1

Injury Control and Safety Promotion: Ethics, Science and Practice

Dinesh Mohan

INJURY CONTROL, SOCIETY AND ETHICS

Injury control, safety of individuals and societal arrangements are all interlinked. William Haddon wrote seminal pieces on the folly of focusing on 'human error' as the main cause in the occurrence of accidents (Haddon, 1968; 1970; 1972; 1973; 1974; 1980). He did not like the use of the word 'accident' as he thought that this leads to a feeling of inevitability in the occurrence of these incidents. Further, he was convinced that the term 'accident prevention' was too limiting and prevented the evolution of other safety counter-measures useful in limiting the severity of injury and in injury management after the event. Instead, he promoted the use of the phrase 'injury control' as being more neutral and scientific. But, he did not address the issues of ideology and the power of elites that societies are influenced by.

Perrow (1994, 1999) on the other hand, agrees with Haddon that individuals cannot always be held responsible for 'human error' under the system they operate in but provides a more sophisticated model of systemic imperatives: 'I wish to point away from the basic and pervasive sin identified by those who casually examine organizational failures, that of operator error; this is given as the cause of about 80 per cent of the accidents in risky systems. I would put it at under 40 per cent. I will suggest that what is attributed to operator error stems primarily from the structure they operate in, and thus, stems from the actions of elites. Elite errors and elite interests stem from their class and historical power positions in society, and changes in these positions are glacial' (Perrow, 1994).

Obviously, societal responsibility in the control of injuries becomes paramount when the problem is stated in these terms. Morbidity and mortality due to injuries have always existed in the past but their recognition as a public health problem is a phenomenon of the mid-twentieth century. Policy makers and safety professionals in every country find it very difficult to institute changes which actually result in a dramatic decrease in fatalities due to injuries. This is mainly because experience shows that individuals do not follow all the instructions given to them to promote safety. Attempts to educate people regarding safety are also not very effective and wide variations are found between people's knowledge and their actual behaviour (Robertson, 1983). This is particularly true for those situations where we cannot select the people who will be involved in a particular activity. For example, almost everyone is involved in domestic chores, in road use and working in offices, factories or on farms. It is not

possible to select people who will always be careful in performing these activities. While some control can be exercised in licensing drivers of motor vehicles, almost no control is possible in selection of pedestrians and bicyclists. At the work place, only some very specialized jobs allow careful selection and monitoring. This makes it very difficult to promote safety by relying on improvements in individual behaviour and makes injury control a very complex process. This is illustrated by using road traffic as an example.

Almost all the persons in the school-going and working age groups have to be on the road at least twice a day in every country. This forces many individuals to use the road even when they are not adequately equipped to do so. These situations would include individuals with any of the following problems:

- Those who unable to concentrate on the road because they have suffered a personal tragedy recently, such as death of a loved one, loss of a job, failure in an important examination, monetary loss.
- Those who are disturbed because of problems in personal relationships with a spouse, parent, sibling or close friend.
- Persons taking medication or drugs which alter behaviour and perceptual abilities, or those who are under the influence of alcohol.
- Children whose cognitive and locomotor abilities make it difficult for them to understand or follow instructions given to them.
- Elderly people whose motor and cognitive functions are impaired.
- Disabled persons who have to be a part of regular traffic if they have to earn a living.
- All psychologically disturbed persons who may not be able to function as desired on the road but who cannot be singled out from participation in traffic.

If we add up the total number of individuals who could be included in these categories on any given day it would amount to a significant proportion of people on the road (say, 20–30 per cent). These individuals cannot always be identified or prevented from using the road space. At the same time it is also a fact that their presence on the road is not out of choice, but a compulsion. In our modern ways of living we have to use products and do things at places and at times which are determined by someone else or by the society at large. The same holds true for activity at the work place or even at home. A large number of us have little choice in the design of the home we live in, the design of the tools we use, or the work place where we spend a major part of the day.

therefore, we have a societal and moral responsibility to design our products, environment and laws so that people find it easy and convenient to behave in a safe manner without sacrificing their needs to earn a living and fulfill their other societal obligations

Therefore, we have a societal and moral responsibility to design our products, environment and laws so that people find it easy and convenient to behave in a safe manner without sacrificing their needs to earn a living and fulfill their other societal obligations. The systems must be such that they are safe not only

for 'normal' people but also for those individuals who might belong to any of the groups of people having problems. These kinds of designs, rules and regulations would reduce the probability of people hurting each other or themselves even when they make mistakes. Such systems are very often referred to as 'forgiving' systems.

