of machine involved in injuries

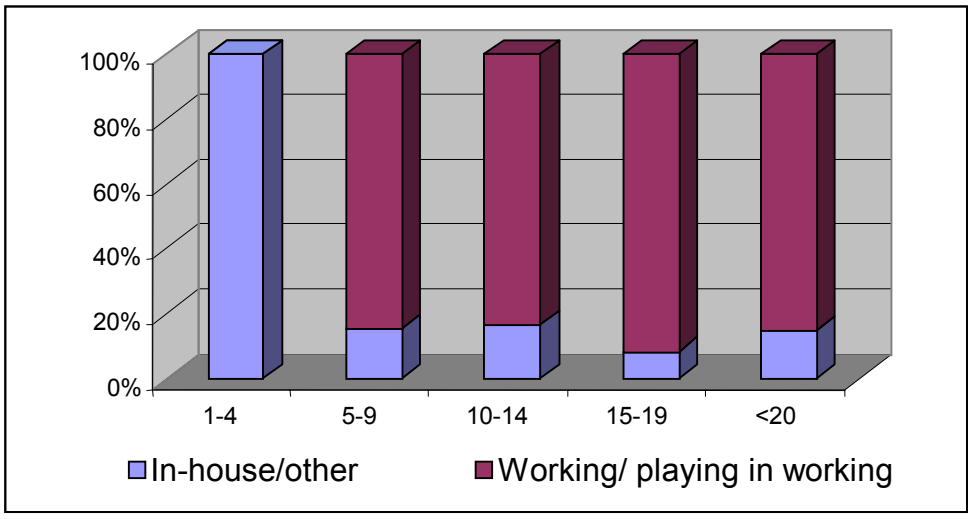


More than 60% of injuries happened when children were working or gardening, and mostly in higher age groups (older than 14). For children under 10, machine injury happened when accompanying other people or playing around work areas.

11.1.2. Consequences and severity of injury caused by machinery

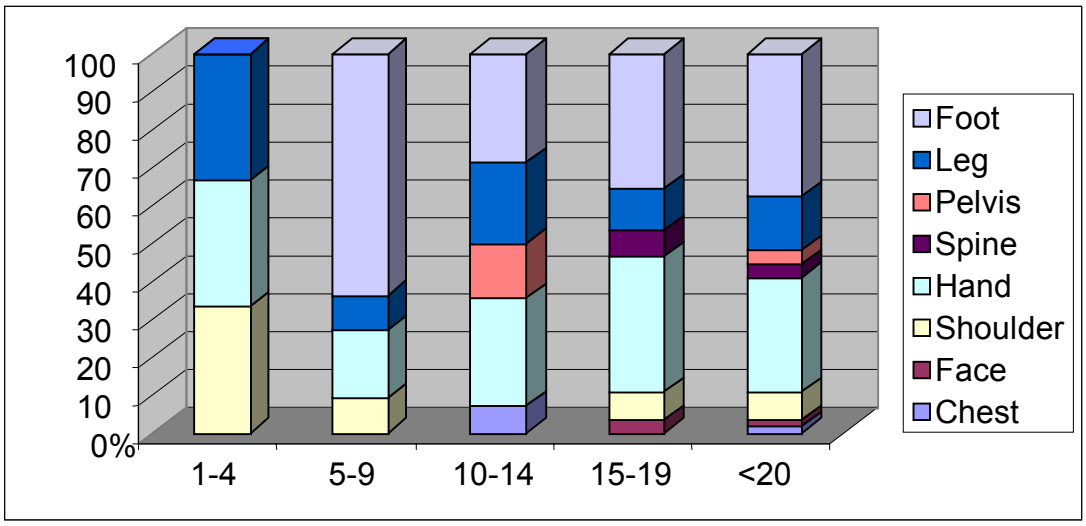
Almost 70% of the injuries caused by machine were moderate or major; about 30% of injuries were severe, often a hand, foot or entire extremity amputation. The extremities were the most frequently affected areas of the body. There were no deaths reported among children due to machinery causes in VMIS2001

Figure 11.3. Location and activities when injury happened



About one third of victims were hospitalized and the average length of stay in hospital was 10.7 days (range 1-60 days). Half of the affected children missed an average of 2 weeks of school.

Figure 11.4. Body locations ofmachinery injury

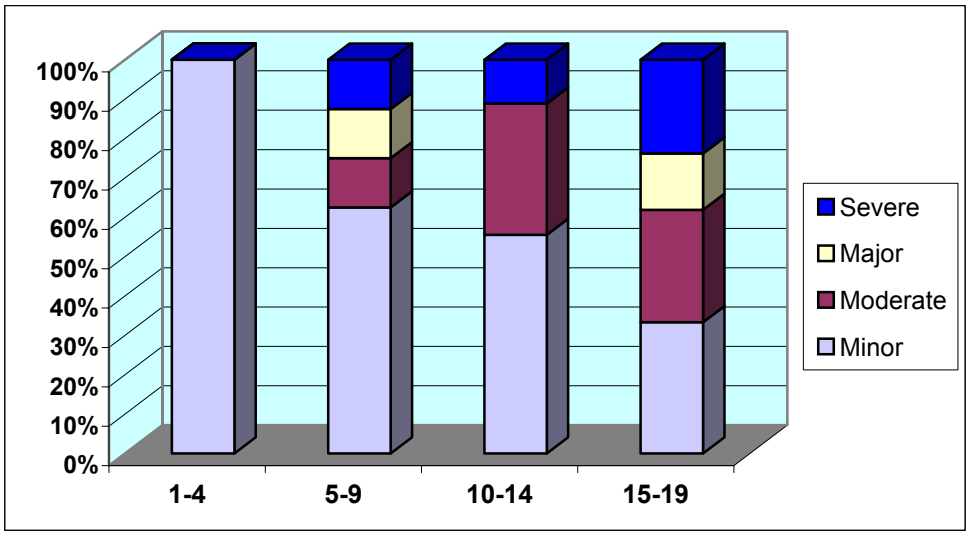


The extremities were the most frequently affected areas of the body.

Almost 5% (4.8%) of the families experienced a major impact on their SES that was permanent and 12.0% of families had moderate impact that was permanent. A third of families suffered a minor effect on SES and 16% of families had a severe or moderate effect that was temporary.

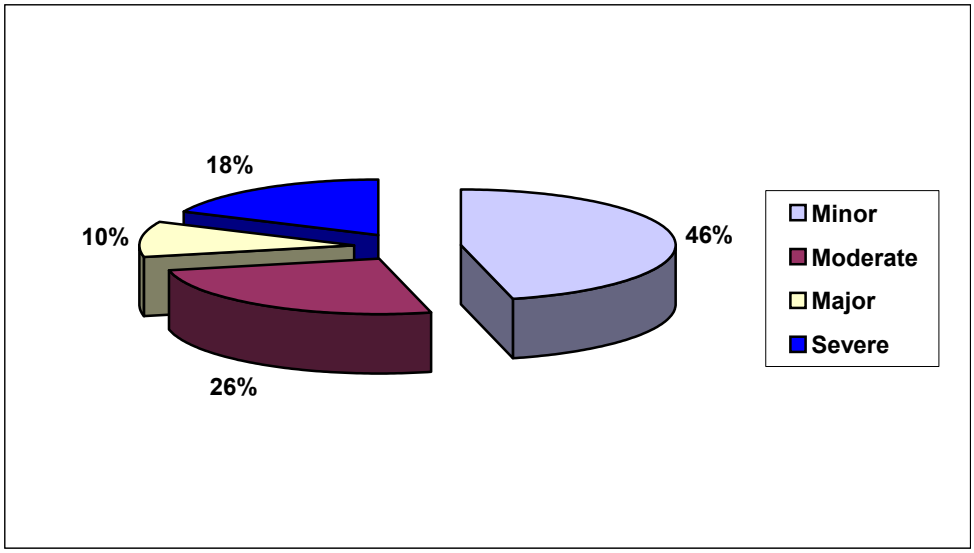
11.1.3 Severity of injury caused by machine

Figure 11.5. Severity of machine injury by age groups



Very young children (1-4) suffered minor injury that required medical attention but did not require hospitalization. The older age groups had increasing rates of severity as the age increased.

Figure 11.6. Severity of machine injury for children

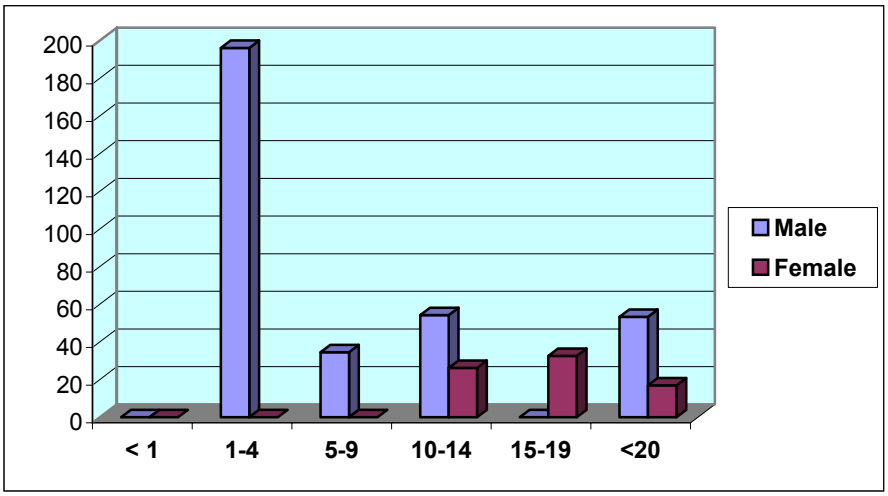


More than one-quarter of victims were hospitalized and the average length of stay was 10.7 days (range 1-60 days). Half of the affected children missed an average of two weeks of school. About 18% victims were permanently disabled; almost half of these from a permanent dysfunction in walking and handling, with the rest blinded, or suffering mental dysfunction (loss of speech, intellect, etc).

11.2. Injury caused by electric shock

Electric shock ranked as tenth in terms of nonfatal injury with a rate of 35.4/100,000. The injury rate in males (53.3/100,000) was significantly higher than for females (16.9/100,000). Electric shock also caused fatal electrocutions, and the fatal injury rate was 3.4/100,000.

Figure 11.7. Electric shock injury rate (/100,000) by age group



The age group 1-4 had the highest rate of electric shock followed by the 10-14 age group.

