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SYMPOSIUM: ABJS/C.T. BRIGHTON WORKSHOP ON TRAUMA IN THE DEVELOPING WORLD

Managing the Injury Burden in Nepal

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Abstract Nepal loses about 530,000 disability adjusted life years (DALYs) per year to injury, predominantly due to falls. It takes 30,000 Nepali rupees (NR), or approximately US$430 at 70 rupees per $US saved per DALY to achieve primary prevention and 6000 NR per DALY if we invest in hospitals, versus 1000 NR invested in prehospital care, because simpler less expensive actions performed early have a greater impact on outcome than more complex measures later. A system for prehospital services was planned for medical emergencies at a national level meeting at the Medical University of Nepal to promote healthcare to victims in inaccessible regions by empowered or enlightened citizens. Feasible actions for common emergencies were defined and a tutorial required to help the majority of such victims was created and packaged. The knowledge and attitude component of the tutorial will be delivered through a web site to citizens motivated to learn and help with emergencies. The knowledge will be tested through a net-based Multiple Choice Questions (MCQ) test. Practical training in medical triage skills will be provided to those who qualify for the test at the University or its designated affiliates. A mobile phone-based

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information system will be created and used to make these enlightened citizens available to the victim at the site/time of the emergency.

Introduction

The burden of injuries in Nepal has yet to be addressed in a systematic fashion. Estimates of that burden are based upon 1990 data from the Indian region from the World Bank Agenda for Health 1993 [22] (Table 1). Estimates from Nepal assume the population of Nepal is 2% of India, though it was 2.5% in 2007 [7], and that the mechanisms of injury would be the same throughout the region. More recent studies of global burden, if more regionally relevant, could improve on these estimates because Nepal is unique in its mountainous terrain and the length of time it takes to get help for emergency victims [18]. Going by the time trend, in 2020 the injuries are expected to move from 9th to 3rd in the causes for DALY loss [7, 13, 14]. Furthermore, even though motor vehicles constitute only 65% of the burden as compared to falls tackling them in pre hospital care may be more cost effective than tackling falls. Self-inflicted injuries constitute 43% of the burden due to falls, and are another area where effective prevention may make a difference.

While strengthening of hospital-based services is extremely important, an effective system for prehospital services has yet to be developed for the injured, especially for the majority of citizens who reside in rural communities in the mountainous regions. Topographic considerations are perhaps most important when considering care for the injured in Nepal. Given the absence of roads navigable by car through 70% of the mountainous regions, and the limited rescue and retrieval services in Nepal [18], it remains impossible for rescue and retrieval teams to reach standards set in the west (8 minutes in urban areas and 11 minutes in rural areas). As such, the potential role for an informed bystander is far more important in Nepal than perhaps anywhere else in the world. The "enlightened and empowered" bystander must be educated, taught skills to act simply, correctly, and algorithmically as if by reflex, to make a substantial difference.

Table 1. Causes of annual burden of injury in Nepal in 1990 [17]

Cause	Women	Men	Total India	Nepal
Injury	**119**	**147.6**	**266.6**	**5.332**
Unintentional	**104**	**126.3**	**230.3**	**4.606**
Falls	21.1	28.9	50	1
Motor vehicle	9.4	23.1	32.5	0.65
Drowning	8.3	9	17.3	0.346
Fires	8.5	7.1	15.6	0.312
Intentional	**14.6**	**21.4**	**36**	**0.72**
Self-inflicted	10.8	11.1	21.9	0.438
Poisoning	0.8	2.1	2.9	0.058
War	0.9	2	2.9	0.058

We have calculated NEPAL DALY Loss as 2% of the Indian loss, assuming that Nepal's population is 2% of India's. Numbers in the cells are in 100, 000 DALYs.

Bold represent groups example **Unintentional** is subclassifiable into falls motor vehicle drowning and fires; **Intentional** includes self-inflicted poisoning and war; and **Injury** includes unintentional and intentional.