Such systems cannot be put in place unless there is a societal and political understanding about the ethical and moral responsibility of the state and civil society to ensure the right to life of all its citizens. This right to life includes living in good health according to currently available knowledge and technology. A document prepared recently by safety professionals summarizes some of these issues as follows (Maurice *et al.*, 1998):

- Safety is a fundamental human right.
- Safety is a state in which hazards and conditions leading to physical, psychological or material harm are controlled in order to preserve the health and well-being of individuals and the community. It is an essential resource for everyday life that an individual and a community need in order to realize their aspirations.
- There are two dimensions to safety: one is objective and assessed by behavioural and environmental objective parameters and the other is subjective and appreciated according to the feeling of safety of the population. Both dimensions can influence each other either positively or negatively. It is therefore necessary to consider these two dimensions to improve the safety of the population
- Safety is a pre-requisite to the maintenance and improvement of the well-being and health of the population. It is the result of a dynamic balance that is established between the different components within a specific setting.

INJURY CONTROL, PUBLIC HEALTH AND TECHNOLOGY

Once we accept that injury control is a public health problem and that we have an ethical responsibility to arrange for the safety of individuals, then it follows that we also incorporate the lessons learned from our experience of the past few decades. We know that drinking water should be purified at its source; it is unreasonable to expect everyone to boil water before drinking it. Those societies which depend upon individuals to purify their own drinking water suffer from much higher rates of communicable diseases than those which purify water at source. Ironically, it is quite common to create a product or environment which is likely to cause injury, warn the user to be careful, and then blame the user if a mishap occurs. We would never tolerate a person who introduced cholera germs in the city water supply and then 'educated' every citizen to boil water before drinking it with the argument that those who knowingly do not do so would then be responsible for getting sick. This is the argument we all to often use when dealing with matters concerning safety. We put in place hazardous roads, vehicles and driving rules, and then expect road users to be safe by behaving in some ideal manner.

Once we are clear that injury control activities involve the same principles as any other public health problem, then we can institute policies and programmes for institutionalizing safety promotion. However, most models of safety promotion and community action have their origins in the high income countries (HIC) and it is assumed that similar measures would work in the low income countries (LIC) also. Many of these policies are heavily dependent on introduction of expensive technologies and difficult regulation and legislation enforcement systems. Therefore, the transfer

of 'knowledge' from HICs to LICs is sometimes almost impossible. However, we forget that many advances in public health in the control of communicable diseases took place before the invention of the modern definitive disease control drugs and vaccines.

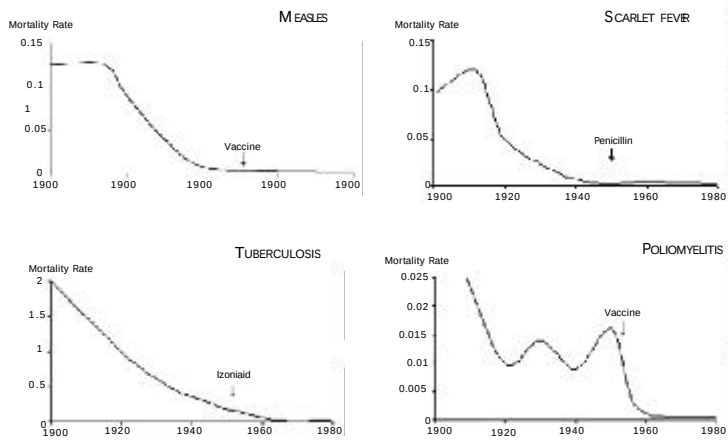

Figure 1 Decrease in disease specific mortality rates in USA 1900–1980 (Data from Sathyamala *et al.*, 1986)