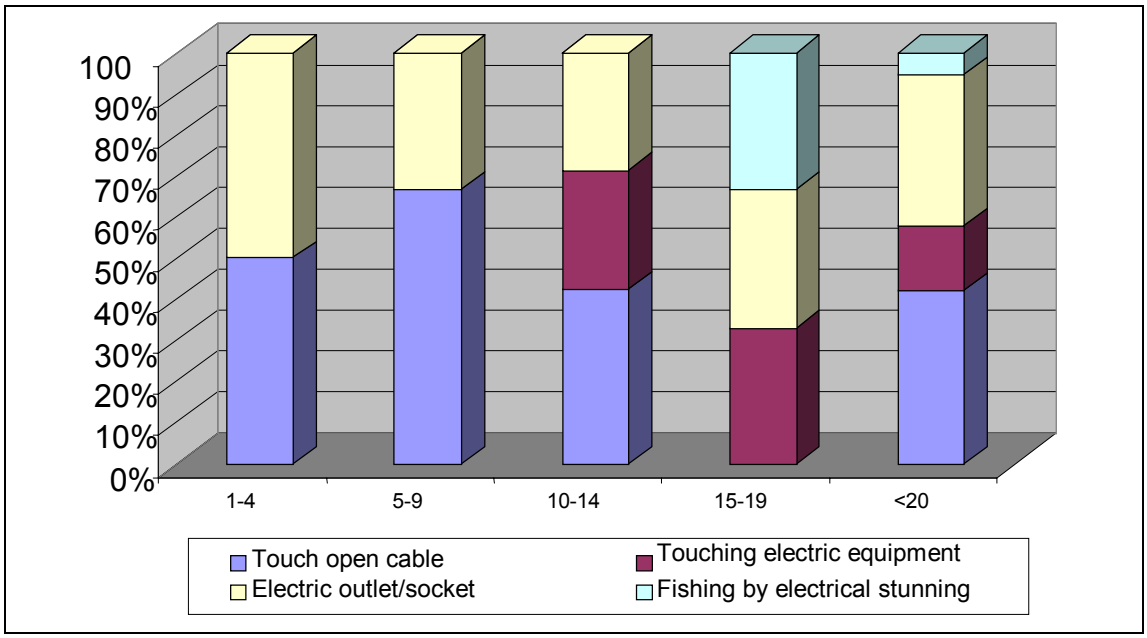
Table 11.1. Causes of fatal electric shock by age group

Electric shock causes	< 1	1-4	5-9	10-14	15-19	<20
Touch open cable	0	50.0%	66.7%	42.9%	0%	42.1%
	0	*3*	*2*	*3*	*0*	*8*
Touch electric equipment	0	0.0%	0.0%	28.6%	33.3%	15.8%
	0	*0*	*0*	*2*	*1*	*3*
Electric outlet/socket	0	50.0%	33.3%	28.6%	33.3%	36.8%
	0	*3*	*1*	*2*	*1*	*7*
Using electrical fishing device	0	0.0%	0.0%	0.0%	33.3%	5.3%
	0	*0*	*0*	*0*	*1*	*1*

** actual numbers in italics*

The fatalities resulting from electric shock in the younger age groups were caused by touching open cables and shock from electric outlets/socketss; in the older age groups (15-19) they were caused equally by the use of electrical fish stunning machines for catching fish, the use of electrical equipment, and electric outlets/sockets.

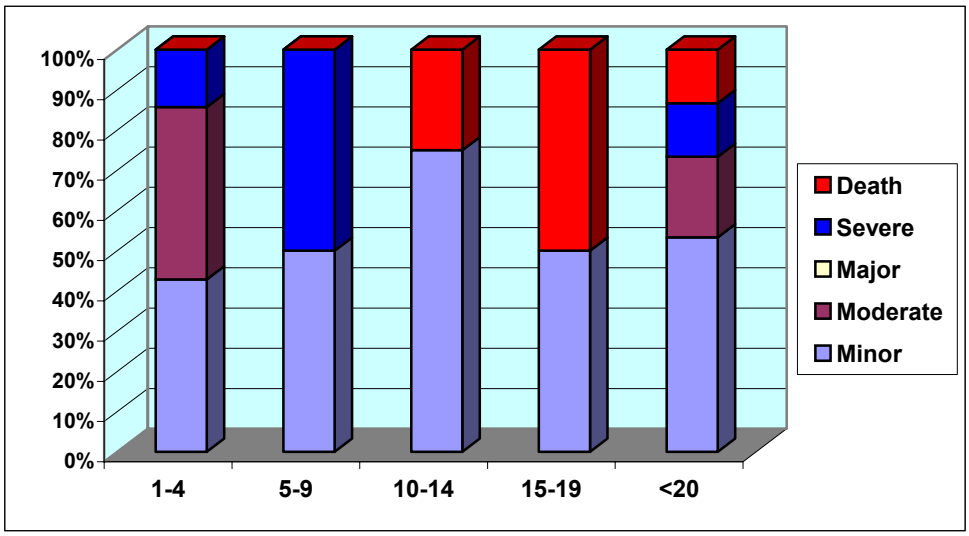
Figure 11.8. Causes of electric shock by age group



More than 80% of shock injuries happened at home, 15% happened outside the house, and about 5% happened in the river/stream where the victim was using electricity to stun fish for capture. Toddlers were at greatest risk of touching a bare cable or inserting their fingers into an electrical socket while exploring their environment.

11.2.1. Consequences of electric shock injury

Figure 11.9 Severity of electric shock by age group



Most (70%) injuries caused by electric shock were major or moderate severity. Electrocution had a relatively high case fatality rate at 18%, and a rate of 3.4/100,000. Severe injury due to shock resulted from 13% of the shocks.

About 3% of shock injuries led to hospitalization averaging three days (range 1-30); and students missed an average of four days of school. About 13% of victims suffered from residual disability, with walking, handling or deafness being the most common.

A little more than a third (35%) of families reported being economically affected due to the injured child. Five percent were strongly and permanently affected; 10% were moderately and permanently affected.

11.3. Discussion

11.3.1. Machinery injury

Injury from machinery is a significant cause of morbidity for children in Vietnam. The rate of 118.6/100,000 means that over 38,500 children were injured by machines in 2001. Given the high rate of severe injury (about one-third) this means abou 35 children are severely injured from machines each day. The vast majority of these are in the older child age groups, with the highest rates in the 15-19 age group. Many of these are occupational injuries given that they are occurring in rural areas where farming is the main occupation and the adolescent child is helping with the work of farming.

It is very difficult to exclusively categorize cutting-type injuries into different categories such as sharp objects and machine injury; these two categories are not entirely mutually exclusive, and thus there are some inevitable overlaps. The categorization was selected by the policy makers participating in the development of VMIS to increase visibility on these two areas of injury, in part due to the differing mechanisms, locations and prevention approaches that might be warranted.

Machine injury is notable for a skewing towards severe injury, due to its nature. Most of the severe injuries result in loss of function of the body part affected; often this was amputation of hands, arms, legs and feet. This results in a high rate of permanent disability and there are very high economic and social costs as a result.

11.3.2. Electric shock.

While the vast majority of electric shocks were nonfatal, electrocution is a significant problem for Vietnamese children. Over 1,100 children died of electrocutions in 2001, which was about three children each day.

This high level of severity is probably due to a "threshold" effect with electric current injury. In all likelihood, the vast majority of all electric shocks suffered by children in Vietnam in 2001 were minor and did not result in any appreciable injury (minor pain and surprise, but little else) as they happened with relatively low household voltages and current levels. It must be noted that very few houses have grounded electrical systems or fully contained and isolated wiring systems and thus minor shocks are extraordinarily common, by anecdotal reports. If electric current levels were high (as is the case with cables to/from substations) or conditions were conducive to fatal shocks (standing in water while fishing with electric apparatus) then severity levels are elevated. Electric shock, like drowning, when the victim is alone has high fatality rates due to the inability for rescue to occur.

Given the fact that the majority of shocks resulting in moderate injury occurred in the home, the concept of the child-safe home where homes are inspected for hazards such as open junction boxes, bare wiring and other obvious shock hazards for children would likely be an effective prevention approach. Toddlers were at greatest risk of touching a bare cable or inserting their fingers into an electrical socket while exploring their environment. Child-proof socket plugs are virtually unknown in Vietnam and would be a cheap and effective prevention measure for this. Similarly, attention to locating outdoors junction boxes and transformers at heights or in ways that help isolate them from children playing would likely be an effective prevention strategy. Finally, the risks associated with stun-fishing with electricity make this an extremely hazardous and inappropriate way to fish. Community-based educational and awareness activities would be an obvious first intervention to reduce this child death rate.

Chapter
12

12. Conclusions

12.1. General conclusions

12.1.1. The leading killer of children

VMIS has shown that injury is the leading killer of Vietnamese children. Almost 75% of deaths in children were caused by injury; communicable diseases accounted only for 12% and noncommunicable accounted for about 15%. The fatal injury rate of 83.2/100,000 means that almost one out of every thousand children in Vietnam died of injury in 2001. The risk of death from injury was over five times larger than the risk of dying from infectious diseases (14.9/100,000) and was four times larger than the risk of dying from chronic diseases (19.3/100,000).

The magnitude of the burden of injury is enormous: if all fatal childhood injury were to be prevented, it would increase LEb (life expectancy at birth) by over seven years; if injury was prevented in infants and children, the U5MR (under-five mortality rate) would fall by almost forty percent from 48.6 to 29.7. Of course, it cannot be completely eliminated and thus these projected effects are simple speculations. However, it clearly shows where the future gains are in preventable child death for UNICEF Vietnam. It is worth noting that if the remaining infectious disease mortality were to be eliminated in children under five, it would only decrease the U5MR from 48.6 to 41.3, a decrease of 15%.

It is also worth noting that thirty years ago, in the pre-Alma Ata era of maternal and child health, elimination of many of the infectious killers such as measles, tetanus, pertussis and diphtheria were seen as similar impossible dreams. The data from Bangladesh showing the virtual elimination of these as significant causes of child death shows what has become possible in today's new era of the public health approach to child health. Application of the same intensity of effort and the same prevention principles so effective for infectious disease prevention will have much the same impact on most types of child injury.

Clearly, since injury accounts for almost half of U5MR, this is an opportunity to make major inroads on mortality in this UNICEF core group. Injury accounts for between two-thirds and four-fifths of mortality in the other UNICEF core group: middle and older children. Given the enormous proportionate contribution to mortality in this group, it is apparent that it will not be possible to have a significant reduction in mortality without placing injury prevention as one of the cornerstones of prevention efforts in this group, along with the more traditional issues of sexuality, gender equity and higher education.

