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**Creating an entire community covering population based injury
registration system: a developed country perspective**

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Abstract

The public-health approach to injury prevention and control includes epidemiological assessment, development of prevention strategies, and evaluation of these strategies. Injury-surveillance systems should be capable of providing essential information for each of these elements. The scale of injury problem is not a matter of dispute. The costs of injury mortality and morbidity are immense not only in terms of lost economic opportunity and demands on national health budget but also in terms of personal and social sufferings. Despite this, few countries have comprehensive surveillance system that generates reliable information on the nature and extent of injuries, especially with regards to non-fatal injuries. Without reliable information health care planners are severely handicapped. They are unable to allocate resources efficiently in order to achieve the greatest impact in preventing injuries. This is true for planners at all levels, whether they are concerned with the world wide injury problem or national, regional or local level injury problems. Injury registries are indispensable in determining the incidence and trends in a particular population. A registry complements the cross-sectional studies of the differences in disease rates by longitudinal investigation. The initiation of the simultaneous monitoring of the incidence, mortality, morbidity, risk factor levels, social and behavioral tendency within defined community over a period of years will help in clarify the interrelation between these variables in terms of the dynamics of change in the natural history of injury trend. Information of injury occurrences and risk factors in population is very essential and surveillance provides this essential information that can be used for designing effective prevention strategies, appropriate allocation of health resource, assessment of effectiveness of the health programs, etc. The purpose of this registration is to follow the injury incidence and mortality trend in Japan using a whole community population covering registry that serve to most up to date information.

Keywords

Injury, Registration, Surveillance, Community, Population

Introduction

The magnitude of injury problem

The landmark report, Global Burden of Disease, published in 1996 by the World Health Organization (WHO), World Bank, and Harvard University, painted a clear picture of how significant injury is to public health. The report presented data on premature mortality and disability from unintentional injuries (traffic-related injuries, poisonings, falls, fires, drowning, and others) and intentional injuries (self-inflicted, violence, and war). In higher-income countries, road traffic accidents are already among the top ten leading causes of disease burden in 1998. With respect to the burden of disease characterized by mortality statistics injuries are ranked as the 9th leading cause of death worldwide. In less developed countries, road traffic accidents were the most significant cause of injuries, ranking eleventh among the most important causes of lost years of healthy life (1). Traffic accidents are a major cause of severe injuries in most countries. In the first World Health Report, published in 1995 by WHO, it was reported that the external causes such as accidents and violence accounted for about 4 million deaths, or about 8% of the total, again mostly among adults. Developing countries have nearly four times the number of deaths from these causes as the developed world (2). The 1999 WHO publication "Injury: A Leading Cause of the Global Burden of Disease," reports that the leading injury-related cause of death among people aged 15-44 years is traffic injuries. Of the 5.8 million people who died of injuries in 1998, about 1.2 million died as a direct result of injuries sustained in a motor vehicle accident. Worldwide, the WHO reports, about 38.8million injuries were received by people involved in motor vehicle accidents in 1998 (3). In the report of WHO – "World report on violence and health" – it reported that the 20th century was one of the most violent periods in human history. An estimated 191 million people lost their lives directly or indirectly as a result of conflict, and well over half of them were civilians (4).

Severity of injury situation

The injury burdens described in general are based on the mortality reports available all over the world. But in reality, like a tip of the iceberg, these reports represent a small fraction of the total injury burden. Because for every injured victim who dies there are typically many more who sustain serious but nonfatal injuries. Many of these victims suffer long-lasting or permanent disabilities. These affect victim's own life as well as the care his or her givers' lives. The fact that nonfatal events (injury related self treatment, outpatient / emergency

department visits and hospitalizations) typically outnumber injury deaths to a large degree can be shown as an "injury pyramid" (5). Figure 1 shows the basic conceptual structure of an injury pyramid.