One pool of trained citizens are the Gorkha army pensioners from the Indian Army, some of who became competent in basic first aid and resuscitation through a 6-week training course given to selected soldiers in the Indian Army. They are designated Battlefield Nursing Assistants (BFNA). BFNA is a formal 6-week training program by the Indian Army followed by a certificate. Nine such soldiers are available to each infantry battalion of 850 at the battle lines. They evacuate (grab and run) casualties give first aid and triage only if conditions permit and get them to two Nursing Assistants under a medical officer at the Regimental Medical Aid posts safely behind battle lines for completion of triage and first aid. The casualty is then referred to the appropriate hospital, which according to the Evacuation Policy it should reach within the Golden period i.e. 6 hours. An estimated 140,000 such soldiers, a proportion of them trained, some of them coming to collect pension in the first 15 days of every month near the University, are available and motivated to become enlightened empowered citizens. These individuals might serve as local or regional trainers in basic first aid and prehospital services, and could supervise cascade training in which those newly trained go on to train others within their community.

This paper presents a plan developed, and being implemented, at the university level to manage the injury burden, based upon a Nepal Community Emergency Prepared Workshop held at the BP Koirala Institute of Health Sciences (Dharan, Nepal) in October of 2007. Stakeholders included individuals from the regional medical colleges and International Community Emergency Preparedness Group from the United Kingdom. At present, 23 of 72 members of the Nepal Orthopaedic Association are registered for this initiative. A similar effort has been initiated in the Chattrapati Shahuji Maharaj University, Lucknow, India where a Web site called Surakshit Lucknow is being designed.

The Country

Nepal is a landlocked country located in southern Asia. It has an area of 140,800 sq km, out of which 136,800 sq km is land and 4,000 sq km of water. It shares borders with China (2,926 km) and India (1,690 km) [7]. Its climate varies from

cool summers and severe winters in the north to subtropical summers and mild winters in the south [3]. Its terrain varies from flat in the south (the Terai), to hilly in the central region, to mountainous in the Himalayas in the north, including Mt. Everest (8848 meters) [3]. Natural resources include quartz, water, timber, hydropower potential, scenic beauty, small deposits of lignite, copper, cobalt, and iron ore. Forty-two percent of the land is forest or woodland, and only 17% is arable land. It has its share of natural hazards including severe thunderstorms, flooding, landslides, drought, and famine depending on the timing, intensity, and the duration of the summer monsoons [3]. Dependence on wood for fuel, and cutting down trees to expand agricultural land (without replanting), has resulted in widespread deforestation, soil erosion, and water pollution. Use of contaminated water presents human health risks. Nepal is part of international agreements on Biodiversity, Climate Change, Desertification, Endangered Species, Hazardous Wastes, Law of the Sea, Nuclear Test Ban, Ozone Layer Protection, Tropical Timber 83, Tropical Timber 94, Wetlands, Marine Dumping, and Marine Life Conservation.

Demographics

The population of Nepal is approximately 29,000,000 (2008), with the majority living in the Central Highlands and 90% living in rural areas [19]. The Nepalese are descendants of three major migrations from India, Tibet, and North Burma and Yunnan via Assam. Among the earliest inhabitants were the Kirat of east midregion, Newar of the Kathmandu Valley and aboriginal Tharu in the southern Terai region. The ancestors of the Brahman and Chetri caste groups came from India Kumaon, Garwal and Kashmir, while other ethnic groups trace their origins to North Burma and Yunnan and Tibet, e.g. the Gurung and Magar in the west, Rai and Limbu in the east, and Sherpa and Bhutia in the north. In the Terai, a part of the Ganges Basin with 20% of the land, much of the population is physically and culturally similar to the Indo-Aryans of northern India. The mountainous highlands are sparsely populated. Kathmandu Valley, in the middle hill region, constitutes a small fraction of the nation's area but is the most densely populated, with almost 5% of the population. Nepal is a multilingual, multireligious and multiethnic society. The major caste/ethnic groups identified by the 2001 census are Chetri (15.8%), Hill Brahmin (12.7%), Magar (7.1%), Tharu (6.8%), Tamang (5.6%), Newar (5.5%), Muslim (4.3%), Kami (3.9%), Rai (2.7%), Gurung (2.5%), and Damai/Dholi (2.4%). The remaining 92 caste/ethnic groups (including the world-famous Sherpa) each constitute less than 2% of the population [3, 7, 18, 19, 22].

Economy

Nepal is one of the poorest countries in the world and was listed as the eleventh poorest among 121 countries in 1989 [8, 16]. Estimates of its per capita income for 1988 ranged from US$158 to US$180. Various factors contributed to the economic underdevelopment—including terrain, lack of resource endowment, landlocked position, lack of institutions for modernization, weak infrastructure, and a lack of policies conducive to development.

