



UNINTENTIONAL AND INTENTIONAL INJURY (VIOLENCE)

The Most Overlooked Public Health Issue?

Stafford C. Rorke

Overview

In a previous advocacy paper outlining the rationale for a new baccalaureate degree, Rorke and Goslin (2002) drew attention to broad wellness, health promotion, and injury prevention (WHP) issues, with only brief reference made to “accidental deaths.” However, the global burden of unintentional (UI) and intentional (II) injury, and specifically the challenge facing the USA, deserves special attention. One purpose of this paper is to reiterate a WHP focus on UI and II. Arguably, UI and II are among the most overlooked of public health issues. Unintentional injury is the 5th leading cause of death in the USA, self-inflicted harm (suicide) the 11th cause of death, and homicide the 15th cause (Centers for Disease Control [CDC], 2006). Given that the leading cause of death between ages 1 to 44 years is injury, when combined, UI and II is the leading cause of years of potential life lost (YPLL) under age 65 in North American society, ahead of coronary heart disease and

cancer (Christoffel and Gallagher, 2006). Annually, worldwide, close to 6 million (M) people die from injury (World Health Organization [W.H.O.], 2001); and, more than 161,000 deaths occur in the US every year (in excess of 440 per day), including over 32,400 suicides and 17,500 homicides (Centers for Disease Control [CDC], 2006). This advocacy paper highlights the magnitude and gravity of the public health injury problem; and, further, is a call to action on the part of concerned citizens. We all have a responsibility for injury prevention and safety promotion. Enhanced awareness of the severity of the problem, a basic understanding of injury epidemiology, and application of public health injury prevention principles and strategies are urgently needed.

Key Words: Unintentional and intentional injury, violence, years of potential life lost, injury prevention, advocacy, safety promotion.

Causes of death: A misplaced public health emphasis?

Leading causes of death for developed countries are well known to health professionals. Health educators routinely teach the “top ten” list in personal and introductory allied health classes. Health professionals are acutely aware of mutual risk factors for the four leading causes of death (heart disease, cancer, stroke, and chronic lower respiratory disease), as well as the leading goal of Healthy People 2010 to increase the quality and years of healthy life (United States Department of Health and Human Services and the Surgeon General [USDHHS], 2000). Therefore, health professionals focus most health promotion efforts toward preventing degenerative and similar lifestyle-related *diseases*. Arguably however, apart from work-related and sport injury prevention efforts, few health promotion professionals or educators devote much time to issues related to UI and II. Given that the greatest contribution

to YPLL is injury, are current health promotion efforts not inappropriately skewed toward degenerative disease? Health professionals need to advocate, educate, and implement more assertive public health injury prevention (IP) strategies for clientele, and/or include IP in the curriculum content of health promotion symposia or courses.

Definition of injury

Injury is defined as damage or harm to the body resulting in impairment or destruction of health: “*Any unintentional or intentional damage to the body resulting from acute exposure to thermal, mechanical, electrical, or chemical energy, or from the absence of such essentials as heat or oxygen*” (National Committee for Injury Prevention and Control [NCIPC], 1989). Injuries are sub-classified UI, judged to have occurred without anyone intending harm to be done; or II, those purposely inflicted, whether by oneself or another. The World Health Organization generally refers to II as violence, defined as: “*The intentional use of physical force or power, threatened or actual, against oneself, another person, or against a group or community, that either results in or has a high likelihood of resulting in injury, death, psychological harm, maldevelopment or deprivation*” (Krug et al. 2002). Injuries in these UI and II contexts are limited to event outcomes that occur over a short time frame, seconds to minutes, rather than chronic overuse or overexposure injuries.

Why injuries should be cause for greater concern

Worldwide, between 5 and 6 million injury deaths occur annually, accounting for 12% of all recorded deaths (USA 6.6% of deaths). Two out of three of these are males and the majority are young adults aged 15–44 (W.H.O., 2001). Table I illustrates data for 2003/2004 leading causes of injury death in the USA. While specific causes vary slightly by year, generally UI accounts

Table 1: Selected leading causes of injury death in the USA (2003/2004 data), by mechanism of injury (NCHC, CDC, 2006) (Summary UI and II in italics).