12.2. Morbidity vs. mortality – differing costs, differing consequences

12.2.1. A leading cause of morbidity

The nonfatal injury rate of 4,818/100,000 means that almost 5% of children in Vietnam are injured each year, significantly enough to warrant seeking medical attention or losing at least one day of work or school. The absolute numbers of injured children are staggering: over 1,500,000 children were injured in the year prior to the survey, or about 4,300 per day. This was an average rate of about 175 per hour, which means a child was injured significantly enough to seek medical attention about every twenty seconds.

VMIS did not attempt to quantify morbidity other than injury so it is not possible to estimate for injury the proportionate contributions to morbidity or ranking in relation to other causes. However, at an annual rate of almost 5% of children being injured enough to seek medical attention or miss school, it is of a magnitude that places it at least on par with infectious and chronic causes, if not surpassing them. Anecdotal reports, as well as some hospital bed surveys indicate that injury cases fill the majority of hospital beds at provincial level in Vietnam, thus it is highly likely that injury accounts for more hospital days and direct medical costs than either chronic or infectious diseases in the child age groups. Regardless of the absolute ranking, injury clearly is one of the leading causes of child morbidity and by its very nature, is more likely to lead to permanent disfigurement and disability than the other causes of child morbidity.

12.2.2. The cost of injury

The majority of the health care and social costs associated with injury come from nonfatal injury, particularly from those types that require lengthy hospitalizations, costly surgical care, or result in serious permanent disability. Road traffic accidents, especially in older teenagers who suffer high velocity crashes on motorcycles generate enormous medical costs due to the need for surgical care, which requires blood banks, anesthesiologists and surgeons plus skilled operative teams, special diagnostic technology like CAT/MRI scanners and surgical intensive care wards. The catastrophic disability resulting from brain and spinal cord injury as well as the frequent amputations of extremities have major economic and social consequences. Facial disfigurements, blinding, and movement restrictions due to scarring after severe scalding are also especially liable to lead to permanent disability. Likewise, crush injuries and amputations caused by machinery and farm tools are major causes of permanent disability. All of these are preventable with some measure of impact and affordability. Given the magnitude of their occurrence in children in Vietnam, efforts to define the most effective and affordable approaches to their prevention are clearly some of the logical next steps.

12.2.3. The leading cause of childhood paralysis

Injury is somewhat unique in terms of the largest portion of the economic, social and health burden is generated by those that survive and not by those that die. Permanent disability rates are highest with some particular types of injury, and it is useful to recall that preventing permanent disability was one major factor in the decision to embark on polio eradication, another cause of permanent disability through paralysis. The enormous economic and social burden incurred by permanent disability from paralysis in childhood brought the international health development community together over the last decade in an unprecedented effort to eradicate polio, spending hundreds of millions of dollars to eliminate it as a cause of childhood paralysis. Injury is the leading cause of child paralysis in all age groups and is responsible for tens of thousands times the numbers of cases of

childhood paralysis caused by paralytic polio. There is every reason to approach this leading cause of childhood disability with the same vigor.

12.3. A characteristic bimodal pattern of fatal child injury

Children in Vietnam have a characteristic epidemiologic pattern of fatal injury that is age dependent. From infancy to puberty, drowning is the overwhelming cause of death in every age group and far outstrips other causes. Beginning just after puberty and then increasing in magnitude as age increases, road traffic injury becomes the predominant cause of child death. This bimodal pattern of drowning predominating in early childhood and traffic injury in late childhood is a common pattern in Vietnam's neighbors (Thailand, China, Malaysia and Bangladesh). These two causes of child death, drowning and road traffic accounted for two-thirds of all child mortality from injury and thus require special attention from health and social policy-makers.

VMIS found that in 2001, drowning accounted for over 12,500 child deaths. This is about 35 children drowning every day. This is a staggering number to contemplate. It is the equivalent of one primary school classroom of students drowning each and every day. An epidemic of this magnitude simply cannot be ignored. Drowning can be prevented as the experience of developed countries clearly shows. The challenge for health, education and social sector policy-makers in Vietnam is to apply the lessons of developed countries to the situation in Vietnam in ways that are appropriate and effective in Vietnam. The principles are relatively simple: provide adult supervision for young children, identify drowning hazards and place barriers or restrict access where applicable; for older children with constant water exposure provide training in swimming; using the institutions and mechanisms directly related to children, such as school, youth groups, mass media, etc., provide water safety knowledge for children and work to develop safe peer group behaviors.

VMIS also documented another childhood epidemic: Road traffic injury killed more than 4,100 children in 2001. It was the second leading cause of child death, and every day, over 11 children died from this cause. Dealing with this public health tragedy will be more complex than drowning. Drowning involves the interaction of children and a body of water and this is a relatively simple set of circumstances for which to develop prevention strategies. In contrast, RTA has a variety of mechanisms leading to death; the most common, especially in the younger child age groups was pedestrians and bicyclists. Motor vehicles, in particular motorcycles, did not become a major cause of child death until the adolescent years, and especially the late teenage years. Preventing pedestrian deaths requires both behavioral changes from young children as well as drivers; and in urban areas also requires the owners of businesses and others encroaching on roadways to alter their behaviors. Preventing deaths from riders and drivers of motorcycles is also a very difficult issue as it involves massive behavioral change that can only be achieved through very costly investments in infrastructure (more and safer roads), driver regulation (strict licensing and teaching safe driving practices) and ensuring that safe driving behaviors become routine (strict police enforcement).

12.4. The pattern of nonfatal child injury

While drowning and RTA were the overwhelming causes of mortality, the picture for morbidity was very different. The two leading causes of mortality, drowning and RTA figured as the ninth and third causes of morbidity respectively, while falls and animal bites took the leading places for morbidity.

Falls and animal bites were extremely common, between them affecting thousands of children each day. Due to the extraordinarily large numbers, even with relatively low

severity ratios, both of these are large causes of hospitalization, permanent disability, and in the case of falls, death of Vietnamese children. These two causes alone accounted for almost 90 children becoming permanently disabled every day. In the case of animal bites, the very large number of bites also has a large economic significance relating to the need to provide rabies prophylaxis to the children bitten.

Scalding deserves a special mention as a cause of morbidity due to the numbers annually in Vietnam and the enormous toll in direct medical costs of caring for these children, as well as the terrible social costs for them in disfigurement and the high rates of permanent disability. It has enormous direct medical costs due to the need for lengthy surgical care and extensive and lengthy rehabilitation. Over 65,000 children were burned in the year 2001, significantly enough to require medical attention or suffer serious consequences, including permanent disability. This is almost 180 children each day. The majority of these children suffered horribly painful and disfiguring injuries and the health sector paid many billions of dong in caring for them. The experience from developed countries shows that scald injury in children is one of the most preventable injuries and Vietnam should rapidly move to adapt appropriate prevention programs suitable for its conditions.

Policy makers in Vietnam should also take note of the data on childhood poisoning. VMIS shows that there were more than 1,750 children fatally poisoned in 2001; or about five each day. Poisoning is another specific type of injury that has been shown to be highly preventable and the techniques and technologies from developed countries are easily adapted to the setting of countries like Vietnam. Many of these technologies, such as childproof caps and household poison safety programs for mothers and fathers, have already been adopted in neighboring countries.

12.4.1. RTA and helmets – a complex issue

The issue of helmets for RTA prevention is a complex one, as noted in detail in the discussion in chapter six. In many countries, motorbikes and other motorized two wheel vehicles are not common; however, in Vietnam, they are the most common vehicle on the road by far, and thus children are very commonly carried on them (and older children drive them). Thus, the issue of helmets and child RTA needs to be examined carefully for a possible approach to effective prevention. VMIS (and other cohort studies) have shown that most of the early childhood RTA was to pedestrians and most of the later childhood RTA did not involve brain trauma. Helmets would have no impact on these leading causes of RTA. The very low rates of serious head trauma from RTA in younger children (early and middle childhood) mean that there are very few helmet-preventable deaths in this group. To prevent the ones there are, all children in these age groups would have to have helmets and always use them. It is not clear that this is either achievable or sustainable given the costs of helmets and the tens of millions of children who would have to always wear them while riding.

The VMIS (and other) data clearly point to helmets as an effective intervention for children 15 years and older for prevention of death and disability from head trauma, but they would have no impact on injury reduction for the other body sites involved. The unstable fractures, extremity amputations, internal organ damage and neck and spinal cord injury generate the majority of the medical and social costs of RTA in this age group, and helmet use would have no impact on these. Despite these limitations, there is clear evidence that helmet use among older teenagers would prevent a significant amount of mortality and permanent disability from brain injury, due to their much higher serious head trauma rates. Thus for older teenagers, there is clear evidence from VMIS that helmet use should be required and is likely economically feasible as a cost-effective intervention in this age group. However, given this age group's particular resistance to wearing helmets of any sort, helmet programs would have to be combined with other interventions

that lead to high usage rates (sustained behavioral change programs and strict enforcement). Now that Vietnam has mandated enforcement of the requirement for driving licenses for those on motorcycles, enforcing the use of helmets on all motorcycles drivers is a potentially achievable prevention measure.

12.5. Vietnamese homes – hazardous to children's health

VMIS shows that a great deal of preventable injury occurred within homes, from burns and scalds, poisoning, falls, sharp objects and electrocutions. Vietnamese mothers and fathers are currently unaware of the dangers to their children present in their houses. In developed countries it is now the norm that expectant parents "childproof" their houses prior to the delivery with low technology devices such as plastic electrical plug blockers, stair gates, plastic drawer locks, and a lockable storage for poisons, dangerous chemicals etc.. These practices are easily translated into similar ones appropriate for Vietnamese houses. Additional measures such as tip-proof stoves, wide-based thermos holders, childproof caps, stair and kitchen gates, and other technologies suitable for Vietnamese culture should not be difficult or expensive to adopt.

UNICEF is already beginning a "child-safe home" program that could form the basis of a national safe home program. Given the variation in households in the different regions of the country, and given the clear regional variation in child injury causes and rates shown in chapter three, it is clear that there will be a need for developing a variety of hazard checklists and risk reduction programs that are suitable for Vietnam as a whole. It is also clear that this is a goal that should be of primary importance. The VMIS data have a very unambiguous message: *an effective program for household hazard reduction would have a dramatic impact on child injury rates.*

12.6. Final conclusions

Overall, the VMIS data document a number of important issues for children in Vietnam. First and foremost, the study shows how incredibly successful the infectious disease prevention and control programs have been in Vietnam. Very few other countries at a similar level of GDP and economic development have achieved this, and heath policy makers, program managers and staff in Vietnam are to be congratulated for this. As a result, infectious diseases are no longer a major killer of Vietnamese children as they were only three decades ago. Injury has taken their place.