Nepal's economy is irrevocably tied to India [16]. Nepal's geographical position and the scarcity of natural resources used in the production of industrial goods meant that its economy was subject to fluctuations resulting from changes in its relationship with India. Trade and transit rights affected the movement of goods and increased transportation costs, despite Nepal engaging in unrecorded border trade with India. Real economic growth averaged 4 percent annually in the 1980s, but the 1989 trade and transit dispute with India adversely affected economic progress, and economic growth declined to only 1.5 percent that year as the availability of imported raw materials for export industries was disrupted. Nepal is focusing on development of tourism, hydro-power projects, agriculture, education and healthcare, and considers India its natural ally in these areas.

The Nepalese rupee has historically been linked to the Indian rupee [16]. Since the late 1960s, the official currency has been Nepalese, although as of 1991 Indian currency was still used as convertible currency. During the trade and transit dispute of 1989, however, Kathmandu made convertibility of the Indian rupee more difficult.

Government and Politics

Nepal has undergone tremendous changes in the past year. A 2006 peace agreement ended a decade of fighting between government forces and the Maoists, and the country's king gave up all power other than his ceremonial status. Plans were set in motion to elect a constituent assembly, which would determine the country's future by writing a new constitution [4]. Now a government lead by Maoist may come in power.

Health Care

Nepal has 12 private medical colleges and three government ones, including a Medical University (from which the plan of training the enlightened citizen arose), a philanthropic hospital for rehabilitation of disabled children, private nursing homes mainly in the capital of

Kathmandu, and a poorly staffed, motivated, equipped and organized government health system. Formal healthcare is available only through medical practitioners, and most medical problems are solved at the level of medical shops. The ratio of doctors/health care providers to population is very low [6].

The government's role in health care is primarily regulatory, and there has been limited responsiveness to the real problems at periphery, which has impeded the growth and development of the public or government health care system. Also, any new public health or education policy must pass through an insensitive system, and is likely to face resistance. However, private enterprise in this area aided by external resources does make modern health care available to the richer people. Ninety percent of the population resides in rural areas and there has been a concentrated shift of the rich and the educated towards the capital in the Kathmandu valley over the past 25–50 years.

The Nepal Community Emergency Preparedness Workshop

The need to create, update, and maintain a chain of enlightened citizens within the territories of Nepal is recognized, and this group should be available to all victims of medical conditions that can kill, acutely distress, or disable the victim, when the outcome can be altered by timely action. Such citizens would also be educated and empowered to appropriately respond to emergencies affecting the community like outbreaks or disasters [21]. The "survival chain" is defined as the victim, the first responder, the community responder, the organized rescue and retrieval service, the emergency services of the hospitals (levels 1 primary heath centers [15] and posts, 2 District Hospitals and 3 Provincial hospitals) and their convalescent wards. Rehabilitation services and outreach followup services were labeled as the "recovery chain." With the goal of making essential, community-based prehospital services available to the last person in the queue, the challenge will be how to educate these enlightened citizens; individuals from all communities must be educated and empowered to act correctly and with confidence in such emergencies. The knowledge must be basic and well thought out, standardized, algorithmic, evidence based, and the risks and benefits must be adequately researched and established. The provision of fast and reliable channels for communication between the links in this survival chain, for example through the use of cellular phones or standard land lines, will also be essential.

This program would build on and add to the existing programs working towards the same goals, and would not threaten or compete with them. The constructive roles of institutions, health providers, pharmacists, associations, practitioners, electronic and print media, government, supporting countries and possible user countries were discussed in detail and their importance recognized. Both individuals and institutions, nationally and internationally, will be welcome to participate in a friendly, collaborative, noncompetitive manner. Inclusiveness will be promoted to avoid duplication of efforts.

Research is an important component of the process. A better understanding of the epidemiology (who, when, where, how and why) of injuries in our environment is required to inform any educational program, to direct the transfer of appropriate knowledge and skills. Regionally relevant data will be used to initiate evidence-based action. The research agenda will also include an ongoing study to evaluate the impact of the project, which will ultimately optimize performance.

With regard to dissemination, the Nepal Community Emergency Preparedness Group decided to use all techniques of creating, updating and transmitting regionally relevant but standardized knowledge including media. This would expand awareness of the project and widespread participation would ensue. Perseverance and patience were identified as the key components of the activity. A website was constructed and launched (www.surakshitnepal.com) to enhance visibility, and to facilitate communication and networking. (An estimated less than 1%[1] of the population has access to the Internet.) Schoolchildren, doctors, and office workers are exposed to networking mainly within cities. But a much larger population is exposed to radios, televisions, health centers, and personal communication through Army pensioners in remote areas. Simple content effectively communicated through multiple channels is the key to the success of the program.

