Chapter 4

Nontransport Unintentional Injuries

Robyn Norton, Rajeev B. Ahuja, Connie Hoe, Adnan A. Hyder, Rebecca Ivers, Lisa Keay, David Mackie, David Meddings, and Fazlur Rahman

INTRODUCTION

Injuries are most commonly categorized as unintentional or intentional, based on the injured party's presumed intent (Norton and Kobusingye 2013). Unintentional injuries comprise both transport and nontransport injuries. This chapter examines in detail the leading causes of nontransport unintentional injuries, namely falls, drowning, burns, and poisoning.

The chapter also briefly discusses the burden of injuries resulting from the other two main categories of nontransport unintentional injuries, namely exposure to forces of nature and all other unintentional injuries combined. All other unintentional injuries combined constitute approximately 38 percent of nontransport unintentional injuries. However, because the numbers of deaths for each cause-specific injury within this group are comparatively small, and because the nature of, risk factors for, and interventions for each cause are unique, this chapter does not include a detailed examination of risk factors or interventions for this group as a whole, nor for any individual cause-specific injury.

Individuals in low- and middle-income countries (LMICs) sustain a higher proportion of deaths and disability-adjusted life years (DALYs) from nontransport unintentional injuries compared with those in high-income countries (HICs). The mortality rates for almost all of these injuries are higher in LMICs than in HICs. The best available evidence suggests that the numbers of deaths from most nontransport unintentional injuries are decreasing globally, with the exception of deaths from falls and possibly from burns, which are increasing.

This chapter places injuries in a global context but documents the burden and known risk factors for nontransport unintentional injuries in LMICs. It also provides an overview of the best available evidence about interventions and policies that are shown to effectively reduce such injuries in those countries. The key focus of the chapter is preventive strategies, although the importance of acute care and rehabilitation is clear, as discussed elsewhere in this volume. Where data are available, the costs and economic benefits of these interventions are outlined.

A consistent theme for every category of cause-specific, nontransport unintentional injury is the dearth of reliable evidence from LMICs on risk factors, interventions, and cost-effective approaches to prevention. This theme reflects the limited availability of human and other resources that would enable researchers to access such information, and it also reflects the low priority key stakeholders place on addressing the burden of such injuries.

The final section makes recommendations about what policy makers need to do to continue the trend of declines in the burden of death and disability from nontransport unintentional injuries; to achieve similar declines for falls; and to reduce the disparities in injury rates between HICs and LMICs.

Corresponding author: Robyn Norton, Principal Director, The George Institute for Global Health; Professor of Global Health, University of Oxford, Oxford, United Kingdom; Professor of Public Health, University of Sydney, Sydney, Australia; rnorton@georgeinstitute.org.

This chapter follows the World Health Organization (WHO) classification of regions: Africa, the Americas, South-East Asia, Europe, the Eastern Mediterranean, and the Western Pacific.

BURDEN OF NONTRANSPORT UNINTENTIONAL INJURIES

Recent estimates of the global burden of death and disability resulting from nontransport unintentional injuries are available from the Global Burden of Disease study for 2013 (Haagsma and others 2015) and from the Global Health Estimates provided through WHO for 2012 (WHO 2014).

Global Health Estimates data suggest that, collectively, nontransport unintentional injuries account for more than 6,700 deaths a day and 2.4 million deaths annually (WHO 2014)—almost twice the number of deaths from transport injuries and twice the number of deaths from intentional injuries. The total is comparable to the number of deaths from HIV/AIDS and tuberculosis combined. Nontransport unintentional injuries also account for more than 148 million DALYs annually—almost twice the number from transport injuries and from intentional injuries (WHO 2014).

Falls

Falls are the leading cause of nontransport unintentional injury deaths, accounting for almost 700,000 deaths a year (figure 4.1). In contrast to most other nontransport unintentional injuries, deaths from falls have increased since 2000, in large part as a consequence of the increasing numbers of older people, who are at greatest risk. Falls are the leading cause of DALYs; between 2000 and 2012, the numbers of DALYs from falls increased by 19.2 percent (figure 4.2).