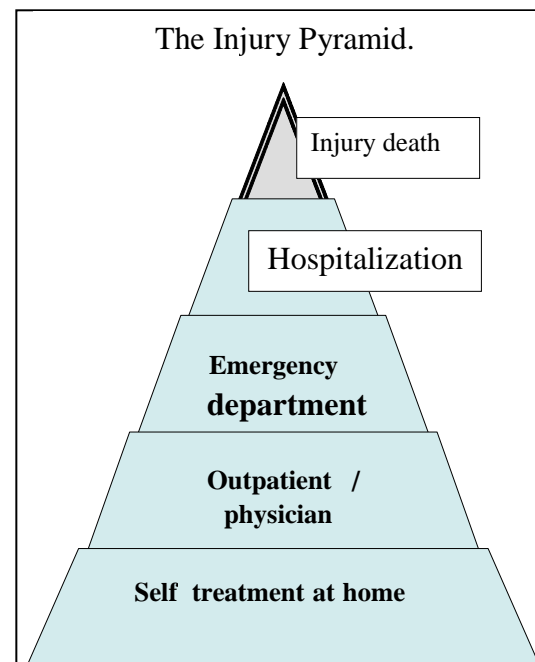


Figure 1.The basic conceptual structure of an injury pyramid

About the fundamentals of the injury pyramid from an absolute number perspective, most injuries are minor and can be treated without any medical attention (represented at the bottom of the pyramid). More severe injuries are fewer in number, but will require medical attention by a professional. Hospitalization from injuries is even less common, and deaths from injuries are fewer still. Events which result in death are considerably more severe, but occur less frequently. Thus, the key point here is that an assessment of the burden of injuries we should keep in mind regarding the other outcomes of injury apart from the death cases. Otherwise we would seriously underestimate the overall burden of injuries.

The gloomy future

According to a WHO/World Bank report "The Global Burden of Disease", deaths from non-communicable diseases are expected to climb from 28.1 million a year in 1990 to 49.7 million by 2020 - an increase in absolute numbers of 77% (1). In the report - 'World report on road traffic injury prevention' – WHO reported that road traffic injuries are predicted to become the third largest contributor to the global burden of disease by 2020. It is estimated that every year, road traffic crashes cost US\$518 billion globally (6).

Public-health surveillance (PHS)

PHS can be regarded as a chain of four inter-related activities that, as defined by Declich and Carter in 1994 (7), include:

1. The systematic collection of data;
2. The consolidation and analysis of collected data;
3. The dissemination of information by means of narrative easy understanding epidemiologic reports to the practitioners of public health and to others who need to know;
4. Follow-up, in order to see that effective actions have been taken (i.e. the application of surveillance data to prevention and control).

PHS is essentially a key instrument for providing a basis on which public-health policy can be shaped (8). It's essential ongoing and action-oriented nature makes surveillance basically different from epidemiologic research (9). A PHS system should include a functional capacity not only for data collection and analysis, but also for the dissemination of information. "No public health surveillance system is complete without being linked to action" (10). Surveillance systems can be very simple or rather sophisticated, depending upon the goal they serve and the capacity to pay of those who need them. They may also serve the public-health authorities of populations of various sizes – such as a local community, a region, a country, or a group of countries. Whatever the case, the system will be effective when the data gathered are appropriately communicated to the full range of constituents who might have use of it – ranging from health-care providers to policy-makers.

Health policy makers, health service providers and consumers need access to timely, high quality information about population health to plan, implement and evaluate health services and make decisions. They need data about:

- The health status of the population; and
- Potential risks to health, including biological, environmental and behavioral risks.

Health surveillance is the mechanism that provides this essential information. A surveillance system produces data that describe:

- The size and characteristics of a health problem (i.e. what are the number of the cases of injury, broken down by type and what are the characteristics of each type?);
- The population at risk (i.e. which kind of people are most likely to incur each type of injury?);
- The risk factors (i.e. what things contribute to each type of injury, and what things are associated with each type of injury?);

- The trends (i.e. is a particular type of injury occurring more or less frequently and is it doing more or less harm?).

Armed with such data it is possible to:

- Design and apply appropriate interventions;
- Monitor the results and assess the impacts of interventions.

Steps for surveillance

The steps of the surveillance system are shown in the flowchart. Figure 2 shows the working flowchart of the basic steps for a surveillance system.