Injury mechanism	Number of deaths (To nearest 100)
<i>All injury</i>	161,800
<i>Unintentional</i>	112,000 (69%)
<i>Suicide</i>	32,400 (20%)
<i>Homicide</i>	17,500 (11%)
Legal intervention	300
Undetermined	4,800
Motor vehicle (# 1 cause of UI death)	
3.3 million non-fatal injuries in 1999	43,300
Firearm (includes suicide, homicide and legal intervention)	30,200
Poisoning	19,500
Falls	17,200
Suffocation	5,600
Drowning	3,300
Fires, flames and smoke	2,600
Natural/environmental	1,600

for 66% of injury deaths, followed by II suicide (approximately 20% of injury deaths), homicide (11% of injury deaths), leaving 3% unaccounted for (National Center for Health Statistics [NCHS], Centers for Disease Control [CDC], 2006).

Critically, although UI ranks as the fifth leading cause of death, UI and II combined are the leading cause of years of potential life lost (YPLL) before age 65 because 1–44 year olds are most affected. Injury accounts for more YPLL than disease (USDHHS 2000; NCIPC, 2003; Christoffel and Gallagher, 2006). Many health professionals argue that injury is the leading public health concern facing the country (Christoffel and Gallagher, 2006; McKenzie et al. 2005). Of those living in the US today, 6 million can expect to die from injury. Death rates are highest in 15–24 year olds and the very old. Trends are mixed

and not entirely encouraging. According to the National Safety Council (NSC, 2005), data for 2004 show increases in overall injury mortality, while motor vehicle crash (MVC) deaths are marginally reduced by comparison to previous years.

Deaths the “tip of the iceberg”

But the focus should not be solely on injury deaths because deaths are a fraction of the overall injury burden to society, representing only the tip of the iceberg (W.H.O., 2001). Non-fatal injuries affect millions of Americans. Relative to the 161,000 annual deaths in the USA, in 2003, approximately 23.8 million people sought medical treatment for injury, 2.8 million were hospitalized, 40 million treated at a hospital emergency department and 99 million visits to physician offices were due to injuries (NSC, 2005).

Economic cost estimation is not exact, but rather an approximation. However, the economic burden of injury becomes apparent when the direct and indirect cost of \$575 billion for injuries in 2004 (NSC, 2005) is compared to the costs for coronary heart disease (\$394 billion in 2005) and cancer (\$210 billion in 2005), (CDC, 2006). Annual acute injury disability statistics are staggering: 21 million disabling injuries, 75,000 brain injuries, 2,000 left in a vegetative state, 6,000 left para- or tetraplegic, 162,000 injuries restrict activities of daily living (92% require medical attention), and more than 5M life-years lost (9 years per injured person). Impact on productivity is startling. Therefore, annual injury disability and cost statistics represent a significant burden to the country (USDHHS, 2000; NCIPC, 2003).

Paradigm shift: Injuries are not “accidents”

The word “accident,” though in common use, is a vague, misleading term suggesting lack of understanding of the

causes of injury, attributing injury to random chance, luck or fate, or unpredictability. Consequently, injury prevention is not uppermost in the minds of most people. Many continue to think of injuries as haphazard, uncontrolled factors, rarely considering injury likely, or within personal control. Denial is often a factor: “It can’t happen to me.” Many individuals, as well as the media, pay little attention to injury except following a catastrophic event such as an airplane crash or natural disaster, when scores are killed or injured, or only when a high-profile personality dies tragically. Negligible education of the public occurs except in the context of questions raised about such events.