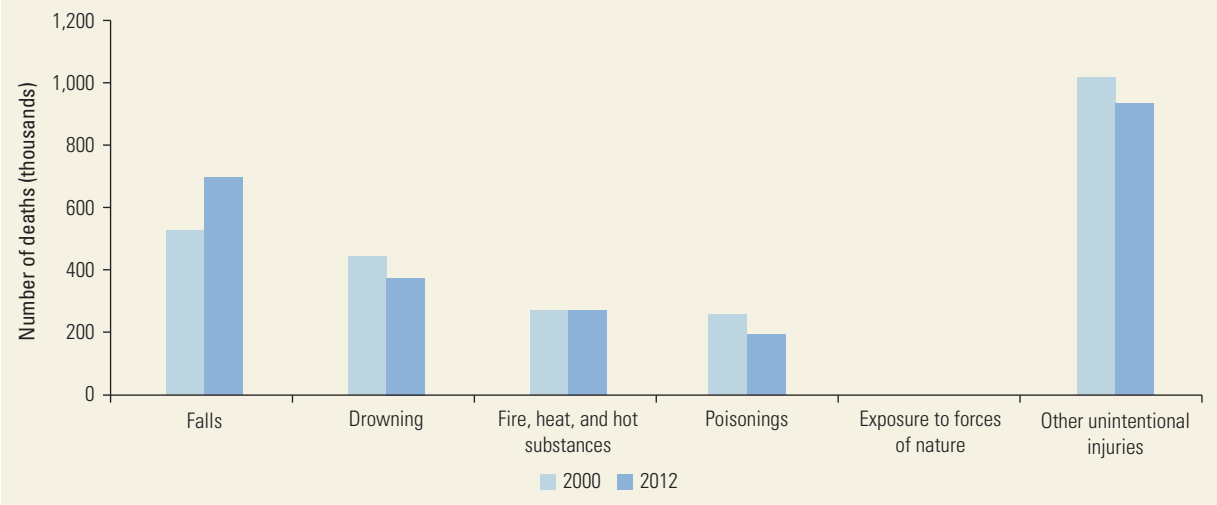
Men account for a slightly higher proportion of deaths from falls (54 percent) than women, with approximately 50 percent of all fall-related deaths occurring in individuals ages 70 years and older. The rates of death from falls in that age group (96.6 per 100,000 population) are strikingly higher than in all other age groups (table 4.1). Although the death rates in LMICs are comparable to those in HICs, they are highest in the LMICs of South-East Asia (16 per 100,000 population) (table 4.2).

Drowning

Drowning is the second most common cause of death and DALYs from nontransport unintentional injuries. Drowning accounts for approximately 15 percent of both deaths and DALYs, with approximately 372,000 individuals dying each year as a consequence (figures 4.1 and 4.2). Over the past two decades, deaths and DALYs from drowning have decreased by approximately 20 percent and 30 percent, respectively, although those figures may be underestimates, given the known data limitations in LMICs (WHO 2012).

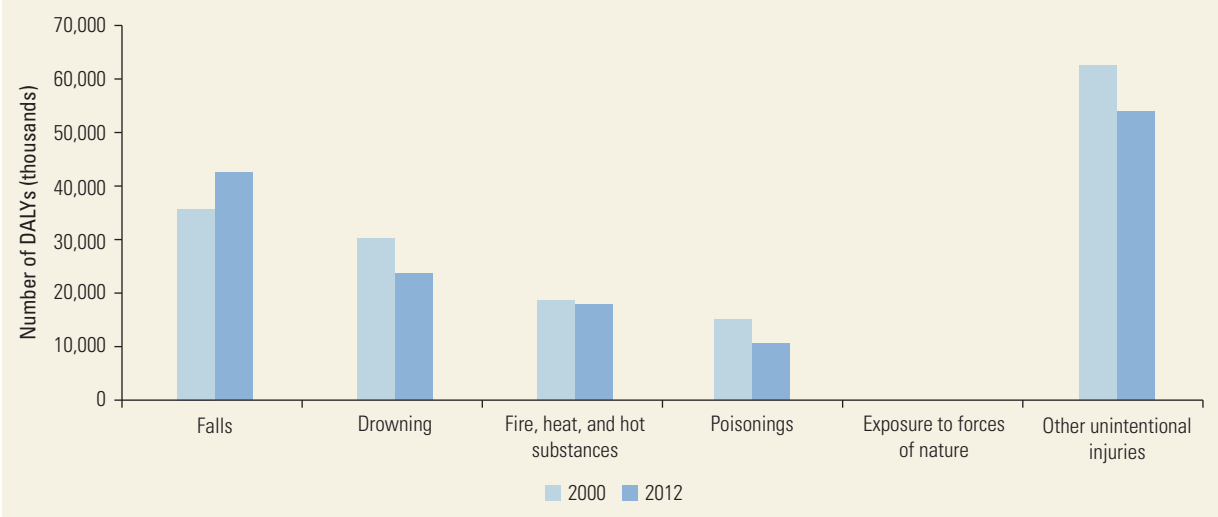
Almost all drowning deaths occur in LMICs (95 percent), and rates of drowning are substantially higher in almost all LMICs compared with HICs (table 4.2). Death rates from drowning are about twice as

Figure 4.1 Nontransport Unintentional Injury Deaths, by Cause, 2000 and 2012



Source: WHO 2014.
Note: The WHO data suggest that negligible numbers of deaths resulted from forces of nature in low- and middle-income countries.