Figure 1 shows the decrease in disease specific mortality rates in USA, 1900–1980. This data show that medical interventions for measles, scarlet fever, tuberculosis and poliomyelitis were introduced when the incidence rates had already declined considerably (Sathyamala *et al.*, 1986). None of these death rates, except polio, show as marked a decline after the medical intervention as before. There is enough other evidence available to show that improvements in public health involve much more than just the introduction of new technologies and treatment methods. For example, in India the crude death rate declined from 47.2 per thousand per year in the decade of 1911–1921 to 27.4 for the decade 1941–1951 (Government of India, 1983). This 42 per cent reduction in death rates over three decades in India took place when most medical technologies were not available to a vast majority of the country's population. These reductions took place because of improvements in environmental and other social conditions.

safety is a pre-requisite to the maintenance and improvement of the well-being and health of the population

Disease is the product of social, economic and technological environments that people live in. Within this environment the power to take decisions regarding choices available for one's own well being and the power to influence other people's lives plays an important role in what health benefits are available to the society as a whole. The same holds true for injury control and safety promotion.

Injury control activities will not be successful around the world unless we address these issues of social, economic and technological environments and the power available to people to influence decision making regarding their own well being. The lower the income of a society, the more important it becomes for injury

control counter-measures to be instituted at the societal and system level. Many of the current approaches in injury control do not give enough importance to these aspects of the problem. They focus on control at the product or environmental design levels or in the establishment of safety standards without looking at the ability of a society to influence or sustain these activities. Success in promoting safety in LICs is further limited because LIC systems happen to be more complex than those obtaining in HICs. We cannot wait for all communities to become rich before they can avail of the same systems. The history of Public health shows that it should be possible for our lives to be safer in all communities before the introduction of new expensive technologies and expensive societal arrangements.

Societal complexity and injury control

The following factors played an important role in instituting safety programmes and policies in HICs:

- *Decline of mortality due to infections and contagious diseases*. This made the community more aware of injuries as a health problem and therefore gave support to injury control initiatives as a priority.
- *Development of a middle class society*. By the mid-eighties a significant majority of Europeans had incomes which would define them as 'middle class'. At the same time an equalization process took place which made most professionals 'equals'. This meant that policemen, school teachers, doctors, nurses, lawyers, university professors could sit around a table and actually communicate and respect each other as equals. Cooperation between various interest groups, law enforcers, policy makers and policy implementers then becomes more possible. These processes resulted in conglomerations of people which could be called 'communities' in a real sense. Most counter-measures for injury control benefit large proportions of the community. It can also be assumed that particular counter-measures would not harm some sections of the population since there are less conflicts of interest by different class categories.
- *Acquisition of decision making powers by local self governments*. Over time local communities have been able to acquire decision making powers over most aspects of community life, owing to national governments' inclination to decentralize policies that relate closely to the citizens' well being. This gives them the confidence to attempt changes.
- *Establishment of institutions and organizations with high degree of expertise*. This makes it possible for reasonably accurate and reliable data to be collected. These data can then be used for policy making purposes with support from most sections of society.
- *Laws can be enforced*. Because of the relative egalitarian structure of society it is assumed that most laws would affect most people in a similar manner. Since the law enforcers belong to the same social stratum as the general public it becomes possible to enforce laws more efficiently and more uniformly.
- *Availability of safer technologies*. Most technologies are developed and their designs controlled by the wider society where they are needed. Such technologies are more in tune with the needs of the community and can be changed if necessary.

• *Safety standards can be enforced.* Since most production is centralized, it is possible to make standards and enforce them.