At the outset, health professionals should utilize correct terminology. There is general consensus among IP advocates that *unintentional injury*, *intentional injury* (or *violence*—self inflicted, interpersonal, collective), *injury prevention*, and *injury control* are appropriate terms, rather than the use of “accident.” Routine reference to a specific injury mechanism, such as *motor vehicle crash* (MVC), *road traffic injury* (RTI), fall, poisoning, or burn, rather than an “accident” is better use of terminology.

Personal responsibility for injury causation should be created in the minds of people, thereby removing common self-pity for being the victim of an uncontrollable event. Instead, acts of personal indifference, carelessness and/or stupidity may be identified (Chapman, 1961); but exclusive emphasis on personal responsibility can result in a climate of blame. Therefore, in addition to personal responsibility, attention should also be given to environmental as well as socio-cultural factors in injury causation. A complex area, the models outlining ecological factors in injury causation (individual, interpersonal, community, and society) by Krug et al. (2002) and Hanson et al. (2002; 2005) are recommended reading.

Issues related to vested interest groups that deliberately confuse IP issues (e.g. gun lobbyists) are beyond the scope of this paper, but it remains troubling that little progress has been made to directly reduce the annual incidence of over 30,200

deaths associated with firearms. Injury prevention also lacks the mystique and high-tech aura of medicine with its “magic bullet,” therefore resulting in limited interest in IP by the public, or those in medicine. In selected instances there is also a lack of injury surveillance and data (Christoffel and Gallagher, 2006). The fact is that injury events are not random, but rather, are predictable, controllable, and preventable.

Responsibilities of every health professional/citizen

It is contended that every person, but specifically every health professional, should be better informed about injury, as follows:

1. Knowledge of major injury risks in the environment

Leading causes: Ranked leading causes of injury death can be seen in Table I above. Generally, with some annual variability, the manner of death for all ages, UI and II combined, is as follows: 1. Motor vehicle crashes; 2. Firearms; 3. Poisoning; 4. Falls; 5. Suffocation; 6. Fire/burns/smoke; 7. Choking 8. Drowning; 9. Cuts and pierces.

More UIs occur in the home than in any other place. Highways are ranked 2nd for non-fatal injury occurrence but 1st for UI deaths. The recreation and sports area is the 3rd most likely place to sustain injury, followed by the workplace (USDHHS, 2000, Christoffel and Gallagher, 2006).

Intentional injuries: In the USA approximately 50,000 people die each year from II while approximately 2.2 million receive nonfatal injuries as a result of interpersonal violence. Types include assaults, family violence, rape, robbery, suicide, and homicide. The US homicide rate has steadily fallen from a high of 9.8 per 100,000 in the early 1990s to the current 5.5 per 100,000, but still far exceeds the Canadian 2004 rate of 1.95 per 100,000. Further, rates of assault and rape have declined in the USA, but clear risk factors are associated with each. Over 32,400 suicides are reported each year; and sadly, rates among

the young have tripled since 1950. Firearms, the 2nd leading cause of injury death (> 30,000 per year), are involved in approximately 60% of homicides and 57% of suicides (USDHHS, 2000, Christoffel and Gallagher, 2006; Statistics Canada, 2006).

Collective violence, including war, is also a factor. As of January 16, 2008, Iraq war US military casualties stood at 3,926; and, with a ratio of death-to-injury argued to be anything from 1:8 to 1:25, depending on injury classification; official reports put the wounded at 28,870, while estimates are as high as 100,000. One of every ten soldiers is evacuated for mental problems and has psychiatric behavioral issues. The Iraqi civilian death toll estimates vary from 80,621 to 88,044 (Iraq Body Count); the British medical journal *The Lancet*, places the number at 100,000; while others estimate the figure at close to 1.2 million (Ewens, 2008). Suicide rates in the US military, normally lower than civilian rates in peace time, now exceed the civilian toll. The long term consequences of post traumatic stress disorder, suggested to affect over one third of veterans, are likely to reverberate in US society for a long time to come; one quarter of US veterans are homeless (Cooper, 2006; 2007).