Figure 4.2 Nontransport Unintentional Injury Disability-Adjusted Life Years, by Cause, 2000 and 2012



Source: WHO 2014.
Note: The WHO data suggest that negligible numbers of deaths resulted from forces of nature in low- and middle-income countries.

Table 4.1 Nontransport Unintentional Injury Deaths, by Proportion of Males and Age Group, 2012
Deaths per 100,000 population

Cause-specific injury category	Male (percent)	Age group (years)					
		<5	5–14	15–29	30–49	50–69	70+
Falls	54	5.0	2.5	2.5	4.0	13.5	96.6
Drowning	67	10.1	6.1	4.2	3.2	4.9	10.9
Burns	53	9.6	3.4	2.7	2.3	3.1	9.7
Poisoning	61	3.6	1.0	2.1	2.7	3.9	6.4
Forces of nature	60	0.0	0.0	0.0	0.0	0.1	0.1
Other	63	17.8	6.3	8.1	9.3	16.9	61.1

Source: WHO 2014.

Table 4.2 Nontransport Unintentional Injury Deaths, by Income and Region, 2012
Deaths per 100,000 population

Cause-specific injury category	Income and region						
	High-income countries	Low- and middle-income countries					
		Africa	Americas	South-East Asia	Europe	Eastern Mediterranean	Western Pacific
Falls	9	10	5	16	5	4	8
Drowning	3	8	3	7	4	5	4
Burns	2	14	1	4	3	4	1
Poisoning	2	4	1	3	2	4	3
Forces of nature	0	0	0	0	0	0	0
Other	14	20	10	14	14	16	8

Source: WHO 2014.
Note: The WHO data suggest that negligible numbers of deaths resulted from forces of nature in low- and middle-income countries.

high for men and boys than for women and girls (table 4.3). Death rates are highest for those younger than age five years, for both genders, followed by those ages 50 years and older.

Burns

Burns are the third most common cause of death and DALYs from nontransport unintentional injuries, accounting for approximately 15 percent of deaths and 14 percent of DALYs. Between 250,000 and 350,000 individuals die each year as a consequence of burns (figures 4.1 and 4.2). Unlike most other unintentional injuries, rates of burn deaths for women and girls are comparable to those for men and boys (47 percent versus 53 percent, as shown in table 4.1). Rates of death from burns are highest in those younger than age five years and those ages 70 years and older. However, as with drowning, almost all deaths occur in LMICs (97 percent); rates of death are highest in LMICs in Africa, followed by South-East Asia, Europe, and the Eastern Mediterranean (table 4.2). The rates in Africa, for example, are 14 per 100,000 population, compared with 2 per 100,000 in HICs.

Although these figures clearly identify a significant burden of death and disability, almost all LMICs lack comprehensive data on burns. The International Society for Burn Injuries (ISBI), WHO, the U.S. Centers for Disease Control and Prevention (CDC), and the Global Alliance for Clean Cookstoves (GACC) have launched initiatives to develop minimal datasets and software platforms for better surveillance of burn incidence in domestic settings.

Table 4.3 Drowning Deaths, by Gender, Age Group, and Country Type, 2012

Deaths per 100,000 population

Gender	Age group (years)	Global	LMICs
Males	0–4	11.5	12.6
	5–14	7.9	8.7
	15–49	5.5	5.9
	50+	8.1	8.9
	Total	7.0	7.6
Females	0–4	8.6	9.6
	5–14	4.3	4.8
	15–49	1.8	2.0
	50+	4.8	5.9
	Total	3.5	4.0

Source: WHO 2014.

Poisoning

Poisoning constitutes approximately 8 percent of nontransport unintentional injury deaths and 7 percent of DALYs, resulting in an estimated 193,000 deaths and almost 11 million DALYs annually (figures 4.1 and 4.2).

Of poisoning victims, 61 percent are men and boys; the highest rates are in those under age five years and over age 50 years (table 4.1). The rates of poisoning deaths in most LMICs are higher than those in HICs, with the rates being twice as high in the LMIC regions of Africa and the Eastern Mediterranean (table 4.2).

Forces of Nature

Deaths and DALYs caused by forces of nature include those arising from exposure to excessive natural heat or cold, earthquakes, and floods. These can vary significantly by year. For 2012, WHO data suggest that forces of nature accounted for only around 2,000 deaths. However, the numbers of deaths and DALYs have increased in recent years.