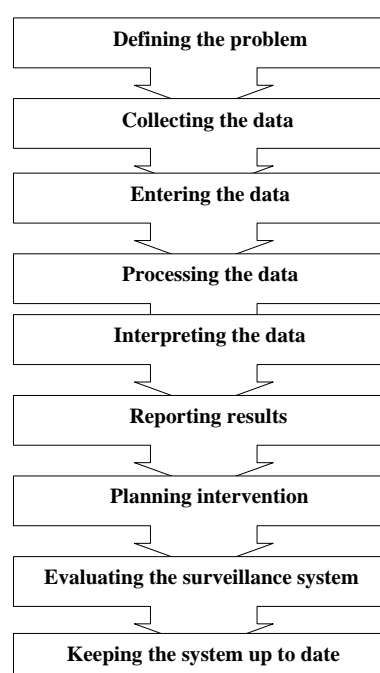


Figure 2. The working flowchart for surveillance system

Attributes of surveillance system

Evaluation of PHS systems has to be based on five general system criteria (7-8, 11). This criterion includes importance of the problem; objectives and components, usefulness, costs of operating the system, and quality of the system. The first four are directly related to the general structure and grounds of the system, whereas the fifth concerns its inner characteristics. This latter aspect has been rather neglected in the discussion above, but will receive greater attention now. Quality of a system should be evaluated on the basis of six attributes. The first two are qualitative (simplicity and acceptability), the other four quantitative (sensitivity, predictive value positive, representative ness, and timeliness).

None of them is more or less important than any other. Rather, they tend to conflict and must therefore be weighted in the light of choices made with regard to general characteristics, such as the importance of the problem and the objectives of the system (7,8,11).

Injury surveillance

The public-health approach to injury prevention and control includes assessment, development of prevention strategies, and evaluation of these strategies (12). Injury-surveillance systems should be capable of providing essential information for each of these elements. The scale of injury problem is not a matter of dispute. The costs of injury mortality and morbidity are immense, not only in terms of lost economic opportunity and demands on national health budget, but also in terms of personal suffering. Despite this, few countries have reliable surveillance system that generates reliable information on the nature and extent of injuries, especially with regards to non-fatal injuries. Without reliable information, health care planners are severely handicapped. They are unable to allocate resources so as to achieve the greatest impact in preventing injuries, reducing the harm they do and treating and rehabilitating injured persons. This is true for planners at all levels, whether they are concerned with the world wide injury problem or national, regional or local injury problems.

Plan of action

Figure 3 shows the working plan of the injury registration is shown as the scheme diagram.

Methodology

Design: Multiple source data collection method for injuries.

Population: Takashima County inhabitants

Study Duration: Continuous.

Data collection technique: Data will be collected about the injuries from Hospital records, Police Registers, County Ambulance register records, Health Insurance records and Official death records.

Data collection tools: "Injury Information Form" will be filled up by the collectors with the information about the victim, the accident, and outcome.