Possible sources for funding were discussed for this comprehensive, nationwide much needed activity. While the magnitude of funds required may be much less than many other health-related initiatives, these must be sustainable. All participants pledged to use their ingenuity and resources for fundraising. The importance of minimizing costs was stressed. Strategies for intervention should be comprehensive yet simple and proven. It should be cost-effective and should utilize existing systems of reaching people. Keeping educational intervention simple, interesting, short, comprehensive, precise, skill-based and in multiple languages to be usable in all SAARC countries were discussed and identified as important keys to success. The expected impact of the workshop was a chain reaction of supportive activities in participating institutes, health providers, bodies, government, lawmakers and other friendly countries.

[1] According to GP Adhikari 2007 in Proceedings of 1st International Conference on Theory and Practice of Electronic Governance 2007.

Action Taken or Planned

This consortium of participating universities and institutions in the CEP workshop decided to act to ensure Community Emergency Preparedness as soon as possible by: (1) creating a Nepal Community Preparedness Group in which all participants will be founding lifetime members; (2) deciding the group will be stationed at the Vice Chancellors Office BP Koirala Institute of Health Sciences and will be coordinated by Dr. Praveen Nepal, the Organizing Secretary of the workshop: (3) members will be those willing to function for Education, Research, Services in the community to achieve and optimize the enlightened citizen chain and community emergency preparedness in Nepal: (4) members may also be those willing to support networking and collaboration between institutions, bodies, officers, offices, persons, groups and people to create the Network of Enlightened Citizens of Nepal, a chain of survival in Nepal, and prepare the communities in Nepal to face individual and mass emergencies.

A web site has been launched (www.surakshitnepal.com), to enable anyone to access to the educational materials. The detailed Power Point presentation that initiated these decisions has been uploaded on the web site. The teaching materials include, but are not limited to, knowledge on how to contain the disaster, how to call for help, and how to classify the injured (walking, talking, breathing versus bleeding, broken, or dying), and help deploy the former three to help the latter three. This is already available in English and is being translated into Nepali and Hindi. The classification was developed by the Department of Orthopedics, BPKIHS and adopted at the Community Emergency Preparedness Workshop in October 2007. The video banks of the WHO will be made available at the web site to allow doctors at the district hospital level to download them and improve their knowledge and skills in treating fractures by simple doable means. After registration, interested individuals may take an online net-based multiple choice question test, consisting of 100 questions covering knowledge needed to act in emergencies. Incorrect responses will be explained to the user. A passing score will make one eligible to receive 3 hours of practical training at the health service delivery center affiliated with the university nearest to his home. After training he/she will be certified and his name, address, and mobile number will be put in the database. The module for practical training was developed and modified during the October workshop, and has been adopted by the Nepal Orthopedic Association.

The victim or those helping them can access the site or call a number and the site will be accessed on their behalf, providing the caller with names, addresses and mobile numbers of five EE citizens nearest to the site of the event. The empowered citizens will also be informed of the nature of the problem and requested to help until formal rescue and retrieval arrives.

A project is also being submitted to the Indian Government through the Indian Embassy to build for BPKIHS five rescue and retrieval centers at 300 km distance along the main east-west highway of Nepal, shortening the time of accessing a facility along the 1300 km highway to 3 hours. The local VDC (village development committee) will provide the land, and the funding organization from India will provide the infrastructure (building, equipment, ambulances) and the manpower (empowered citizens to staff the centers).

The Research component, including both epidemiology and impact analysis, focusing on strengthening the system for delivering care, will be performed by the School of Public Health and the Clinical Epidemiology Unit at BPKIHS.

Discussion

In Nepal, the lack of any organized system for prehospital care has a negative impact on outcomes following injury; many of the injured are carried on another person's back through miles of jungles and mountains before they reach a health post. Political instability has also impaired the development of a formal rescue and retrieval system, which remains a distant dream. How can Nepal keep up with the rest of the world with regard to initial care of the injured? One approach is to train ordinary citizens in first aid. This concept has been used in other low income countries using various approaches [1, 9, 12, 20].