In most LICs at present many of these conditions are not ment. Some characterisitics of LICs are as follows:

• *Heterogeneity*. The post-war period has witnessed the emergence of a very large number of independent nation-states in Africa and Asia. Most of these nation-states had never existed in the present form ever before in history. Many of these countries came into existence, most of them have very mixed population. These population may differ in religions, languages, common law, social customs and may not have shared values. The urban areas in these countries house people with very diverse backgrounds and so there may be very little homogeneity. In many cities in LICs people live in developments characterized by ethnic and religions bonds.

infections, contagious diseases, and other health problems due to malnutrition, air and water contamination, parasites, mosquitoes and unsafe work conditions, dominate the attention of the public and policy makers. Under such circumstances it becomes very difficult to arrive at a consensus to consider injuries as an important public health problem

• *Inadequate public health facilities*. Most LICs have not been able to institutionalize twentieth-century levels of hygiene and public health. Infant mortality and maternal mortality indices remain much higher than those in HICs. In addition, infections, contagious diseases, and other health problems due to malnutrition, air and water contamination, parasites, mosquitoes and unsafe work conditions, dominate the attention of the public and policy makers. Under such circumstances it becomes very difficult to arrive at a consensus to consider injuries as an important public health problem.

• *Hierarchical societies.* Most LICs have not been able to achieve high enough levels of economic growth over the past four decades. Low economic growth combined with non-egalitarian ideologies result in very low levels of upward mobility. The poorer sections of society remain dominant in terms of proportions of the population, but they have little influence on setting the policy agenda. Within institutions the hierarchy also gets in the way of the dialogue needed for smooth functioning. Teachers, nurses, policemen occupy low social status as far as decision making is concerned. They hardly ever get to sit at the same table where bureaucrats and experts discuss policies and take decisions.

• *Inadequate control over technology*. Most LICs import almost all technological products and processes from HICs. Even aid projects ensure movement of technology from the donor to the receiver. Very often this technology is old or less expensive, and therefore, more hazardous. Local communities have almost no control over the choice of these technologies. For example, when a highway project is executed, the design and construction are done by people who belong to the metropolis of that country aided by experts from multilateral or bilateral international agencies and multinational corporations. The local community can hardly influence the execution of these projects except in the form of protests to halt the construction or change the location of the

highway. Most of the time they do not have the expertise or the power to influence design. In addition, the local community may not possess the expertise to evaluate the hazards implicit in the designs of products or technologies being put in place.

• *Increase of complexity in social and technological systems*. Over the past few decades standardization of and homogenization of technologies has resulted in the reduction of complexity in many sectors in HICs. The roads have become identical in layout and design, vehicles have become similar, variety of vehicles has been reduced, school designs for most sections of the population are becoming similar, technologies used in houses are similar and the labour component in industry and farming has reduced. This reduction in complexity has made it somewhat easier to institute safety counter-measures.

On the other hand, in most LICs, both social structures and technologies include a great deal of variety which leads to more complex systems. The most modern vehicles share the same road space with non-motorized transport, modern gadgets are used in a traditional kitchen, inadequately trained labour is forced to handle high energy chemicals and equipment, and mechanized systems co-exist with labour intensive ways of living. These issues concerning increasing complexity in LICs is discussed in the following section.

Consequences of increasingly complex systems in LICs

Systems which have unfamiliar feedback loops, many potential interactions, indirect or inferential information sources, and limited understanding of some processes are considered to be more complex than those with the opposite characteristics (Perrow, 1999). These characteristics of LICs show that these countries tend to have more complex social and technological environments than those present in HICs. The most important issue to be understood regarding increasingly complex systems in LICs is that these societies face new problems which are different from those currently prevalent in HICs. They also have little precedence in the past of the HICs. It is not usually possible to find solutions from the past of HICs and transfer these old solutions to LICs today.

The complexity in the socio-political domain is a result of centralized decision making systems of nation-states and local government bodies not being able to accommodate the interests of the poorer sections of society. This happens because the individuals who take decisions are getting increasingly insulated from the daily lives and concerns of disadvantaged communities. Ease in international travel and instantaneous communication links between elite groups around the world tends unifies their interests and concerns. In earlier centuries and the first few decades of the present century there was greater conflict between the elite groups across nation-states than there exists today. This interaction and solidarity between richer sections of society in different communities and the conflicts between the poor sections within and across communities is at the expense of the interests of the poor.