WHO data also suggest that men are at greater risk than women and that forces of nature primarily impact older adults (table 4.1).

All Other Nontransport Unintentional Injuries

All other causes combined account for approximately 38 percent of deaths from nontransport unintentional injuries and a similar proportion for DALYs (figures 4.1 and 4.2). WHO Global Health Estimates give little additional detail on these. However, the Global Burden of Disease report breaks out several subgroups, the largest of which are exposure to mechanical forces, adverse effects of medical treatment, and animal contact (Lozano and others 2012).

As with most deaths from unintentional injuries, men and boys account for a disproportionate number of all other causes (63 percent) (table 4.1). The rates of death are highest in those ages 70 years and older, and among deaths occurring in LMICs, the rates are highest in Africa (table 4.2).

RISK FACTORS FOR INJURIES

Falls

Falls in Older People

The high burden of fall-related deaths in older people is due in part to the physical, sensory, and cognitive changes associated with aging, in combination with environments that are not adapted for this population (Lord and others 2007). Risk factors in LMICs are largely

similar to those in HICs: age, female gender, previous falls, mobility problems, declining vision, medication use, unsafe environments, and chronic health problems (Kalula and others 2011; Ranaweera and others 2013).

However, the nature of the environmental risks differs in LMICs, with more falls resulting from factors relating to street and house design, transport, violence, and rural locations (Dandona and others 2010; Jagnoor and others 2014; Jitapunkul, Yuktananandana, and Parkpian 2001; Kalula and others 2011; Ranaweera and others 2013). Often, access to water is limited only to locations outside of the home (Hestekin and others 2013). The risk factors for fall-related injuries, including osteoporotic fractures, may differ across settings because of variations in diet and in load-bearing exercise (Lau and others 2001).

Falls in People of Working Age

Research to examine risk factors for falls in people of working age in HICs is scarce, but studies of falls in the home may have some relevance. Those have highlighted the role of alcohol (Kool and others 2008) as well as structural or environmental hazards (Kool and others 2010). Falls in people of working age in LMICs are reported more commonly for men and are reported as occupational injuries, including those on farms (Dandona and others 2010; Gururaj, Sateesh, and Rayan 2008).

Falls in Children

The risk factors for falls for children in HICs include male gender, younger age, and low socioeconomic status. Fall-related injuries are commonly sustained on playgrounds; on bunk beds and equipment, such as baby change tables or baby walkers (Khambalia and others 2006); or from windows (Harris, Rochette, and Smith 2011). The risk factors in LMICs are similar, with falls reported from ladders or stairs, or beds or other furniture (Hyder and others 2009). More falls occur in boys and in rural locations (Jiang and others 2010).

Drowning

The International Life Saving Federation World Drowning Report (International Life Saving Federation 2007) divides drowning risk factors into two groups: human factors and environmental factors.

Human Factors

Sociodemographic factors, socioeconomic conditions, behavioral factors, and medical conditions have all been postulated or shown to be risk factors for drowning. Higher rates among men and boys purportedly result from their increased exposure to water and riskier behaviors (Peden and McGee 2003). Children under age five years have the highest drowning mortality rates worldwide. Deaths in this age group frequently occur as a result of children's inherent vulnerability—the inability to keep their airway clear of water—combined with a lapse in adult supervision. Individuals with lower education levels are at increased risk of drowning; across all regions and countries, lower socioeconomic groups are more vulnerable to drowning than higher socioeconomic groups (Giashuddin and others 2009).

The absence of, or a lapse in, adult supervision has been shown to be an important, potentially modifiable risk factor for drowning incidents in children (Bierens 2006; Chalmers, McNoe, and Stephenson 2004; International Life Saving Federation 2007; WHO 2006; Yang and others 2007), and individuals with few swimming skills or those who have not received swimming lessons have been shown to be at increased risk (Yang and others 2007). Alcohol consumption is one of the most frequently reported contributory factors associated with adolescent and adult drowning (WHO 2006). Some medical conditions such as epilepsy, which are often poorly controlled in LMICs, also place individuals at increased risk (Bell and others 2008).

Environmental Factors

Children who live near open water sources are particularly at risk (Peden and McGee 2003). People who work on or near water, travel on water, or use surface water or open wells for household water are all likely to face increased risk of unintentional immersion in a water hazard. Similarly, those who live in settings susceptible to flash floods, river flooding, storm surges, or tsunamis are at increased risk of drowning.