Some may contend that the II arena is beyond the scope of many health professionals; but each individual can act as an advocate, educator, or counselor in appropriate situations, provided that the individual is well informed and appreciative of factors contributing to injury: firearm accessibility, family violence (1 in 6 homicides), child maltreatment (abuse, neglect), human trafficking and slavery, intimate partner violence, elder abuse, negative shifts in normative behavior, politics, and public policy issues.

2. Knowledge of basic injury epidemiology theory and practice

Injuries occur in predictable patterns but can only be produced by an energy exchange between humans and their environment (Christoffel and Gallagher, 2006). The basic task of IP is to prevent the agent (energy) from reaching people in amounts or at rates that exceed the capacity of human body

tolerance. An injury triad of host (human), agent (energy, vector), and environment interacts to create injury potential, exacerbated by socio-cultural issues. William Haddon Jr. (1970; 1981) developed a phase-factor matrix useful for IP planning, strategy identification, and resource allocation (see Table II example).

Timing and precursors: Unintentional injuries, though unplanned events, are usually preceded by an unsafe *act* or *condition*. There is predictability to UI events, for example, MVC rates are highest in December and January, in the *post-midnight* hours (9 to 12pm for novice drivers), with alcohol involved in 40% of the fatalities. Fatigue is as devastating as alcohol. Distractions are also a leading cause of MVC (15,000 deaths per year; 3,000 attributable to cell-phone use). Drowning occurs more often in summer months with alcohol being involved in nearly half. More fires occur in winter (McKenzie et al, 2005).

3. Awareness of disparities in injury occurrence

Injury profiles vary by age, sex, race, income, location and type (USDHHS, 2000; Christoffel and Gallagher 2006, McKenzie et al. 2005): Native Americans have highest injury death rates. African Americans have highest homicide rates. African American males have 7 times greater risk of violent death than Caucasian males. White and Native Americans have the highest suicide rates. Death rate varies inversely with per capita income. UI is highest in rural areas where males have greater UI than females. Burns, firearms, and MVCs are most prevalent in the young and in adults, falls are more prevalent in the aged. The majority of non-fatal injuries occur in the home, but the mostly likely place for death is the road.

4. Recognition that it costs less to prevent than treat an injury

Though dated, these statistics from USDHHS (2000) illustrate this point: Every child safety seat saves \$85 in direct medical costs, plus \$1,275 in indirect costs; every bicycle helmet saves \$395 in total costs; every smoke detector saves \$35 in

Table II: A Haddon Matrix Example—Motor Vehicle Crash. Adapted from Christoffel and Gallagher, 1999.

Phases	Human factors (Host)	Agent or Vehicle (Vector, Energy)	Physical Environment	Socio-cultural Environment
Pre-event	Driver ability Driver training Fatigue Alcohol use	Vehicle roadworthiness How well vehicle is maintained	Inadequate signs and signals Inadequate policing	Public attitudes on drinking and driving, speed, seat belt use etc.
Event	Energy absorbed via occupant restraints—seat belts, front and side air bags	Vehicle Crash Worthiness: Crumple zones Energy absorbing steering wheel Side impact bars	Presence of fixed objects—trees, ditches, poles bridges Soft shoulders on roadside	Law enforcement of mandatory seat belt use, speeding, drinking
Post-event	Crash victim's health status; includes sobriety	Vehicle gas tank designed to minimize risk of post-crash fire	Availability of effective EMS response	Public support for trauma care and rehabilitation infrastructure

direct medical costs and \$865 in other costs; every dollar spent on poison control saves \$6.50 in medical costs.

5. Knowledge of what works in injury prevention

Strategies combining behavior change, environmental modification and law enforcement have demonstrated success: Car safety seats and belts, air bags (including side airbags), bicycle helmets, motorcycle helmets, graduated novice driver laws (including eliminating peers in the vehicle, distractions such as cell-phones, and driving after 9pm), minimizing driving distractions and universal application of no cell-phone use while driving, zero tolerance laws for drinking and driving, child resistant packaging, smoke and carbon monoxide detectors, swimming pool fencing, miscellaneous use of protective equipment in sports and recreation such as helmets, eye/ear protection, mouth guards, gloves, elbow or shin guards, protective equipment at home/work such as eye safety glasses when using a lawn edge trimmer, and/or gloves when using harsh chemicals.