Second, and in part due to the health system achievements, Vietnam has clearly passed through it's epidemiologic transition as now both injury and chronic diseases are the leading killer of children in every region. This strongly suggests the need for health policymakers in Vietnam to assess the current balance of prevention and control programs to see if they are most appropriate for the new realties of child morbidity and mortality in Vietnam.

Third, given the fact that almost half of all child deaths were due to drowning, these data show that there is a clear need to target this particular cause of child death with the same intensity and level of effort that has been used for infectious diseases. Each district should monitor child drowning rates in the same way that they currently do with immunization coverage rates. At district and commune level, health officials should identify effective methods of reducing the drowning risk and work at the community level to involve them in prevention efforts. Vietnam's child drowning rate is at least ten times what it is in most developed countries. The fact that developed countries have been able to reduce child drowning rates to a level ten-fold less shows that child drowning can be effectively prevented. If Vietnam can equal developed countries in its ability to reduce

infectious diseases as killers of its children, it can easily do the same thing for drowning if it sets this as a national priority.

Fourth, these data demonstrate that economic development brings with it injury hazards for children. Increasing use of chemicals, electrification, machinery and motorized vehicles for transport have specific impacts on children. Just as economic development leads to improvements in health through improved nutrition, sanitation and hygiene, and access to health services, it also brings with it health hazards for children. Dealing with these requires a multi-sectoral approach and for the health sector to be a partner in the planning process of development.

Fifth, it is clear that in the new era of the epidemiologic transition, reduction in the leading killers of children will require investments in health areas that traditionally have not been a major focus. Injury prevention will require skills and knowledge in behavioral epidemiology, behavioral science, health communications, social marketing, health informatics, health economics, child health policy and other disciplines that are currently under-developed in Vietnam. Environmental and behavioral interventions have been demonstrated to be the most effective approaches to reduction of risk of injury in developed countries and Vietnam would benefit from adopting the principles of these and adapting them to the Vietnamese situation.

Finally, it is important to recognize that despite the limitations of this survey, which impose a lack of precision and confidence intervals that challenge interpretation, there is an overwhelming level of confidence in the general conclusions of it. While there will be a natural tendency to focus on some numbers or argue the precision or accuracy of others, it is important to step back from these technical distractions and focus on the larger, overarching lesson apparent in this data: ***Injury is an enormously significant issue for Vietnamese children and is a major cause of morbidity and mortality in all child age groups.*** While researchers can argue at great length about fine matters of technique or method, UNICEF staff and Vietnamese policy-makers should have no doubt that in most child age groups, injury is the leading cause of morbidity and mortality. It is time to act on this knowledge and begin developing injury prevention and control programs as integral parts of UNICEF Vietnam's programs.

12.7. A final note

VMIS is simply a starting point. Now there are national rates that serve as baselines and benchmarks. As noted in multiple places, VMIS has many limitations, in large part due to sample size. It needs to be complemented with local and regional data gathered to fill in the many blanks and provide needed increases in precision in many areas, chief among these the minority ethnic groups, groups living in isolated areas; migratory populations; and for UNICEF, children in special circumstances (street children, etc.).

Over the next several years, as child injury prevention efforts become national programs, a system of monitoring child injury will be a very necessary part of the programs; at local, regional and national levels. Ongoing surveillance systems will need to be put in place, special surveys will need to be periodically commissioned and other means of monitoring and evaluation methods using both qualitative and quantitative methods will be necessary. Periodically, VMIS should be conducted using similar instruments and sampling methods to provide ongoing information on trends and to document the progress made. Ideally, this should occur every two or three years.

Appendix 1. Sample population descriptors

Table A 1. Sample population by region and sex

Region	Average HH members	Male		Female		Total
		n	*%*	*n*	*%*	
North East	4.6	8,584	6.7%	8,689	6.9%	17,273
North West	5.3	4,671	3.6%	4,728	3.7%	9,399
Red River delta	4.1	8,873	6.9%	9,399	7.3%	18,272
North Central	4.8	8,291	6.4%	8,743	6.8%	17,034
Central Coast	4.7	6,580	5.1%	7,183	5.6%	13,763
Central Highland	5.2	5,186	4.0%	5,136	4.0%	10,322
South East	4.9	9,672	7.5%	9,842	7.6%	19,514
Mekong River Delta	5.1	11,286	8.7%	11,759	9.1%	23,045
Total	4.8	63,143	49.1%	65,479	50.9%	128,622

The average number of persons per household was 4.8. The response rate of the survey was 98.9%. The sex distribution of the sample was 49.1% male and 50.9% female.

Table A 2. Sample population by region and age group

Region	< 1	1-4	5-9	10-14	15-19	20+	Total
NE	226	1,039	1,859	2,341	1,696	9,985	17,146
NW	140	651	918	1,229	1,015	5,437	9,390
RR	238	1,021	1,555	1,840	1,763	11,763	18,180
NC	296	1,233	2,235	2,268	1,690	9,239	16,961
CC	145	774	1,462	1,586	1,158	8,623	13,748
CH	212	877	1,322	1,341	1,062	5,500	10,314
SE	154	1,145	1,840	2,099	1,721	12,454	19,413
MR	503	1,326	1,828	2,795	2,320	14,238	23,010
Total	1,914	8,066	13,019	15,499	12,425	77,239	128,162

Slightly different totals in Table 3.1 and 3.2 due to missing data

Economic status is an important factor, but it is very difficult to get accurately, especially in household surveys. In this study respondents were asked a very simple question about income. The number of transportation means that were owned at household level was counted as a proxy measure for income. The results are listed below in Table A 3.

Table A 3. Average household measures of ownership

Transportation means	Estimate	95% Conf. interval	
Bicycle	1.15	1.14	1.16
Motorbike	0.47	0.47	0.48
Car	0.18	0.17	0.18
Television	0.68	0.68	0.69
Cassette	0.54	0.54	0.55

The average number of bicycles per household was 1.15; motorbikes was 0.47 per household, and car ownership was very low at .18 per household, consistent with national SES data.

Table A 4. Monthly family income

Income (thousands of VND/month)[1]	Freq.	Percent	Cum.
0-99	4,138	3.2	3.2
200-249	14,791	11.5	14.7
250-499	27,214	21.2	35.9
500-749	28,275	22.0	57.8
750-999	14,090	10.9	68.8
1000-149	19,754	15.4	84.2
1500-199	8,438	6.6	90.7
2000-249	4,647	3.6	94.3
2500-299	1,416	1.1	95.4
3000-349	1,742	1.3	96.8
3500-399	358	0.3	97.1
4000-649	975	0.8	97.8
>650	438	0.3	98.2
Not answered	2,358	1.8	100
Total	128,634	100	

[1] * 2001 exchange rate: 15,000 VND = 1 USD

Slightly over a third (35.6%) of households earned less than 500,000 VND per month; the percentage of households that earned more than 1.5 million VND per month was only 10%.

Table A 5 shows that the education level of the survey population was similar to the national pattern. Over three quarters had completed primary and secondary schooling.

Table A 5. Education level of survey population

Education	Freq.	Percents	Cum.
Illiterate	8,841	6.9	6.9
Primary school	41,118	32.1	39.0
Lower secondary school	41,665	32.6	71.6
Upper secondary school	17,424	13.6	85.2
Vocation school	1,853	1.4	86.7
Undergraduate	3,587	2.8	89.5
Graduate	94	0.1	89.6
Children under school age	13,359	10.4	100
Total	127,941	100	

Appendix 2. Key contributors - further analyses

VMIS is the result of the team work of a large group of researchers and staff of different public health institutions listed below:

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This report to UNICEF is intended to provide an overview of the information obtained in VMIS in the infant, child and adolescent age groups. The aggregate VMIS dataset includes all ages and both sexes. There are a number of analyses ongoing or planned and several of these are likely to be of interest to UNICEF. These are listed below:

- Additional detailed analyses of the child age group are in process or planned for looking at each of the major killers and disablers of children by cause. CIPPR will explore the data through logistic regression to treat morbidity and mortality as one outcome variable and exploring the various associations evident by this.

- Analysis of the impact of injury of heads of households on the dependents in the households with a special emphasis on the effect on spouses and children. One related study that is intended is the relationship of various types of injury and the socio-economic status of the victims: the health-equity burden of injury.

- Analysis of the issue of injury in women, with a special emphasis on those women of reproductive ages, and those who are mothers.

Appendix 3. Injury rates by age and sex

Nonfatal Injury rates /100,000 population by age and sex

Age	Male	LCL	UCL	Female	LCL	UCL	Both	LCL	UCL
< 1	1175.9	434.0	1917.8	1424.8	507.7	2341.9	1295.4	709.4	1881.4
1-4	5641.4	4611.4	6671.4	3615.1	2790.1	4440.1	4653.5	3947.5	5359.5
5-9	6118.8	5254.2	6983.4	4530.4	3727.8	5333.0	5336.5	4696.2	5976.8
10-14	6401.1	5526.2	7276.0	3469.7	2892.5	4046.9	4945.5	4387.1	5503.9
15-19	6312.1	5517.9	7106.3	3206.3	2713.8	3698.8	4786.1	4267.3	5304.9
0-20	5999.7	5461.1	6538.3	3598.7	3185.1	4012.3	4818.0	4416.0	5217.9

LCL = lower confidence interval; UCL = upper confidence interval

Fatal Injury rates/100,000 population by age and sex

Age	Male	LCL	UCL	Female	LCL	UCL	Both	LCL	UCL
<1	377.1	0.0	755.0	0.0	0.0	0.0	196.0	0.6	391.4
1-4	53.1	0.0	118.0	36.6	0.0	108.3	45.0	0.0	92.8
5-9	93.6	10.3	176.9	131.6	35.2	228.0	112.3	42.1	182.5
10-14	91.3	23.3	159.3	47.6	0.0	101.9	69.6	23.3	115.9
15-19	137.6	50.2	225.0	16.4	0.0	48.5	78.0	31.2	124.8
0-20	109.9	67.4	152.4	55.6	22.476	88.724	83.2	54.8	111.5