The interests of poor communities can also be in direct conflict with the interests of the richer ones. Providing safety at the work place to prevent a small number of injuries and deaths may reduce the profits of the owner and the shareholders of the company. Slowing down traffic and providing a larger number of safer pedestrian crossings annoy car owners. Providing low-cost housing for low income groups takes away expensive land for making larger houses for the richer ones.

These problems are further compounded by the fact that the global information exchange makes poor people more aware of the latest happenings all over the world and raises their expectations for fair play. This results in more conflict in society making governance

more difficult. Known counter-measures for safety demand the use of latest technologies which may or may not be suitable for the problem at hand. Innovative technologies need to be developed, but most LICs do not at present have the scientific pool of manpower or the institutional structure to develop these new technologies. A result of injury control work still not being perceived as an activity requiring sophisticated scientific and academic input. So communities end up trying out one unsuccessful 'solution' after another. This promotes a feeling of helplessness, powerlessness and lack of trust in policy makers. Not an ideal situation for 'community' action.

What needs to be understood is that the theoretical base of injury control counter-measures may have international applicability but the actual physical solutions may not. There is clearly a poverty of theory for work around the globe. For example, most road safety measures instituted in HICs have centred around the automobile and the automobile occupant. Road and intersection designs are based only on car, bus, and truck movement. Roads in LICs are dominated by motorcycles, human-powered vehicles, pedestrians carrying loads and locally-designed vehicles. No traffic flow models and computer programs are able to account for this mix. Even if all the solutions developed in HICs were put in place on the roads of LICs, the decrease in fatality rates would not be of the same magnitude as experienced in the HICs.

what needs to be understood is that the theoretical base of injury control counter-measures may have international applicability but the actual physical solutions may not. There is clearly a poverty of theory for work around the globe

A good example of this is the role of expressways in inter-city travel. When an expressway is built through the countryside it divides the landscape into separate zones. People from one side of the expressway cannot go to the other side of the expressway easily on foot or on a bicycle. In HICs this does not pose a serious problem as most people possess motorized transport. However, in LICs the countryside may be heavily populated on both sides of the expressway by people of low income who need to interact with each other. They need to cross the expressway carrying or pulling heavy loads. In such a situation they do not like to go long distances to cross the expressway at designated overbridges or underpasses. They end up breaking the fences and crossing the expressway at locations convenient for them. This makes the expressway much more hazardous for everyone concerned. The decision makers come from a different strata of society who are only concerned with increasing the flow of inter-city motor traffic and see the villagers as impediments to 'progress'. This is just one example showing the inherent conflict among different 'communities' and the difficulties inherent in promoting a safer environment for everyone.

SCIENTISTS, SOCIETY AND INJURY CONTROL

The discussion in the previous section highlights the complex issues involved in dealing with public health problems at different income and organizational levels. A further complication is the role of scientists in dealing with issues concerning changes in technology and policy at the societal level. Accompanied by the 'globalization' of the economy is the globalization of the measure of scientific competence irrespective of the location where

the professionals work. Pressures on scientists force them to try and maintain 'high standards' judged by the concerns of HICs. At times this works against the interests and the needs of the many in order to concentrate on the conditions of the few holding economic power. It will not be easy to change this state of affairs without understanding the changing role of scientists and their interaction with society.

Safety promotion requires a great deal of understanding between scientists, the public and policy makers they seek to address. A very large number of findings in the injury control area are counter-intuitive: limitations of education, lack of effectiveness of severe punishment for violators of safety norms, low correlation between attitude and behaviour of individuals, some safer technologies promoting riskier behaviour, etc. In this situation large doses of 'science', especially through the mass media, does not enable people to digest information adequately as experts disagree on many issues. Within this confusion, it is very convenient for vested interests to introduce political and business agenda in the guise of technical and cost-benefit analyses. The citizen is left with little except cynicism as she has no competence to examine competing claims. Discussing the problems inherent in the public understanding of science, Raina (1999) claims that, 'The scientists' understanding of science is a very limited aspect of a more complex web of understanding that weaves together science and society ... We all grew up with the image of science as disinterested investigation. But this image of science has been bruised and science is now projected as serving vested interests ... Studies on scientific controversies reveal that every time a controversy erupts, the reserves of trust available within the community of science are exposed, and there is a corresponding change in the social authority of science ... Thus both trust and judgement, central and enduring characteristics of academic science, are rendered suspect in practical circumstances.'