6. Implementation of the Es of IP and becoming an IP advocate

Education: Continuing education efforts can be devoted toward personal safety and IP, for the family and the community. Public health injury epidemiology and prevention can be added to academic course work. Basic IP or safety awareness questionnaires can be implemented in the health promotion setting. Clients/patients can be asked about routine behaviors or attitudes related to IP strategies. Follow-up discussion opportunities can increase personal safety awareness, for example, use of protective equipment. Provision of IP and safety fact sheets in the health center setting is encouraged. Such materials are readily available from local and national IP agencies.

Environment: In addition to providing a safe environment for others, individuals can increase awareness of the general environment in the community, both physical and socio-cultural, by looking for ways to enhance physical safety and to positively

influence collective IP behaviors. To create a normative shift in society individual attitudes toward injury need to be assertively challenged by IP advocates. For example, there is widespread lack of knowledge about *inattention blindness* risk while driving and using a cell-phone.

Enforcement: Individuals can collaborate with local authorities to increase safety measures such as helmet use, or operational smoke detector use; by supporting enhanced law enforcement for existing legislation; or being an advocate for appropriate new legislation.

Emergency Response System: Individuals should become familiar with the Department of Homeland Security national community emergency response preparedness strategies. For example, have a disaster emergency plan and routinely practice emergency response drills, such as home fire escape routes. (Many people underestimate the danger of fire—depending on combustion factors there are only 2–5 minutes to safely escape a home fire). The author asserts that at least one worker per company division, and at least one family member in every US household should complete Community Emergency Response Team (CERT) training (US Citizen Corps, 2006).

7. Application of the “The Haddon Ten” principles of IP

William Haddon Jr. left a legacy of straightforward injury principles, which are relatively easy to apply. Selected examples of the application of each principle appear below.

i. Prevent creation of the hazard: Individuals should avoid high-risk activities that increase hazard potential and injury risk. For example, alcohol has no place in sports activity, during most activity-based recreational settings (e.g. boating), or when driving. Cell-phone use, or fatigue while driving, significantly increases crash potential. Failure to use recognized safety equipment invites disaster. Being alone without partner assistance in selected activities (e.g. hiking), increases injury risk. Prolonged activity in excessive heat and humidity without adequate fluid intake increases risk. “Trip” hazards increase fall

risk in sport, recreation and in home/work environments. While suffering an infection, viral myocarditis risk increases with high-intensity or prolonged physical effort (increased risk for fatal heart attack).

ii. Reduce the amount of the hazard: Individuals should not be overconfident about skill, strength or fitness level; and reduce speed in risky activities to reduce injury potential. To avoid over-training injuries training volume and intensity should not be increased by more than 10% per week. Heat and sun exposure times should be limited. Many common household chemicals are hazardous in concentration and should be diluted.

iii. Prevent release of existing hazards: Many sport and recreational activities have an inherent risk that can be modified or reduced. Proper maintenance of equipment (brakes, safety harnesses) reduces risk of catastrophe. Recommended safety procedures with “dangerous” items (guns, other weapons, sports/recreation equipment, or household products) should be followed to prevent unexpected discharge of hazardous energy.

iv. Modify rate or spatial distribution of the hazard: Impact is inherent in sport, recreation, and several activities of daily living. Individuals should ensure impact surfaces are “human friendly” to dissipate force/momentum. Basic understanding of physics and injury biomechanics related to energy transfer apply: a 50lb child cannot resist a 200lb adult in a “game;” wearing a seat belt in a car crash increases survivability; an unrestrained 20lb child (or pet animal) without proper restraint technology in place (air bag) is likely to suffer significant injury, or die, following a dead-stop car crash at 35 miles per hour. Crashing an automobile at 30 miles per hour is like diving headfirst off a three-story building (Allman, 1985).