LCL = lower confidence interval; UCL = upper confidence interval

Appendix 4. Cause specific injury rates

Nonfatal injury-specific rates by age and sex, /100,000 population

< 1	Male	LCL	UCL	Female	LCL	UCL	Both	LCL	UCL
Road traffic	133.3	0	394.4	0	0	0	69.3	0	205.4
Sharp object	0	0	0	46.1	0	136.4	22.1	0	65.4
Drowning	0	0	0	0	0	0	0	0	0
Poisoning	109.2	0	322.4	386.6	0	827.4	242.4	4.0	480.7
Fall	224.6	0	531.5	309	0	686.3	265.2	26.8	503.5
Electric shock	0	0	0	0	0	0	0	0	0
Animal bite	221.1	0	653.7	263.2	0	626.5	241.3	0	522.5
Burn	378	0	802.5	419.9	0	893.	398.2	83.0	713.3
Natural objects	109.5	0	323.3	0	0	0	56.9	0	168.2
Machine	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0
ALL	**1175.9**	**434.0**	**1917.8**	**1424.8**	**507.8**	**2341.9**	**1295.4**	**709.4**	**1881.4**
1-4	**Male**	**LCL**	**UCL**	**Female**	**LCL**	**UCL**	**Both**	**LCL**	**UCL**
Road traffic	682.4	404.0	960.7	765	422.9	1107.0	722.7	488.8	956.5
Sharp object	540	189.5	890.4	268	53.1	482.8	407.4	205.9	608.8
Drowning	126	3.1	248.9	86.5	0	256.0	106.8	3.704	209.8
Poisoning	210.9	46.4	375.4	83.7	1.5	165.8	148.8	52.5	245.0
Fall	1852.1	1311.9	2392.3	1066.6	596.3	1536.8	1469.2	1113.8	1824.5
Electric shock	196.1	3.6	388.6	0	0	0	100.5	1.9	199.0
Animal bite	1146	784.5	1507.4	812.2	407.2	1217.1	983.3	700.8	1265.7
Burn	529.9	281.3	778.4	477.1	248.5	705.6	504.2	325.4	682.9
Natural objects	325.2	82.3	568.0	27.6	0	81.8	180.1	53.0	307.1
Machine	32.9	0	97.2	28.4	0	83.8	30.7	0	73.2
Other	0	0	0	0	0	0	0	0	0
ALL	**5641.4**	**4611.4**	**6671.4**	**3615.1**	**2790.1**	**4440.1**	**4653.5**	**3947.5**	**5359.5**
5-9	**Male**	**LCL**	**UCL**	**Female**	**LCL**	**UCL**	**Both**	**LCL**	**UCL**
Road traffic	835.4	576.8	1093.9	981.5	629.0	1333.9	907.3	682.4	1132.1
Sharp object	752.8	482.3	1023.3	358.9	152.5	565.2	558.8	376.7	740.8
Drowning	75.5	8.2	142.73	72.5	1.548	143.4	74	26.1	121.8
Poisoning	302.2	82.4	521.9	226.7	85.7	367.6	265	117.6	412.3
Fall	2026.5	1638.0	2414.9	1142.6	819.2	1466	1591.1	1320.4	1861.7
Electric shock	34.5	0	75.66	0	0	0	17.5	0	38.2
Animal bite	1564.2	1187.4	1940.9	1360.9	1003.5	1718.2	1464	1183.9	1744.1
Burn	133.9	48.6	219.16	217.5	99.9	335.1	175.1	101.4	248.7
Natural objects	192.3	47.2	337.3	53.6	0	114.9	123	44.0	201.9
Machine	114.7	30.8	198.5	58.8	0	118.7	87.2	35.6	138.7
Other	88.8	0	203.8	57.5	0	122.3	73.4	3.2	143.5
ALL	**6120.8**	**5254.2**	**6983.4**	**4530.4**	**3727.8**	**5333.0**	**5336.5**	**4696.2**	**5976.8**

LCL = lower confidence interval; UCL = upper confidence interval

Nonfatal injury-specific rates by age and sex, /100,000 population (continued)

10-14	Male	LCL	UCL	Female	LCL	UCL	Both	LCL	UCL
Road traffic	784.6	578.8	990.4	590.8	414.2	767.3	688.3	552.2	824.3
Sharp object	1232.4	938.5	1526.2	436	283.9	588.1	836.9	667.8	1006.0
Drowning	15.8	0	46.9	0	0	0	8	0	23.6
Poisoning	91.2	10.2	172.1	138.9	41.1	236.7	114.8	35.4	194.1
Fall	2015	1627.5	2402.4	809.5	594.8	1024.1	1416.4	1191	1641.8
Electric shock	54.2	0	128.1	26.2	0	62.2	40.3	0	85.9
Animal bite	1649.7	1225.1	2074.2	1140.5	861.9	1419.0	1396.9	1133.1	1660.7
Burn	167.3	51.8	282.7	165.2	38.3	292.0	166.2	83.8	248.5
Natural objects	247.2	108.2	386.2	63	5.9	120.0	155.7	78.1	233.3
Machine	101.4	26.7	176.1	87.2	0	176.7	94.3	30.9	157.6
Other	42.4	0.6	84.1	12.5	0	37	27.6	3.4	51.7
ALL	**6401.1**	**5526.2**	**7276.0**	**3469.7**	**2892.5**	**4046.9**	**4945.5**	**4387.1**	**5503.9**
15-19	**Male**	**LCL**	**UCL**	**Female**	**LCL**	**UCL**	**Both**	**LCL**	**UCL**
Road traffic	1610.3	1245.3	1975.2	993.8	734.1	1253.5	1307.4	1056.5	1558.2
Sharp object	1451.4	1104.4	1798.3	510.4	294.9	725.8	989.1	771.3	1206.8
Drowning	12.3	0	36.4	0	0	0	6.2	0	127.7
Poisoning	104.3	11.5	197.0	179.1	78.3	279.8	141.1	71.3	210.8
Fall	1663.3	1337.9	1988.6	430.6	262.6	598.5	1057.7	867.5	1247.8
Electric shock	0	0	0	32.6	0	78.1	16	0	38.3
Animal bite	601.3	367.6	834.9	763.8	502.7	1024.8	681.1	504.1	858.0
Burn	25.2	0	62.4	125.2	22.3	228.1	74.4	21.1	127.7
Natural objects	425.2	241.0	608.6	76.1	13.7	138.4	253.7	151.7	355.6
Machine	390.5	244.0	536.9	65.2	6.4	124	230.7	152.1	309.2
Other	28.3	0	67.6	29.4	0	70.1	28.9	0.6	57.1
ALL	**6312.1**	**5517.9**	**7106.3**	**3206.3**	**2713.8**	**3698.8**	**4786.1**	**4267.3**	**5304.9**
0-20	**Male**	**LCL**	**UCL**	**Female**	**LCL**	**UCL**	**Both**	**LCL**	**UCL**
Road traffic	993.2	837.2	1149.2	804.3	646.1	962.5	900.2	779.1	1020.7
Sharp object	1030.0	848.7	1211.3	400.0	295.9	504.1	719.9	602.5	836.7
Drowning	45.1	18.4	71.8	30.2	0.2	60.2	37.8	18.2	57.3
Poisoning	164.2	84.4	244.0	172.0	99.9	244.1	168.1	102.8	233.0
Fall	1826.3	1594.6	2058.0	801.9	663.7	940.1	1322.1	1171.8	1471.7
Electric shock	53.3	16.1	90.5	16.9	0.4	33.4	35.4	14.2	56.5
Animal bite	1200.7	997.6	1403.8	1006.6	819.2	1194.0	1105.2	952.1	1257.5
Burn	181.1	123.1	239.1	221.5	151.7	291.3	201.0	156.5	245.3
Falling objects	291.0	200.8	381.2	57.0	25.8	88.2	175.9	123.6	228.0
Machine	173.1	119.4	226.8	62.3	26.0	98.6	118.6	81.9	155.1
Other	41.6	7.7	75.5	25.8	5.2	46.4	33.8	12.4	55.1
ALL	**5999.7**	**5461.1**	**6538.3**	**3598.7**	**3185.1**	**4012.3**	**4818.0**	**4416.0**	**5220.0**

LCL = lower confidence interval; UCL = upper confidence interval

Fatal injury-specific rates by age and sex, /100,000 population

< 1	Male	LCL	UCL	Female	LCL	UCL	Both	LCL	UCL
Road traffic	95	0	281.2	0	0	0	49.4	0	146.2
Sharp object	60.8	0	180.0	0	0	0	31.6	0	93.3
Drowning	221.3	0	527.8	0	0	0	115	0	274.0
Poisoning	0	0	0	0	0	0	0	0	0
Fall	0	0	0	0	0	0	0	0	0
Electric shock	0	0	0	0	0	0	0	0	0
Animal bite	0	0	0	0	0	0	0	0	0
Burn	0	0	0	0	0	0	0	0	0
Suffocation	0	0	0	0	0	0	0	0	0
Natural objects	0	0	0	0	0	0	0	0	0
Machine	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0
ALL	**377.1**	**0**	**755.0**	**0.0**	**0.0**	**0.0**	**196.0**	**0.6**	**391.4**
1-4	**Male**	**LCL**	**UCL**	**Female**	**LCL**	**UCL**	**Both**	**LCL**	**UCL**
Road traffic	0	0	0	0	0	0	0	0	0
Sharp object	0	0	0	0	0	0	0	0	0
Drowning	42.6	0	104.1	0	0	0	21.8	0	53.4
Poisoning	10.5	0	31.1	0	0	0	5.4	0	16.0
Fall	36.6	0	108.3	0	0	0	17.9	0	52.8
Electric shock	0	0	0	0	0	0	0	0	0
Animal bite	0	0	0	0	0	0	0	0	0
Burn	0	0	0	0	0	0	0	0	0
Suffocation	0	0	0	0	0	0	0	0	0
Natural objects	0	0	0	0	0	0	0	0	0
Machine	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0
ALL	**89.7**	**24.8**	**154.6**	**36.6**	**0.0**	**108.3**	**45.0**	**0.0**	**92.8**
5-9	**Male**	**LCL**	**UCL**	**Female**	**LCL**	**UCL**	**Both**	**LCL**	**UCL**
Road traffic	0	0	0	17.6	0	52.3	8.7	0	25.8
Sharp object	0	0	0	22.5	0	66.4	11.1	0	32.7
Drowning	71.7	0	143.4	72	1.636	142.4	71.8	0	122.2
Poisoning	0	0	0	19.4	0	57.4	9.6	0	28.4
Fall	0	0	0	0	0	0	0	0	0
Electric shock	0	0	0	0	0	0	0	0	0
Animal bite	0	0	0	0	0	0	0	0	0
Burn	0	0	0	0	0	0	0	0	0
Suffocation	21.9	0	64.6	0	0	0	11.1	0	32.7
Natural objects	0	0	0	0	0	0	0	0	0
Machine	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0
ALL	**93.6**	**10.3**	**176.9**	**131.6**	**35.2**	**228.0**	**112.3**	**42.1**	**182.5**

LCL = lower confidence interval; UCL = upper confidence interval

Fatal injury-specific rates by age and sex, /100,000 population (continued)