Burns

The etiological factors responsible for the majority of burn injuries in LMICs are very different from those in HICs. In the United States, for example, 69 percent of burns happen at home, with factors such as alcohol, smoking, and high bathing temperatures dominating (American Burn Association 2012). Almost 50 percent of burn deaths have been attributed to the combination of alcohol and smoking.

In LMICs a large proportion of burn injuries is sustained in the kitchen or cooking area and is related to the nature of the cooking appliances, the source of heat, and the heating of liquids (Hyder and others 2009; Mashreky and others 2010). Several studies have implicated kerosene stoves in a large percentage of burn injuries (Ahuja and Bhattacharya 2002; Ahuja, Bhattacharya, and Rai 2009; Ahuja, Dash, and Shrivastava 2011; Mabrouk, El Badawy, and Sherif 2000). As the source of heating

moves up the energy ladder from biomass products to kerosene to liquefied petroleum gas (LPG) to electricity, the fuel becomes safer, cleaner, and more expensive. Cooking appliances that use LPG appear to be safer and less polluting than those fueled by kerosene, but they still pose serious risks if not properly used and maintained (Ahuja, Dash, and Shrivastava 2011).

In India, most domestic burns are sustained by women ages 16–35 years; almost 70 percent of these injuries are due to the traditional practice of cooking at floor level or over an open fire, compounded by wearing loose-fitting clothing made from non-flame-retardant fabric (Sanghavi, Bhalla, and Das 2009).

Burns from incidents involving traditional homemade bottle lamps or commercial wick lamps are a cause of major morbidity and mortality in Bangladesh, India, Mozambique, Nepal, and Sri Lanka. In a study in Sri Lanka, 41 percent of the burns in patients admitted with unintentional flame burns resulted from homemade kerosene bottle lamps tipping over (Laloë 2002). A case-control study of childhood burn injuries in 2008 in rural Bangladesh revealed that households using traditional kerosene lamps (*kupi bati*) had a greater than threefold risk of childhood burns relative to households not using such lamps (Mashreky and others 2010).

Poisoning

Although some studies have been conducted in LMICs to examine victims of all ages admitted to hospitals for unintentional poisoning (Akbaba and others 2007; Peiris-John and others 2013; Sawalha and others 2010), much of the available literature on unintentional poisoning in these countries focuses on young children. Findings from these studies show that, consistent with overall trends, boys tend to be at higher risk than girls (Balan and Lingam 2012; Lifshitz and Gavrilov 2000; Soori 2001). Paraffin and kerosene, other types of chemical products, medicines, and drugs are the most common agents in unintentional child poisoning cases (Balan and Lingam 2012; Balme and others 2012; Kohli and others 2008; Lifshitz and Gavrilov 2000; Ozdemir and others 2012; Zia and others 2012).

Case-control studies in LMICs have also highlighted the importance of risk factors such as unsafe storage of chemicals or medicines (Ahmed, Fatmi, and Siddiqui 2011; Chatsantiprapa, Chokkanapitak, and Pinpradit 2001; Ramos and others 2010; Soori 2001); history of previous poisoning (Ahmed, Fatmi, and Siddiqui 2011; Soori 2001); distraction or lack of adult supervision (Ramos and others 2010; Soori 2001); hyperactive child behavior; low socioeconomic status; and low maternal educational status (Ahmed, Fatmi, and Siddiqui 2011).

INTERVENTIONS, EFFECTIVENESS, AND COVERAGE

Evidence for the effectiveness of interventions and policies associated with nontransport unintentional injuries, and especially interventions that are effective in LMICs, is extremely limited. Few randomized controlled trials have been undertaken; some before-and-after studies are available, but much information derives from observational studies. This section outlines the best available evidence and highlights those interventions that show the greatest likelihood of being effective in LMICs (table 4.4).

Falls

Falls in Older People

Substantial progress has been made in the development of effective fall prevention programs for older people in HICs. The incidence of falls in older people living in the community has been reduced by either group and home-based exercise programs, usually containing some balance and strength-training exercises, or by Tai Chi programs (Gillespie and others 2012). Successful multifactorial interventions include home safety modifications, cataract surgery, withdrawal of psychotropic medication, and insertion of a pacemaker for those with carotid sinus hypersensitivity (Gillespie and others 2012). The effectiveness of fall prevention programs for older people in acute and subacute hospital settings, though promising, especially in high-risk groups, is limited and requires further investigation (Cameron and others 2012).