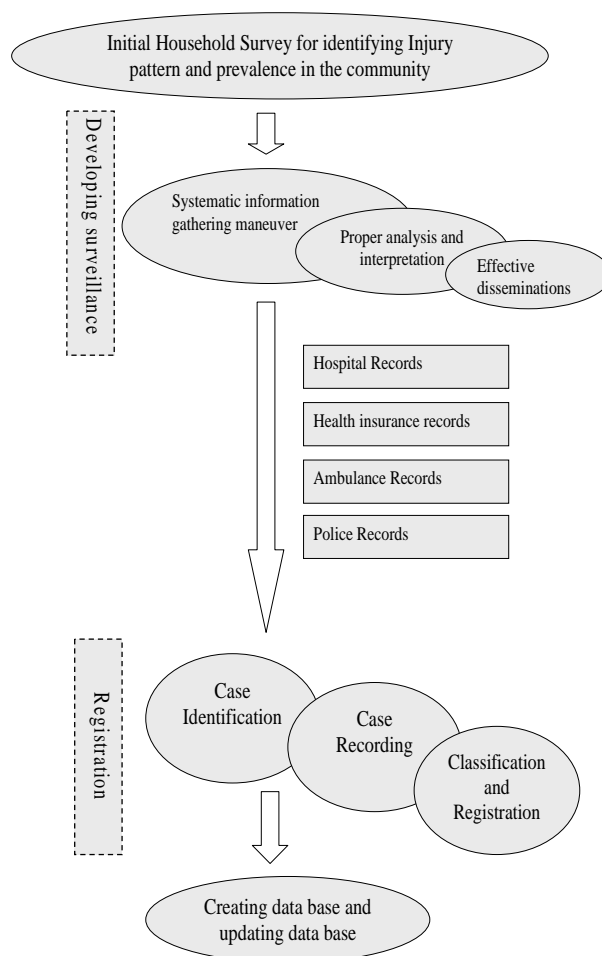


Figure 3 – The scheme diagram of the working plan for proposed injury registration and surveillance system

Data collection: 1) Initial baseline data collection will be done as a household survey with interview questionnaire and checklist.

2) New case registration will be done with hot pursuit or cold pursuit according to the situation.

Data congregation method: An Electronic Data Capture (EDC) system will be utilized for the data congregation purpose. An EDC system is a computerized system designed for the collection of clinical data in electronic format. Typically, EDC systems provide a graphical user interface component for data entry, a validation component to check user data, and a reporting tool for analysis of the collected data.

Analysis plan: Analysis software will be used for two-sample and three-sample analysis and frequency, cross tabulation and other relevant analysis of statistical importance.

Matching Variables: As we will be using multiple sources for case identification, we may end up with same case from different sources. Each injury cases will be matched with other sources on the following variables to prevent duplicate registrations:

- 1) Name of the Victim
- 2) Sex of the victim
- 3) Age of the Victim
- 4) Address of the Victim
- 5) Date of the accident
- 6) Place of the accident
- 7) Type of the accident
- 8) Outcome

Preferred injury coding system

The International Classification of External Causes of Injury (ICECI) (13) will be used for the purpose of the injury coding. It is more preferable for us due to its superiority over the ICD 10 (International Classification of Diseases and related Health Problems) (14) in terms of what has happened. ICD will give us very little information about what has happened. The ICECI helps researchers and prevention practitioners to define more precisely the domain of injuries they are studying, answer questions on the circumstances of the injuries, and provide more detailed information about specific accident categories. Internationally, WHO's ICD is the most widely used coding frame for categorizing the extent and cause of injury. ICD-10 was endorsed by the 43rd World Health Assembly in May 1990. On the other hand the ICECI was released in a draft format at the Fourth World Conference on injury prevention and control in Amsterdam, May 1998. Variables describing external causes of injury that are considered in this system include: mechanism of injury, object or substance producing injury, activity when injured, place of occurrence, and intent.

Ethical consideration: Ethical clearance would be sought from relevant authority of administration from where the data are supposed to be collected.

The Takashima injury registry

Topographical conditions of registration area

Takashima County is located in Shiga prefecture. The Shiga prefecture borders on Kyoto municipal area to the northeast, and is located at about the geographical centre of Japan. The largest freshwater lake in Japan and one of the world's oldest lakes, Biwako Lake, popularly known as Lake Biwa is located to the east of Takashima County stretching from north to south. And the Mount Hira mountainous belt, locally called Hira-san, runs north-south to the west. Weather in the Shiga, as with central Japanese weather, follows four very distinct seasons. There are the early spring rains in April, the rainy season between mid

June to mid July, the autumn rains in September and the typhoons before and after September. There are also snowfalls between December and February. Figure 4 shows the location of the study area in the map of Japan.



Figure 4. The location of Takashima County, Shiga in Japan

Population characteristics of Registration area

Takashima County has a stable population of around 55,000 with aging homogeneous populace. It is a farming community with inhabitants mainly classified culturally into the same subgroup and has similar standards of living. Majority of the residents are covered by either National Health Insurance Program or Employees' Health Insurance Program. Table 1 shows the characteristics of the residents of Takashima County, the Takashima Injury Registration area; all data are based on the 2000 population census of Japan (15).

Case finding and registration process

Baseline household survey

A baseline survey will be arranged in the initial phase of the development of the surveillance system. The objective will be to identify the prevalent injury demography of the Takashima County.