10-14	Male	LCL	UCL	Female	LCL	UCL	Both	LCL	UCL
Road traffic	11.7	0	34.6	16.1	0	47.7	13.9	0	33.3
Sharp object	0	0	0	0	0	0	0	0	0
Drowning	49.6	0.6	98.6	19.2	0	56.8	34.5	5.1	63.9
Poisoning	0	0	0	0	0	0	0	0	0
Fall	0	0	0	0	0	0	0	0	0
Electric shock	14.2	0	42.0	0	0	0	7.1	0	21.0
Animal bite	0	0	0	0	0	0	0	0	0
Burn	0	0	0.0	0	0	0	0	0	0
Suffocation	15.8	0	47.0	0	0	0	8	0	23.6
Natural objects	0	0	0	0	0	0	0	0	0
Machine	0	0	0	0	0	0	0	0	0
Light	0	0	0	0	0	0	0	0	0
Other	0	0	0	12.4	0	36.7	6.2	0	18.2
ALL	**91.3**	**23.3**	**159.3**	**47.6**	**0.0**	**101.9**	**69.6**	**23.3**	**115.9**
15-19	**Male**	**LCL**	**UCL**	**Female**	**LCL**	**UCL**	**Both**	**LCL**	**UCL**
Road traffic	33	0	72.2	0	0	0	16.8	0	40.7
Sharp object	13.9	0	40.9	0	0	0	7	0	20.7
Drowning	31.3	0	75.6	0	0	0	15.9	0	38.4
Poisoning	0	0	0	16.4	0	48.5	8.1	0	23.8
Fall	14	0	41.6	0	0	0	7.1	0	21.2
Electric shock	9.2	0	27.2	0	0	0	4.7	0	13.9
Animal bite	0	0	0	0	0	0	0	0	0
Burn	0	0	0	0	0	0	0	0	0
Suffocation	0	0	0	0	0	0	0	0	0
Natural objects	17.3	0	51.2	0	0	0	8.8	0	26.0
Machine	0	0	0	0	0	0	0	0	0
Other	18.9	0	55.9	0	0	0	9.6	0	28.4
ALL	**137.6**	**50.2**	**225.0**	**16.4**	**0.0**	**48.5**	**78.0**	**31.2**	**124.8**
0-20	**Male**	**LCL**	**UCL**	**Female**	**LCL**	**UCL**	**Both**	**LCL**	**UCL**
Road traffic	16.3	1.6	31.0	8.9	0.0	21.2	12.7	3.1	22.3
Sharp object	6.2	0.0	15.2	5.4	0.0	16.0	5.8	0.0	12.6
Drowning	55.0	22.9	87.1	22.9	2.9	42.9	39.2	20.4	57.9
Poisoning	1.6	0.0	4.7	9.3	0.0	22.0	5.4	0.0	11.8
Fall	4.0	0.0	11.8	5.4	0.0	16.0	4.7	0.0	11.3
Electric shock	6.7	0.0	16.1	0.0	0.0	0.0	3.4	0.0	8.3
Animal bite	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Burn	0	0	0	0	0	0	0	0	0
Suffocation	9.8	0.0	23.3	0.0	0.0	0.0	5.0	0.0	11.9
Natural objects	4.9	0.0	14.5	0.0	0.0	0.0	2.5	0.0	7.4
Machine	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other	5.4	0.0	16.0	3.6	0.0	10.7	4.5	0.0	10.9
ALL	**109.9**	**67.4**	**152.4**	**55.6**	**22.5**	**88.7**	**83.2**	**54.8**	**111.6**

LCL = lower confidence interval; UCL = upper confidence interval

Appendix 5. Selected injury rates

Nonfatal child Injury rates (0-19) by type of injury and venue with confidence intervals

Injury type	URBAN	LCL	UCL	RURAL	LCL	UCL
Road traffic accident	1051.6	813.3	1289.9	854.5	714.9	994.1
Sharp objects	260.5	148.4	372.6	858.9	706.4	1011.4
Drowning	7.7	0.0	22.6	46.9	21.8	72.0
Food poisoning	86.9	29.9	143.9	141.1	67.2	215.0
Poisoning	34.6	0.0	102.2	43.7	10.2	77.2
Fall	1343.3	1087.1	1599.5	1315.7	1135.8	1495.6
Electric shock	16.6	0.0	39.5	41.1	14.4	67.8
Animal bite	682.3	442.2	922.4	1233.1	1029.1	1437.1
Burn	123.2	60.3	186.1	224.5	169.6	279.4
Falling objects	64.4	21.5	107.3	209.6	142.8	276.4
Machine	65.8	11.1	120.5	134.6	89.3	179.9
Other	42.1	5.3	78.9	31.3	5.8	56.8
ALL	3770.4	3181.2	4359.6	5134.8	4617.8	5651.8

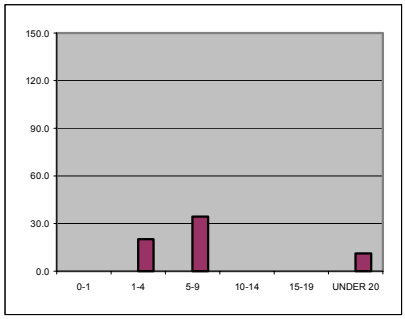
Fatal child injury rates (0-19) by type of injury and venue with confidence intervals

Injury types	URBAN	LCL	UCL	RURAL	LCL	UCL
Road traffic	15.7	0.0	38.0	11.8	1.2	22.4
Sharp object	8.7	0.0	25.6	5.0	0.0	12.3
Drowning	28.8	0.0	59.2	42.3	19.4	65.2
Food poisoning	0.0	0.0	0.0	0.0	0.0	0.0
Poisoning	9.9	0.0	29.3	4.0	0.0	10.3
Fall	8.8	0.0	26.1	3.5	0.0	10.4
Electric shock	0.0	0.0	0.0	4.4	0.0	10.7
Animal bite	0.0	0.0	0.0	0.0	0.0	0.0
Burn	0.0	0.0	0.0	0.0	0.0	0.0
Falling objects	0.0	0.0	0.0	3.3	0.0	9.8
Machine	0.0	0.0	0.0	0.0	0.0	0.0
Other	0.0	0.0	0.0	5.9	0.0	14.1
ALL	71.8	22.0	121.6	86.6	52.7	120.5

DROWNING INJURY SEVERITY RATE PER 100,000 POP, URBAN:RURAL

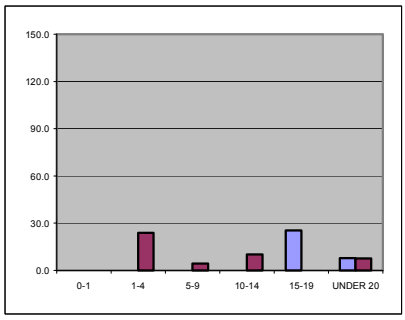
Minor	Urban	LCL	UCL	Rural	LCL	UCL
0-1	0.0	0.0	0.0	0.0	0.0	0.0
1-4	0.0	0.0	0.0	20.1	0.0	59.5
5-9	0.0	0.0	0.0	34.3	0.0	72.1
10-14	0.0	0.0	0.0	0.0	0.0	0.0
15-19	0.0	0.0	0.0	0.0	0.0	0.0
<20	0.0	0.0	0.0	11.2	0.4	22.0

17% of all drowning



Moderate						
0-1	0.0	0.0	0.0	0.0	0.0	0.0
1-4	0.0	0.0	0.0	24.0	0.0	71.0
5-9	0.0	0.0	0.0	4.4	0.0	13.0
10-14	0.0	0.0	0.0	10.2	0.0	30.4
15-19	25.4	0.0	75.0	0.0	0.0	0.0
<20	7.7	0.0	22.6	7.6	0.0	16.8

13% of all drowning

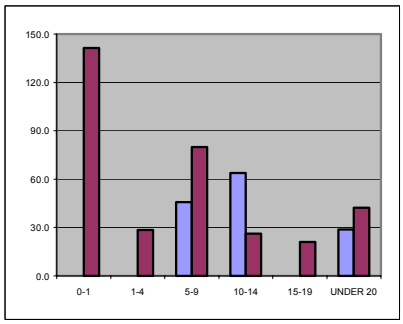


Major						
0-1	0.0	0.0	0.0	0.0	0.0	0.0
1-4	0.0	0.0	0.0	0.0	0.0	0.0
5-9	0.0	0.0	0.0	0.0	0.0	0.0
10-14	0.0	0.0	0.0	0.0	0.0	0.0
15-19	0.0	0.0	0.0	0.0	0.0	0.0
<20	0.0	0.0	0.0	0.0	0.0	0.0

Severe						
0-1	0.0	0.0	0.0	0.0	0.0	0.0
1-4	0.0	0.0	0.0	0.0	0.0	0.0
5-9	0.0	0.0	0.0	0.0	0.0	0.0
10-14	0.0	0.0	0.0	0.0	0.0	0.0
15-19	0.0	0.0	0.0	0.0	0.0	0.0
<20	0.0	0.0	0.0	0.0	0.0	0.0

Death						
0-1	0.0	0.0	0.0	141.3	0.0	336.1
1-4	0.0	0.0	0.0	28.4	0.0	69.6
5-9	45.8	0.0	113.6	79.9	17.6	142.2
10-14	63.8	0.0	157.3	26.1	0.0	55.9
15-19	0.0	0.0	0.0	21.1	0.0	50.9
<20	28.8	0.0	59.2	42.3	19.4	65.2

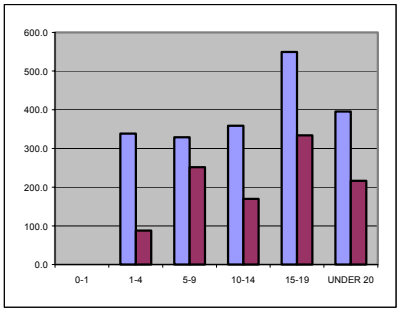
70% of all drowning



RTA INJURY SEVERITY RATE PER 100,000 POP, URBAN:RURAL

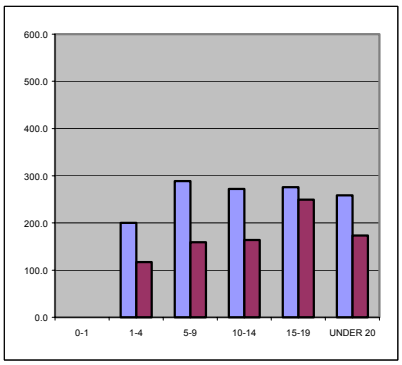
Minor	Urban	LCL	UCL	Rural	LCL	UCL
0-1	0.0	0.0	0.0	0.0	0.0	0.0
1-4	338.5	51.0	626.0	87.6	0.0	182.1
5-9	329.0	103.6	554.4	251.8	134.6	369.0
10-14	358.9	119.8	598.0	169.6	91.8	247.4
15-19	549.3	301.0	797.6	333.7	195.5	471.9
< 20	395.7	258.9	532.5	216.5	160.2	272.8