Although a substantial body of work is emerging on the burden and risk factors for falls in older people in LMICs, little or no evidence exists about the effectiveness of fall prevention programs in these settings (Kalula and others 2011). Although many of the interventions shown to be effective in HICs might be effective in LMICs, implementing them can be difficult. Competing health care demands that are perceived to be more urgent, combined with a lack of trained health care professionals, create challenges for implementing or translating evidence-based policy for fall prevention in LMICs. Further, the lack of systematic care for older people places much of the burden on family members. Without substantial investment in prevention programs, elder-care facilities, acute-care hospital services, and rehabilitation, the burden on families will increase.

Falls in People of Working Age

Fall prevention for those of working age in LMICs requires a systematic approach, with a focus on industrial and construction safety standards. Little work has

Table 4.4 Interventions for Cause-Specific Injuries, with Promising or Good Evidence, in HICs and LMICs

Cause-specific injury	Age group	HICs	LMICs
Falls	Older people	Group and home-based exercise programs, containing balance and strength-training exercises, or Tai Chi (Gillespie and others 2012)	—
		Multifactorial interventions, including home safety modifications (Gillespie and others 2012)	—
		Targeted interventions involving cataract surgery, withdrawal from psychotropic medication, and pacemaker insertion (Gillespie and others 2012)	—
	Working age	Company-oriented safety campaigns and drug-free workplace programs (van der Molen and others 2012)	—
	Children	Home safety interventions providing free, low-cost, or subsidized safety equipment (Kendrick and others 2012)	—
Drowning	Children	Legislation and enforcement of swimming pool fencing (Stevenson and others 2003; Thompson and Rivara 2000)	Parental or other adult supervision and swimming lessons (Rahman 2010; Rahman and others 2009; Rahman and others 2012)
		Provision of swimming lessons (Brenner, Saluja, and Smith 2003; Brenner and others 2009)	—
		Legislation and enforcement of PDF use for recreational boaters (Bugeja and others 2014)	—
Burns	All ages	Installation and maintenance of smoke detectors (Mock and others 2011; Norton and others 2006)	Improvements in stove design (Mock and others 2011)
		Education, legislation, and enforcement to regulate the temperature of household taps (Norton and others 2006)	—
Poisoning	Children	Home safety education, with the provision of safety equipment (Kendrick and others 2013)	Community-based educational interventions (Schwebel and others 2009)
			Child-resistant containers (Krug and others 1994)

Note: — = not available; HICs = high-income countries; LMICs = low- and middle-income countries.

been done to evaluate the effectiveness of programs to reduce falls at building sites or in industrial settings, either in high- or low-income environments. Low-quality evidence suggests that company-oriented safety interventions–such as multifaceted safety campaigns and drug-free workplace programs—can reduce non-fatal injuries among construction workers (van der Molen and others 2012). Further improvements in construction safety standards and regulations are likely to reduce fall-related injuries, but these will require the development and implementation of appropriate policies, as well as education and enforcement.

Falls in Children

In HICs, home safety interventions for the prevention of falls in children have been shown to increase the use of stair gates and to reduce the use of baby walkers, although no evidence suggests that such programs increase the possession of window locks, screens, or windows with limited openings (Kendrick and others 2008; Kendrick and others 2012). Interventions that provide free, low-cost, or subsidized safety equipment appear to be more effective in improving safety practices than interventions that do not do so (Kendrick and others 2012). However, little research has been conducted on adapting known effective interventions to LMICs (Kendrick and others 2008).

Although many important challenges face efforts to prevent falls for both young and older people in rural settings, the increasing and rapid urbanization of LMICs will present additional challenges. The development of high-rise apartments is likely to increase the risk of falls from windows and stairways, particularly in poorly lit buildings. Urban slums and squatter camps pose

particular risks (Rizvi and others 2006). Urban planning and architectural design can play a major role in mitigating the risks of falls, as can regulation of sidewalks to provide a safe walking environment free of roadside stalls.

Drowning

Evidence for Drowning Prevention

The scientific literature on drowning prevention studies published since the late 1990s identifies a number of possible and promising options for drowning prevention. In HICs, much of the evidence relates to the prevention of drowning in recreational settings. Evidence from observational studies suggests that legislation and enforcement of swimming pool fencing are likely to significantly reduce drowning, especially among children (Stevenson and others 2003; Thompson and Rivara 2000). Also, a growing body of evidence shows the contribution of alcohol consumption to recreational drowning in young people and adults, so legislation and enforcement to control alcohol use, especially in relation to aquatic activities, are likely to have an important effect (Diplock and Jamrozic 2006).

Some evidence indicates that providing swimming lessons may reduce drowning risks (Brenner, Saluja and Smith 2003; Brenner and others 2009; Rahman and others 2012). Increased knowledge of water safety, both for children and adults, also may decrease the risk of drowning. However, little evidence shows that water safety knowledge alone leads to improved safety (Kendrick and others 2007; Moran 2006; Solomon and others 2013). By comparison, increasingly strong evidence supports legislation requiring and enforcing the use of personal flotation devices (PFDs) by recreational boaters as an effective intervention strategy (Bugeja and others 2014).