These concerns become particularly relevant for those involved in injury control and safety promotion because very few safety policies can be put in place without political support and public agreement. This necessitates the engagement of at least some scientists in the public domain. Traditional research activity, especially in universities, was confined to the academic world without frequent interaction with users of the knowledge. However, effective injury prevention and control work cannot be done in the in the confines of academia and needs the practitioner to engage professionals in other disciplines along with civil society. This mode of operation is relatively new and has been characterized by Gibbons *et al*. (1994) as 'socially distributed knowledge'. The differences between 'traditional knowledge generation' and 'socially distributed knowledge' is shown in Table 1.

Table 1
Features of traditional and socially distributed knowledge generation (Adapted from Gibbons *et al.,* 1994).

	Traditional Knowledge Generation	Socially Distributed Knowledge
Production sites	Problems set and solved by academic interests of a specific community	Context of application
Nature	Disciplinary	Transdisciplinary
Characteristic	Homogeneity	Heterogeneity
Organization	Hierarchical	Hetrarchical and transient
Social feedback	Individualistic, emphasizes autonomy	More socially accountable and reflexive

Injury control scientists work on generation of socially distributed knowledge. Such knowledge is difficult to produce and even more difficult to disseminate in an effective

manner. It is difficult to produce because of its transdisciplinary, heterogeneous, hetrarchical and transient characteristics. The work requires not only people in different disciplines working together but also the integration of knowledge generated by professionals who have no personal contact with each other. The actual operation of research projects may involve individuals who are not controlled by a single authority figure. In addition these scientists could also be working under very different paradigms and who may also have very heterogenous working methods. Scientific work under such conditions does not have a long history and tradition and so the methods and approaches used are in a nascent stage of evolution.

Injury control research fits this description of socially distributed knowledge rather adequately. Such work needs very innovative working techniques and the same are being evolved slowly. The present institutional structures, collaboration mechanisms for intradisciplinary research, peer recognition methods, information dissemination and sharing techniques, and structures for interaction between scientists and the public are still somewhat weak. The better structures and methodologies will become apparent only if we consciously evaluate experiences, successes and failures in widely different societies and settings and spread our net much wider than at present.

THE WAY FORWARD

This re-focusing of our efforts will not be easy. The international scientific community still does not view much of the work being done for injury control as 'sophisticated' enough. However,this view is likely to change as we become more adept at generating 'socially distributed knowledge' and our work leads to benefits for a larger proportion of the population around the world. Though most of the principles we discover will have universal applicability, many of the technologies and specific methods may not. Some critics may still not regard research work on many of these non-global technologies to be 'modern' or 'scientific' enough. However, the contrary is true. The issues surrounding these products are actually very modern. They are the products of the late twentieth century–combination of new socio-economic living patterns, instantaneous global communication, availability of sophisticated scientific knowledge and low per capita incomes. Work on these technologies will require very innovative thinking, familiarity with the latest scientific information, and packaging of products in ways which may require combination of technologies already available with those developed by locally in new settings. Unless we change our research and development activities in this direction we are likely to end up with very inefficient technological systems in our

effective injury prevention and control work cannot be done in the in the confines of academia and needs the practitioner to engage professionals in other disciplines along with civil society

society. Our success in future will depend on how much we are willing to learn from each other and blending perspectives rather than working in our narrow confines of 'science'.