v. Separate in time or space, the hazard from that which is to be protected: When sick with a cold or flu, one should choose voluntary isolation from co-workers, clients, friends and family. No favors are done when exposing others to infection risk. Spec-

tators (particularly children) should be at a safe distance to avoid being hit with objects in sport (balls, pucks, athletes). In residential areas, authorities should be encouraged to provide and enhance cycle and pedestrian paths to separate cyclists, walkers and runners from other vehicular road traffic.

vi. Place a barrier between the hazard and what is to be protected: Clear-cut, self-responsibility means of protection are often overlooked, either through lack of economic means to afford protection, overconfidence, complacency, negligence, ignorance, or sadly, stupidity. Protective equipment should always be worn. Helmets, gloves and pads used for cycling, motorcycling, skate-boarding, when using roller-blades, or when skiing and eye/ear safety protection at home/work (edge trimming, high decibel environments). Sadly, the recent skate-boarding death on the Oakland University campus could probably have been prevented if the individual had worn a helmet. Hazardous substances/objects should be out of the reach of children.

vii. Modify the relevant basic qualities of the hazard: Examples: Training wheels on a child's bicycle; limit power outputs, speed, and area of force impact (reduced pressure) via equipment or rule modification in sport and recreation, as appropriate to age and physical capability. Ergonomically modify the workplace and enhance home safety.

viii. Make what is to be protected more resistant to the hazard: Not everyone can afford a crashworthy "Hummer," but individuals can research and choose the safest affordable car. Sports participants should "get-fit-to-play-sport," rather than use "sport-to-get-fit" because "weekend athletes" often suffer needless injury. Functional physical fitness should also be improved if engaged in a physically demanding occupation. Individuals should be fit before the snow-shoveling season to prevent back injury. SportSmart®, a 10-point plan for sports injury prevention, can be used as a sports injury prevention tool (New Zealand Accident Compensation Corporation, 2006).

ix. Counter the damage already done by the hazard: Emergency response drills should be practiced. Appropriate first aid principles should be applied using *D.R.A.B.C.*—eliminate further *Danger*, determine victim *Response*, check *Airway* is patent, *Breathing* is unobstructed, and *Circulation* is maintained; and *P.R.I.C.E.D.*—*Protect* the victim or patient from further injury, *Rest* the affected injury site, as appropriate, *Ice* the injured site, apply *Compression* and *Elevation* for the injured site, ensure rapid *Diagnosis*, and appropriate use of *Drugs* for optimum prognosis. Activity patterns should be modified accordingly. *Heat*, *Alcohol*, *Running*, and *Massage* (*H.A.R.M.*) should be avoided immediately after acute injury. Before, during or after a disaster CERT preparedness significantly mitigates additional harm to individuals and the community.

x. Stabilize, repair and rehabilitate the object of damage: The least desired and most costly option, yet inattention to proper final-phase functional rehabilitation, and too early a return to activity, is often the cause of re-injury. Functional activity tests should be used to gauge readiness before returning to sport, recreation, or other physically demanding work. Again, following a disaster, at the community level CERT preparedness has applicability to mitigate negative effects.

8. Utilization of resources, being informed and staying current with IP

The Wellness Health Promotion and Injury Prevention Program in the School of Health Sciences at Oakland University has posted several useful Web links to resource agencies in the IP field. These can be accessed at: <http://www2.oakland.edu/shs/whp/>

Conclusion

Unintentional injury is ranked the fifth cause of death, but is a leading cause of years of potential life lost and results in a severe burden to the country. Every individual can play an im-

portant public health role through increased personal responsibility and by including elements of injury prevention, control, and safety promotion in daily life. To become an effective injury prevention advocate, individuals need to be informed about injury epidemiology, and be seen to proactively and assertively encourage implementation of effective injury prevention strategies. Only then can the US hope to see a decline in the untimely death and disabling non-fatal injury that impacts the 1–44 year old age groups.

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