In LMICs, evidence has shown that both increased parental or other adult supervision of and swimming lessons for children reduce child drownings (Rahman 2010; Rahman others 2009; Rahman and others 2012). The Prevention of Child Injury through Social Intervention and Education (PRECISE) was implemented in Bangladesh between 2006 and 2010 and covered more than 750,000 people in rural villages in three separate subdistrict intervention areas. The research design involved a comparison between very large cohorts of children participating in the interventions with nonparticipating children who were matched for age, gender, and location of residence. For children ages one to five years, a village *crèche* (child care) program called Anchal was established to provide a safe haven where mothers could drop off their children for four hours a day while they tended to domestic work. Children ages four years and older received training in a program called SwimSafe, which taught water safety, safe rescue, and survival swimming in the village pond, which had been converted into a safe training site. Both program components appeared to reduce the incidence of drowning in the intervention villages (Rahman 2010; Rahman and others 2009; Rahman and others 2012).

The *World Report on Child Injury Prevention* summarized the evidence on key strategies to prevent drowning among children. It suggested that four interventions should be considered as effective: removing or covering water hazards, requiring isolation fencing around swimming pools, wearing PFDs, and ensuring immediate resuscitation (Peden and others 2008). The report suggested that although other strategies are promising, including ensuring the presence of lifeguards in swimming areas and raising targeted awareness about drowning, for the remainder, the evidence is insufficient, ineffective, or potentially harmful.

Prevention Challenges in LMICs

A 2012 report prepared on behalf of the Working Group on Child Drowning in LMICs has highlighted the challenges in addressing drowning prevention, especially among children (Linnan and others 2012):

- Most LMICs are predominantly rural.
- Water and other environmental hazards are ubiquitous around the home and throughout the community.
- Building codes and zoning ordinances are lacking or unenforced.
- Universal primary education is a goal, not a reality, resulting in high levels of illiteracy across large segments of the population.
- Parents often have many children and must rely on older children to supervise younger ones.
- Essential social services are lacking, such as emergency medical and rescue services that extend lifesaving services outside hospitals or other safety infrastructure.
- Sufficient financial resources are lacking.
- Adequate human resources for drowning prevention are lacking.

In contrast, the report suggests, HICs have built a culture of water safety on these foundations, using the wealth of financial and social capital that they possess. Introducing drowning prevention and the creation of a culture of water safety was a natural progression in the process of developing strong public health and public safety institutions connected to effective civil governance and enforcement structures.

Although, in theory, the principles underlying drowning prevention are the same among all population groups, whether in LMICs or HICs, they require thoughtful and extensive adaptation, given the different

societal contexts and norms (Hyder and others 2008). It may not be possible to adapt the drowning prevention strategies for HICs in low-resource settings. The report by Linnan and others (2012) highlights, in particular, that of the four interventions deemed to have sufficient evidence for effectiveness in the *World Report on Child Injury Prevention*, three—fencing around swimming pools, legislating the use of PFDs, and ensuring immediate resuscitation—are likely to be unfeasible or unsustainable in LMICs.

Burns

In HICs, prevention efforts have focused on education and on the installation and maintenance of smoke detectors for the prevention of fire-related burns. To reduce the incidence of scald-related burns, efforts have included legislation and enforcement to regulate the temperature of household taps (Mock and others 2011; Norton and others 2006). In LMICs, strategies have primarily focused on the prevention of fire-related burns.

Education and Increasing Awareness in Communities

Education alone is unlikely to lead to behavioral changes. However, in many LMICs, especially in areas with high levels of literacy, educating the public on safe practices may be an important strategy in improving awareness levels. This education may lead to increased pressure on authorities to pass appropriate prevention legislation and to provide the necessary impetus for resources to address the problem.

Improvements in Stove Design

Between 1992 and 1994, a household randomized trial, RESPIRE (randomized exposure study of pollution indoors and respiratory effects), was implemented in rural highland Guatemala to determine the effects of having an improved wood stove with a chimney (*plancha*) on the health of young children younger than 18 months, compared with continued use of open fires (Smith and others 2011). Prior to the intervention, the burn incidence rate among young children was 42.1 per 1,000 per year. Six months postintervention the rates were 18.1 and 35.2 per 1,000 children per year among the intervention and control groups, respectively. In addition, the plancha group had fewer serious burns (Mock and others 2011).