This topic has been debated at the University level, and the specific example of the Gorkha Battle Field Nursing Assistants may serve as an excellent model. The literature has shown that informal mechanisms for prehospital care, such as our enlightened citizen, may be successful. There is considerable variation between low income countries in the type of emergencies, as well as their time, place and person distribution, the skills of first responders available to tackle them, and transport times to a treatment facility. Despite this, innovative solutions have been developed at the local or regional level. Mock et al. [12] reported results of training drivers in Ghana. Control of external hemorrhage was quickly learned and used appropriately by the drivers. Areas identified needing emphasis in future trainings included consistent use of universal precautions and protection of airways in unconscious persons using the recovery position. They concluded that the training should be locally developed, evidence based, educationally appropriate, and focus on practical demonstrations. Tiska et al. [20] conducted interviews with 71 of the 335 drivers

receiving 6 hours of training in Ghana at a mean of 10.6 months after the course. Sixty-one percent indicated that they had provided first aid since taking the course. There was considerable improvement in the provision of the components of first aid in comparison to what was reported before the course: crash scene management (7% before versus 35% after), airway management (2% versus 35%), external bleeding control (4% versus 42%), and splinting of injured extremities (1 versus 16%). They conclude that even in the absence of formal Emergency Medical Services, improvements in the process of prehospital trauma care are possible by building on existing, although informal, patterns of prehospital transport. Arreola-Risa et al. [2] report that increasing the number of ambulance dispatch sites from two to four in a Latin American city decreased response time from a mean of 15.5 ± 5.1 minutes to 9.5 ± 2.7 minutes. They further report that prehospital trauma care improved after initiation of the PHTLS course. For all trauma patients, use of cervical immobilization increased from 39% to 67%. For patients in respiratory distress, there were increases in the use of oropharyngeal airways (16–39%), in the use of suction (10–38%), and in the administration of oxygen (64–87%). For hypotensive patients, there was an increase in use of large-bore intravenous lines from 26% to 58%. The improved prehospital treatment did not increase the mean time at the scene (5.7 ± 4.4 minutes before versus 5.9 ± 6.8 minutes after). The percentage of patients transported who died enroute decreased from 8.2% before the course to 4.7% after. These improvements required a minimal increase (16%) in the ambulance service budget. Chandy et al. [5] tested a model for rural prehospital trauma care in a five-year prospective study in North Iraq and Cambodia. From 1997 to 2001, 135 local paramedics and 5,200 lay first responders were trained to provide in-field trauma care. The study population comprised 1,061 trauma victims with a mean evacuation time of 5.7 hours. The trauma mortality rate was reduced from preintervention level at 40% to 14.9% over the study period (95% CI for difference 17.2–33.0%). There was a reduction in trauma deaths from 23.9% in 1997 to 8.8% in 2001 (95% CI for difference 7.8–22.4%), and a corresponding major improvement of treatment effect by year. The rate of infectious complications remained at 21.5 percent throughout the study period. They conclude that low-cost rural trauma systems have a substantial impact on trauma mortality in low-income countries.

The situation in Nepal differs from many of these other countries, especially due to topography and the absence of motorable roads for a large percentage of the population. Approximately 70% of victims must be transported on the backs of animals (or humans) to a road, and then through either public transportation or private buses, to either private nursing homes or the government hospitals. As such, an innovative approach must be developed to improve the delivery of prehospital services. After considerable thought and discussion, we feel that trained citizens are the most likely individuals to provide initial care for the injured. The target population for our training program is young, enthusiastic, eager to learn, and has sufficient intelligence to act correctly and in time. These individuals are remotely distributed, and most cannot access the Internet. Most do have access to radios and television. The challenge will be to create a critical mass, to maintain interest in this worthy project, and to develop an educational pathway focusing on learning, doing, and then teaching. Quality control may be achieved through both internet-based examinations (multiple choice) and more practical skills-based assessment governed by a university or its affiliates. We hope to engage the large group of Battle Field Nursing Assistants in remote areas to champion this approach. They may help to deliver services, train others, and increase visibility/network for this cause. However, since many things in Nepal move through the government, the enlightened citizens program might fit within a larger initiative supported by the British government, which envisages strengthening the primary health services. Indian help through the BFNA trained army pensioners will also be invaluable. We are headed toward a day when victims will receive adequate care at the site of injury, and will have a well-established mechanism for transportation to a treatment facility. In addition to the citizens who will ultimately run this program, we will require the support of multiple stakeholders, including the Nepal government, governments of friendly nations, the media, the medical community and professional associations, and students. We hope to initiate a sustainable program for the delivery of services for the injured at the site of injury.

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