In development of the surveillance system the continuous collection of comprehensive data will have a leading role for the success. The following probable data source will be used for the monitoring of the injury situation of the County after the baseline survey is over.

Hospital records

Takashima County contains two community hospitals. One of them is Takashima General Hospital which is in the south and is a public facility providing 261 beds. The other one is Makino Hospital which in the north and is a private facility providing 72 beds. There is also a geriatric hospital, Imazu Hospital, which is the only care facility for elderly people in Takashima. It has been estimated that approximately 98% of all hospital admissions are seen at these community hospitals (16, 17). The remaining patients are seen at three tertiary hospitals outside the county but in the same prefecture which have more sophisticated facilities for advanced treatment. Those are Shiga University of Medical Science Hospital and Otsu Red-Cross hospital in Otsu City and Shiga Medical Center for Adults in Moriyama City.

Registered patients will be from all residents of the county who were hospitalized with an injury in the two community hospitals and the one geriatric hospital. Also the patients who are residents of Takashima County but visit or will be referred to the three tertiary hospitals outside the county will also be included. Internist and specialist investigative personnel trained by epidemiologists will carry out both the case finding and registration of patients who met the criteria. Before finally including the cases in the registry, physicians and epidemiologists will check the records for absolute verification. Registration procedures will investigate once in every 2 months at the facilities. We will register all cases that meet the inclusion criteria on the basis of the medical records from all the relevant hospitals inside and outside the county.

Ambulance records

The usual practice in Japan is to take patients with any acute conditions to the emergency facilities. Some more, twenty four hour's round the clock emergency ambulance service is available for residents without any charge. Thus, any injury cases with need for hospital visit will have very faint chance for not visiting the hospital. The ambulance service keeps their own log book about the patient's identification information and condition description. Thus we believe that we will be able to cover even the cases of moderate injuries from the hospital and ambulance records.

Insurance records

In Japan almost 100 % of the residents are covered by health insurances under the control of Ministry of Health and Welfares (18). These insurances cover partial medical costs incurred on the beneficiaries availing the treatment facilities in terms of visiting medical professionals and availing prescribed drugs. Therefore, information from the insurance records would enable us to bring the

individuals with mild injuries needing medical attention under coverage of the registration system.

Japan practices a universal medical care insurance system in which all citizens subscribe one of medical care insurance systems so that everybody has access to adequate medical care (18). The medical care insurance system in Japan consists of a number of systems. There are mainly 2 types of health insurances:

- 1) **The National health insurance:** which self-employed people, farmers and jobless people subscribe, and
- 2) **The Employees' health insurance:** This includes the Health Insurance Society which is mostly subscribed by the employees of large companies, and Government-Managed Health Insurance which is mainly subscribed by the employees of small to medium size companies.

As these health insurances are centrally managed thus a combined information source would be available from them to be used.

Police records

The Japanese police have a systematic approach of detail recording of any event ending with any sort of injury. This not only helps in the proper ascertain of the event in terms of investigational purpose but also provides details for usage in medico legal or claim purpose. So detailed information regarding an injury incidence will be available for the case finding process and case ascertain process of the registry.

Death records

Every death event in Japan is assessed and appropriate cause related to the death event is recorded in the death certificate. The copies of the death certificates are kept in the relevant local governmental institutions. These death certificates can be used as a source of case finding process.

Catchments area demographic records

A registration study population will be persons with their chief current residence in the study area, which will be defined geographically to correspond with administrative and census boundaries. Instability of the population followed is among certain factors which in general can influence the detection of the events and calculation of the event rates, in terms of temporary or permanent migration in and out of the study area. The population demographic data derived from the routine census and vital statistics system are to be collected annually for the Takashima County for

each of the years of the study period. These will provide the precise denominators for the calculations of different rates. Figure 5 shows the continuous case findings and registration process for the Takashima Injury Registry.