43,5% of all RTA injury



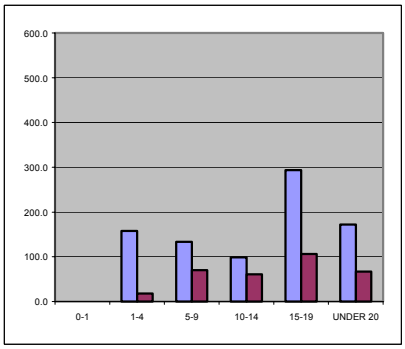
Moderate						
0-1	0.0	0.0	0.0	0.0	0.0	0.0
1-4	200.3	4.7	395.9	116.8	22.9	210.7
5-9	289.0	90.3	487.7	159.4	69.2	249.6
10-14	272.3	85.1	459.5	164.1	95.3	232.9
15-19	275.5	112.6	438.4	249.5	148.2	350.8
< 20	258.7	167.6	349.8	173.5	122.9	224.1

32.6% of all RTA injury



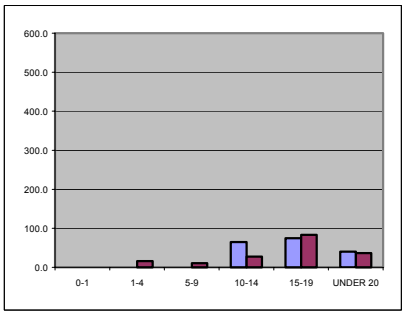
Major						
0-1	0.0	0.0	0.0	0.0	0.0	0.0
1-4	157.8	0.0	335.6	18.0	0.0	53.3
5-9	133.6	2.9	264.3	70.4	18.3	122.5
10-14	99.0	0.0	233.3	60.7	17.0	104.4
15-19	294.0	0.0	617.6	106.7	49.5	163.9
< 20	172.3	15.9	328.7	67.2	42.9	91.5

15.3% of all RTA injury



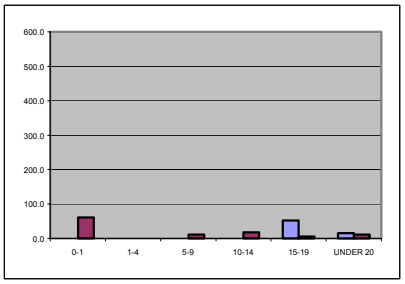
Severe						
0-1	0.0	0.0	0.0	0.0	0.0	0.0
1-4	0.0	0.0	0.0	15.6	0.0	46.2
5-9	0.0	0.0	0.0	11.0	0.0	32.6
10-14	64.5	0.0	152.1	27.4	0.0	58.4
15-19	74.6	0.0	158.9	83.0	17.9	148.1
< 20	40.3	5.8	74.8	36.3	15.1	57.5

6.5% of all RTA injury



Death						
0-1	0.0	0.0	0.0	60.7	0.0	179.7
1-4	0.0	0.0	0.0	0.0	0.0	0.0
5-9	0.0	0.0	0.0	11.4	0.0	33.7
10-14	0.0	0.0	0.0	17.8	0.0	42.9
15-19	51.9	0.0	126.2	5.3	0.0	15.7
< 20	15.7	0.0	38.0	11.8	1.2	22.4

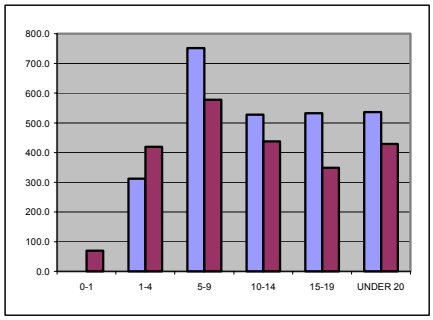
2.2% of all RTA injury



FALL INJURY SEVERITY RATE PER 100,000 POP, URBAN : RURAL

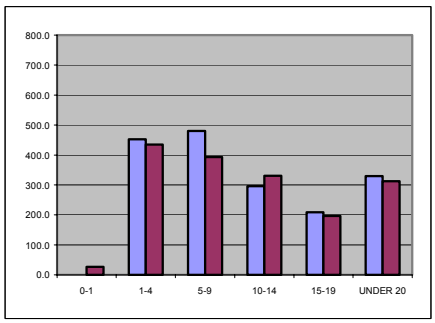
Minor	Urban	LCL	UCL	Rural	LCL	UCL
0-1	0.0	0.0	0.0	69.9	0.0	0.0
1-4	312.3	51.0	626.0	419.8	0.0	182.1
5-9	751.3	103.6	554.4	577.3	134.6	369.0
10-14	527.1	119.8	598.0	437.2	91.8	247.4
15-19	532.8	301.0	797.6	349.0	195.5	471.9
<20	536.1	258.9	532.5	429.2	160.2	272.8

47.5% of all fall injury



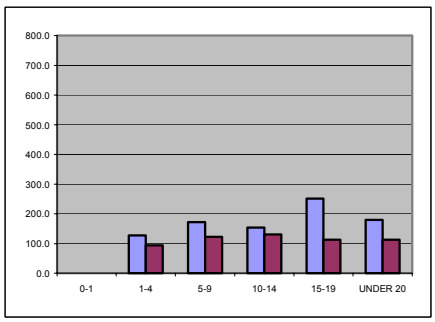
Moderate						
0-1	0.0	0.0	0.0	27.2	0.0	0.0
1-4	451.8	4.7	395.9	434.9	22.9	210.7
5-9	479.7	90.3	487.7	393.0	69.2	249.6
10-14	296.3	85.1	459.5	330.8	95.3	232.9
15-19	208.6	112.6	438.4	196.5	148.2	350.8
<20	329.2	167.6	349.8	311.9	122.9	224.1

33% of all fall injury



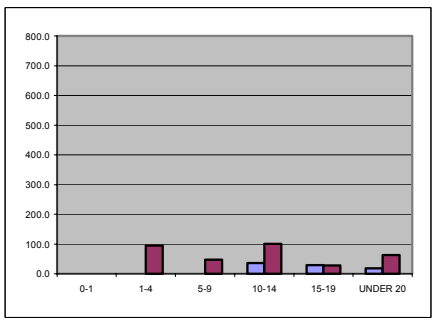
Major						
0-1	0.0	0.0	0.0	0.0	0.0	0.0
1-4	128.0	0.0	335.6	94.0	0.0	53.3
5-9	171.8	2.9	264.3	123.1	18.3	122.5
10-14	153.8	0.0	233.3	130.1	17.0	104.4
15-19	251.1	0.0	617.6	113.0	49.5	163.9
<20	179.3	15.9	328.7	113.2	42.9	91.5

13.5% of all fall injury



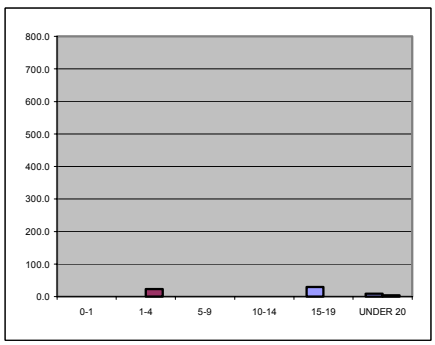
Severe						
0-1	0.0	0.0	0.0	0.0	0.0	0.0
1-4	0.0	0.0	0.0	94.6	0.0	46.2
5-9	0.0	0.0	0.0	47.6	0.0	32.6
10-14	35.8	0.0	152.1	100.2	0.0	58.4
15-19	29.3	0.0	158.9	27.8	17.9	148.1
<20	18.7	5.8	74.8	62.7	15.1	57.5

5.6% of all fall injury



Death						
0-1	0.0	0.0	0.0	0.0	0.0	179.7
1-4	0.0	0.0	0.0	23.3	0.0	0.0
5-9	0.0	0.0	0.0	0.0	0.0	33.7
10-14	0.0	0.0	0.0	0.0	0.0	42.9
15-19	29.1	0.0	126.2	0.0	0.0	15.7
<20	8.8	0.0	38.0	3.5	1.2	22.4

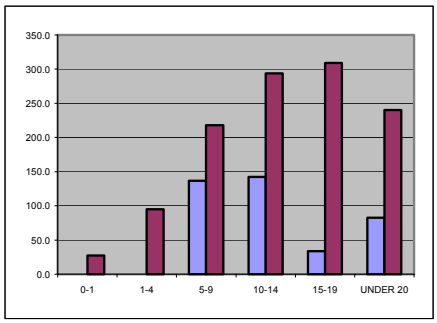
0.4% of all fall injury



SHARP OBJECT INJURY SEVERITY RATE PER 100,000 POP, URBAN:RUAL

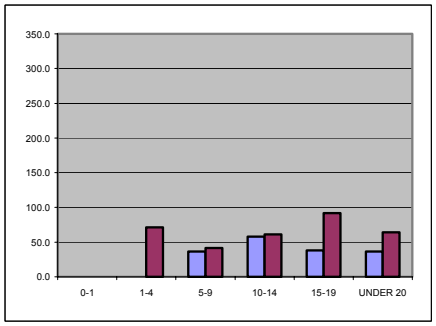
Minor	Urban	LCL	UCL	Rural	LCL	UCL
0-1	0.0	0.0	0.0	27.2	0.0	80.5
1-4	0.0	0.0	0.0	95.0	17.4	172.6
5-9	136.8	7.0	266.6	217.9	125.8	310.0
10-14	142.2	22.1	262.3	293.9	163.6	424.2
15-19	33.6	0.0	86.7	309.0	168.5	449.5
<20	82.7	21.9	143.5	240.0	171.0	309.0

67.7% of all sharp object injury



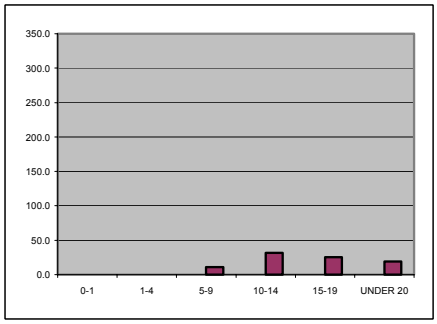
Moderate						
0-1	0.0	0.0	0.0	0.0	0.0	0.0
1-4	0.0	0.0	0.0	71.2	7.5	134.9
5-9	36.4	0.0	107.4	41.6	3.8	79.4
10-14	57.9	0.0	126.3	61.0	16.1	105.9
15-19	38.1	0.0	89.8	91.9	30.9	152.9
<20	36.3	6.7	65.9	64.2	36.6	91.8