Such changes will require much greater efforts to integrate theory with practice. Current trends in injury control are giving prime importance to data generation, surveillance and epidemiology. More and more sophisticated statistical methods are being used to analyse these data resulting in debates on micro-issues of methodology and definitions. Such work is also rewarded by journal editors and the scientific peer group in the form of published articles and recognition. However it need not result in deeper insight needed for socially generated knowledge. It is difficult to write a prescription for the future course of action, but the following guidelines may help us stumble onto the right path.

- A conscious effort to examine the theoretical directions in disciplines which do not have much involvement in injury control at present. Theories on complexity in physics, mathematics and computer science may help us understand the behaviour of the system that we want to make safer. Work in evolution, biology and genetics may give us clues on how natural systems behave. Linguists and philosophers of science could lead us to a better understanding of the role of metaphors and symbols in the building of knowledge. This transdisciplinary work would need the development of arrangements for information exchange even when partners are not involved in work on the same problem.
- Development of a better understanding of the needs, aspirations, compulsions and operational mechanisms of people belonging to low income communities. Only then would it be possible to promote safety policies which are sustainable in such settings. Such communities form the majority of the world population and also exist in a minority in HICs. They are the norm rather than the exception.
- Institution of imaginative collaborative projects between researchers working in low and high income communities. Since safety counter-measures in LICs have to be low cost, such projects could provide to useful insight on reduction of safety expenditures in HICs with evolution of innovative ideas and products. Joint working in LICs and HICs would give a better understanding of the characteristics of 'natural' systems.
- Exploration of societal arrangements and technologies which ensure safer lives with minimum policing.
- Promotion of safety as a fundamental human right. Inclusion of the costs of safety in the basic design of products, infrastructure, roads, buildings and work places. These considerations would decide whether any of these items should be put in place or not.

REFERENCES

Gibbons, M., Limoges, C., Noworthy, H., Schwartzman, S., Trow, M. and Scott, P., 1994, *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies*. (London: Sage).

Government of India, 1983, *Health Statistics of India*. Ministry of Health and Family Welfare (New Delhi: Government of India).

Haddon W., Jr., 1970, On the Escape of Tigers: An Ecologic Note. *American Journal of Public Health*, **60(12)**, pp. 2229–2234.

Haddon W., Jr. , 1972, A logical framework for categorizing highway safety phenomena and activity. *Journal of Trauma*, **12(3)**, pp.193–207.
Haddon W., Jr., 1973, Energy damage and the ten countermeasure strategies. *Human Factors* , **15(4)**, pp. 355–366.
Haddon W., Jr., 1980, Advances in the epidemiology of injuries as a basis for public policy. *Public Health Report* , **95(5)**, pp. 411–421.
Haddon W., Jr., 1974, Editorial: Strategy in preventive medicine: passive vs. active approaches to reducing human wastage. *Journal of Trauma*, **14(4)**, pp. 353–354.
Haddon, W., Jr., 1968, The changing approach to the epidemiology, prevention, and amelioration of trauma: the transition to approaches etiologically rather than descriptively based. *American Journal of Public Health*, **58(8)**, pp. 1431–1438.
Maurice, P., Lavoie, M., Charron, R.L., Chapdelaine, A., Bonneau, H. B., Svanstrom, L., Laflamme, L., Andersso, R. and Romer, C., 1998, *Safety and Safety Promotion: Conceptual and Operational Aspects*. (Quebec, Cananda: Quebec WHO Collaborating Centre for Safety Promotion and Injury Prevention).
Perrow, C.,1994, Accidents in high-risk systems. *Technology Studies*, **1(1)**, pp. 1–38.
Perrow, C., 1999, *Normal Accidents: Living with High-Risk Technologies*. (Princeton, NJ: Princeton University Press).
Raina, D.,1999, Science and its publics. *IIC Quarterly*, **26(2)**, pp. 42–53.
Robertson, L.S.,1983,*Injuries: Causes, Control Strategies and Public policy.* (Lexington, MA: Lexington Books).
Sathyamala, C., Sundharam, N. and Bhanot, N.,1986. *Taking Sides: The Choices Before the Health Worker*. (Chennai: Asian Network for Innovative Training Trust).