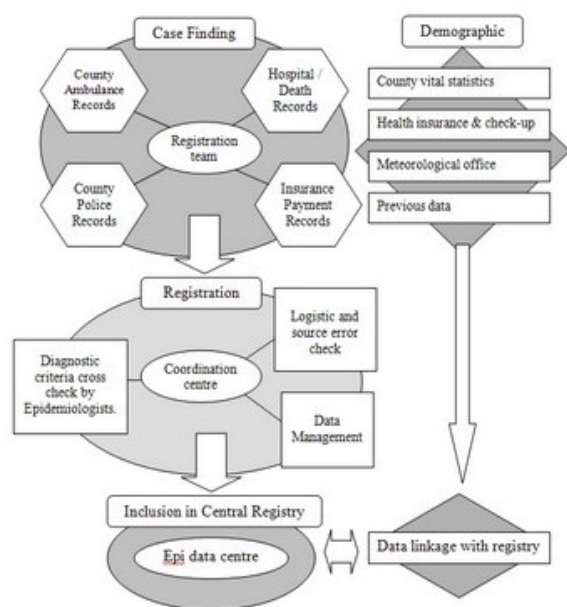


Figure 5. The scheme diagram of the continuous case finding and registration process

Focus of results

- The estimations also will be provided according to the matching sensitiveness of the cases from various sources.
- The difference of value between the estimation and the sources will be calculated and will be compared.
- Comparison will be done among the types and causes and outcome of the accidents.

Research strategy

The operational components of the injury registration and surveillance system produce data sets that can be used in many aspects of injury research. In addition, special simultaneous intervention and safety promotion activities can be evaluated from following the time trend of the natural history of the injury problem. The registration system will be able to assist in the development of a safety promotion and injury prevention program, injury research strategy and coordination plan that will contribute to the following:

- 1) Follow the trends in injury and epidemiology of injury in a given population
- 2) Evaluation of existing sources of injury information to assess their possible role in developing injury surveillance;
- 3) Researches of medical care seeking for injury related events;
- 4) Evaluation of community-based safety-promotion programs.

Probable obstacles

Some probable obstacles will be there to work out in the present planning.

- 1) In the death records system in Japan the cause of the death are classified by the ICD 10 but we want to use ICECI instead of the ICD. In that case the death records will have to be cautiously examined for the proper recording in aspect of the ICECI coding system.
- 2) Regarding the registration and surveillance of the injury death cases or severe injury cases we will hopefully have relatively less problem. But we might have the difficulty in terms of missing events for the less severe injury events.
- 3) Japan has a traditionally privacy oriented nature of community people. Here injury to himself or herself is sometimes taken as an event of shame rather than to discuss with others. So there might be some cases in which the recorded cause of injury may not be in fact the real reason.
- 4) Initiating coordination between different self managed institutions will be a matter of lots of hectic ground work, but after putting the surveillance into running the workload will come down to proper supervising only. The information gathering mechanism will be needed to monitor continuously for proper running.

Global application

This method of developing a comprehensive injury registration and surveillance might be extended to a strategy for injury monitoring in the other parts of the world, especially in the developed part of the world. As the aging populace in the developed part of the world is a growing concern for their society, they need to give emphasis more in injury prevention and safety promotion. They will need to build elderly friendly environments in order to avoid the injury burdens for the elderly. On the other hand, other parts of the world also are developing in terms of economic strength and technology transfer. And this ultimately is leading towards a change in their life style. So, we believe

that this program could be implemented to those set ups also with necessary modifications according to their background, demography and situation.

Table 1. Population characteristics of the Takashima Stroke Registration area, Takashima County, Shiga, Japan.*

Characteristics		Takashima County
Population		Number
Total		55,451
Gender		
	Men	27,323 (49.2%)
	Women	28,128 (50.7%)
Age group		
	Aged up to 14 years	8,720 (15.7%)
	14 to 64 years	34,360 (62.0%)
	Aged 65 years or more	12,354 (22.3%)
Sex ratio (males per 100 females)		94.9
Population density		
	Total land area	511 square km
	No. people per hectare (total land area)	1.08
	No. people per hectare (total dwell able area)	4.70
Industrial Population		Number
Primary†		1,871 (6.8 %)
Secondary‡		10,470 (38.1 %)
Tertiary§		15,145 (55.1 %)

* Data are based on the 2000 population census of Japan. (Age reported unknown for 16 persons)

† Primary: Agriculture, fishing, forestry, etc., ‡ Secondary: Industry sector, and § Tertiary: Service sector.

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