19.0% of all sharp object injury



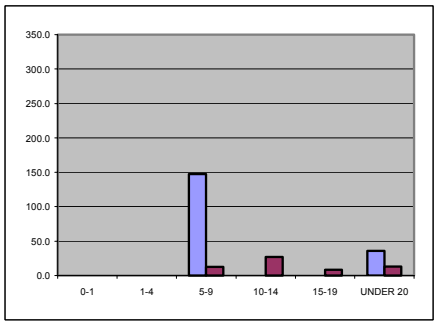
Major						
0-1	0.0	0.0	0.0	0.0	0.0	0.0
1-4	0.0	0.0	0.0	0.0	0.0	0.0
5-9	0.0	0.0	0.0	11.2	0.0	33.2
10-14	0.0	0.0	0.0	31.6	0.0	67.1
15-19	0.0	0.0	0.0	25.2	0.0	61.3
<20	0.0	0.0	0.0	19.0	3.9	34.1

5.1% of all sharp object injury



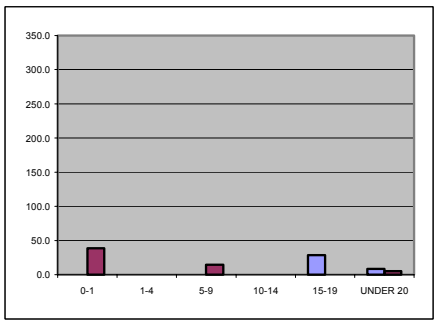
Severe						
0-1	0.0	0.0	0.0	0.0	0.0	0.0
1-4	0.0	0.0	0.0	0.0	0.0	0.0
5-9	147.4	0.0	435.5	12.7	0.0	32.7
10-14	0.0	0.0	0.0	27.0	0.0	66.2
15-19	0.0	0.0	0.0	8.3	0.0	24.6
<20	36.0	0.0	106.4	13.3	0.0	28.0

6.3% of all sharp object injury



Death						
0-1	0.0	0.0	0.0	38.8	0.0	114.7
1-4	0.0	0.0	0.0	0.0	0.0	0.0
5-9	0.0	0.0	0.0	14.5	0.0	42.7
10-14	0.0	0.0	0.0	0.0	0.0	0.0
15-19	28.7	0.0	84.6	0.0	0.0	0.0
<20	8.7	0.0	25.6	5.0	0.0	12.3

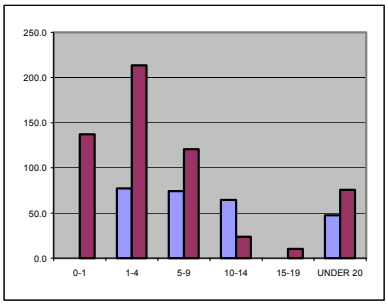
1.9% of all sharp object injury



BURN INJURY SEVERITY RATE PER 100,000 POP, URBAN : RURAL

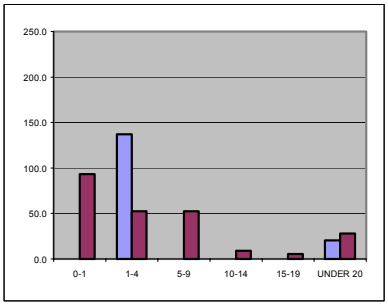
Minor	Urban	LCL	UCL	Rural	LCL	UCL
0-1	0	0.0	0.0	137.1	0.0	326.0
1-4	77.3	0.0	161.8	213.5	54.0	373.0
5-9	74.2	0.5	147.9	120.7	46.2	195.2
10-14	64.5	0.0	153.3	23.8	0.0	53.2
15-19	0	0.0	0.0	10.4	0.0	30.8
<20	47.4	12.5	82.3	75.8	43.5	108.1

58% of all burn injury



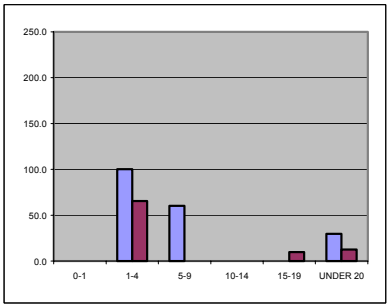
Moderate						
0-1	0	0.0	0.0	93.2	0.0	276.1
1-4	137	0.0	294.4	52.4	0.0	109.4
5-9	0	0.0	0.0	52.6	6.5	98.7
10-14	0	0.0	0.0	9.2	0.0	27.2
15-19	0	0.0	0.0	5.3	0.0	15.7
<20	20.4	0.0	43.7	28.1	9.1	47.1

22% of all burn injury



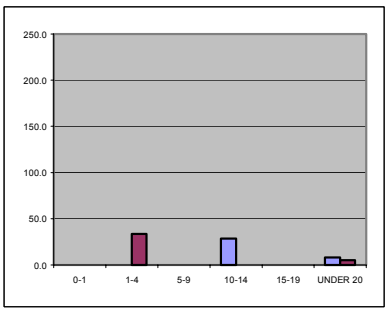
Major						
0-1	0	0.0	0.0	0	0.0	0.0
1-4	100.3	0.0	237.7	65.6	0.3	130.9
5-9	60.2	0.0	144.7	0	0.0	0.0
10-14	0	0.0	0.0	0	0.0	0.0
15-19	0	0.0	0.0	9.8	0.0	29.0
<20	29.7	1.1	58.3	12.5	1.3	23.7

15% of all burn injury



Severe						
0-1	0	0.0	0.0	0	0.0	0.0
1-4	0	0.0	0.0	33.6	0.0	80.2
5-9	0	0.0	0.0	0	0.0	0.0
10-14	28.5	0.0	84.0	0	0.0	0.0
15-19	0	0.0	0.0	0	0.0	0.0
<20	7.9	0.0	23.2	5	0.0	12.1

5% of all burn injury

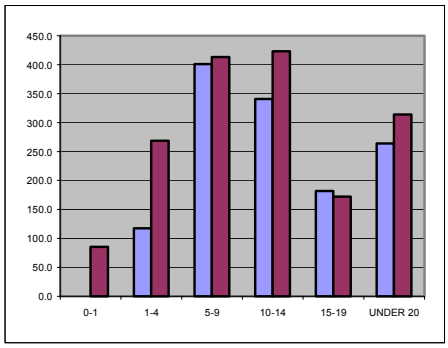


Death		
0-1	0	0
1-4	0	0
5-9	0	0
10-14	0	0
15-19	0	0
<20	0	0

ANIMAL BITE INJURY SEVERITY RATE PER 100,000 POP, URBAN:RURAL

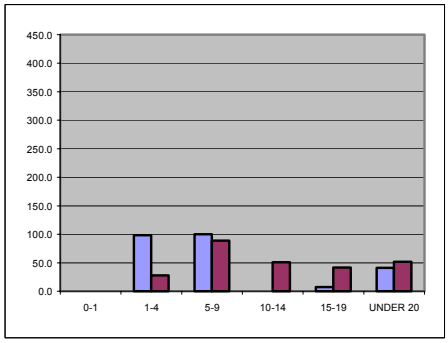
Minor	URBAN	LCL	UCL	RURAL	LCL	UCL
0-1	0.0	0.0	0.0	85.1	0.0	252.3
1-4	117.3	0.0	278.2	268.5	118.8	418.2
5-9	400.8	163.6	638.0	413.0	256.6	569.4
10-14	340.7	164.3	517.1	423.1	258.7	587.5
15-19	181.7	27.8	335.6	172.1	74.5	269.7
< 20	264.1	150.2	378.0	314.3	224.5	404.1

79% of all animal bite injury



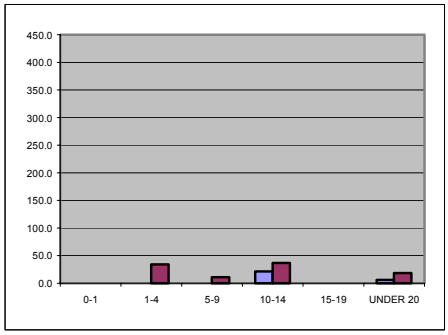
Moderate						
0-1	0.0	0.0	0.0	0.0	0.0	0.0
1-4	98.4	0.0	237.2	28.0	0.0	68.2
5-9	100.0	0.0	211.9	89.0	14.5	163.5
10-14	0.0	0.0	0.0	50.9	11.7	90.1
15-19	7.6	0.0	22.5	41.7	9.2	74.2
< 20	41.4	7.7	75.1	52.0	24.0	80.0

13% of all animal bite injury



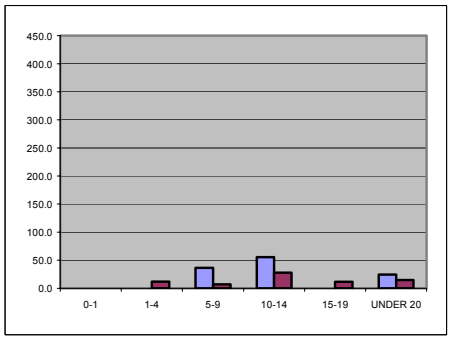
Major						
0-1	0.0	0.0	0.0	0.0	0.0	0.0
1-4	0.0	0.0	0.0	34.4	0.0	82.6
5-9	0.0	0.0	0.0	11.2	0.0	33.2
10-14	21.4	0.0	63.5	37.0	0.0	80.7
15-19	0.0	0.0	0.0	0.0	0.0	0.0
< 20	5.9	0.0	17.5	18.7	1.6	35.8

4% of all animal bite injury



Severe						
0-1	0.0	0.0	0.0	0.0	0.0	0.0
1-4	0.0	0.0	0.0	11.7	0.0	34.4
5-9	36.5	0.0	108.2	7.3	0.0	21.6
10-14	55.6	0.0	164.2	27.7	0.0	58.7
15-19	0.0	0.0	0.0	11.6	0.0	34.3
< 20	24.2	17.7	0.0	14.9	2.9	26.9

4% of all animal bite injury



Death						
0-1	0.0	0.0	0.0	0.0	0.0	0.0
1-4	0.0	0.0	0.0	0.0	0.0	0.0
5-9	0.0	0.0	0.0	0.0	0.0	0.0
10-14	0.0	0.0	0.0	0.0	0.0	0.0
15-19	0.0	0.0	0.0	0.0	0.0	0.0
< 20	0.0	0.0	0.0	0.0	0.0	0.0