Another intervention with tremendous potential to prevent burn injuries is the use of a safer and cleaner kerosene stove design that is competitively priced. The Global Alliance for Clean Cookstoves is investing significant resources in research and design improvements for kerosene stoves (http://www.cleancookstoves.org).

Platform Cooking

Floor-level cooking has been implicated in increasing the incidence of burn injuries, whether on a woodstove, a kerosene stove, or an open three-stone fire. Cooking on a platform immediately distances children from fires and from toppling cooking vessels. Platform cooking also renders irrelevant, to an extent, the type of clothing worn by women while cooking. Loose-fitting clothes are much less likely to get caught in the fire if the stove is on a platform. However, there is no published literature outlining the development and implementation of platform design, nor evaluation of their effectiveness.

Poisoning

The traditional three "E" approach to preventing injuries—education, engineering, and enforcement—can be used as a framework to select intervention strategies for preventing unintentional poisonings in LMICs. Because these three Es generally refer to two broad concepts, behavior and environment, the focus is first on strategies to change the behavior of individuals and communities and then on strategies to alter the environment.

Behavioral Strategies for the Prevention of Poisoning

Many experts have highlighted the need to target behavioral change to prevent accidental poisoning. Suggested interventions include safe storage of poisons, that is, where they are stored as well as the types of containers used (Ahmed, Fatmi, and Siddiqui 2011; Kohli and others 2008; Schwebel and Swart 2009). Ozdemir and others (2012), for example, recommended storing poisons in high places or locked cupboards after finding that 70 percent of responsible agents were easily accessible to child victims.

Unfortunately, the few studies that have assessed the effectiveness of behavioral approaches to addressing unintentional poisoning, such as paraffin- and kerosene-related injuries in LMICs, have mixed results (Schwebel and Swart 2009). One strategy, known as community-based educational interventions, has shown promise in South Africa. In 2008, Swart and others evaluated the effectiveness of a paraprofessional home visitation program to prevent child injuries. Intervention households received four visits from home visitors recruited from the community. During these visits, the trained home visitors gave caregivers safety information, as well as devices to improve safety. Although statistically insignificant, the findings showed a decline in risks associated with poisoning, as well as other injuries (Swart and others 2008).

Complementing this work, Schwebel and others (2009) examined the effectiveness of a trainer-to-trainer model, in which experts from the Paraffin Safety

Association of Southern Africa trained local community members to distribute educational materials to an intervention community in South Africa. The educational materials were based on the theory of health behavioral change. The findings showed that the intervention was effective at significantly changing the level of kerosene safety knowledge in the intervention community. The researchers found slight behavioral changes related to kerosene safety as well as to perceptions of risk (Schwebel and others 2009).

Results from these two studies are consistent with findings from HICs. A meta-analysis conducted in 2013, for example, showed that home safety education used in interventions that included the provision of safety equipment were effective at increasing safety practices for preventing injury, including poisoning (Kendrick and others 2013).

Environmental Strategies for the Prevention of Poisoning

Some of the identified risk factors point to the need to target broader environmental risk factors, such as by enacting and enforcing poisoning prevention legislation. Krug and others (1994), for example, demonstrated in a controlled before-and-after study in South Africa that the incidence rate of paraffin ingestion decreased by 47 percent when child-resistant containers were widely distributed (Krug and others 1994). However, government policies mandating the use of such child-resistant containers do not exist in many LMICs (Balan and Lingam 2012). In Turkey, only a limited number of medications are sold with child safety caps (Ozdemir and others 2012); in Pakistan, a call for child-resistant packaging legislation has been made (Ahmed, Fatmi, and Siddiqui 2011).

Other types of legislation, such as laws that mandate standards for wick stoves in South Africa, are lacking in many LMICs (Schwebel and Swart 2009). Suggested interventions include ensuring that labels possess all the necessary safety information and are in languages that people can understand. Nonyelum and others (2010), for example, showed that safety warnings on pharmaceutical and consumer products still need improvement in Nigeria. Their study revealed that only 70 percent of the 600 products examined had adequate warning labels. Moreover, despite English being Nigeria's official language, 5 percent of products had only non-English labels.

COSTS AND COST-EFFECTIVENESS OF INTERVENTIONS

Not surprisingly, given the dearth of evidence on effective interventions for the prevention of nontransport unintentional injuries in LMICs, the published data on the costs and cost-effectiveness of interventions are limited. This section presents information on the costs incurred by such injuries, where data are available, and on potential cost-effective interventions for LMICs, supplemented by the best available information from HICs (table 4.5). All costs presented in this section have been converted to 2012 U.S. dollars.

Falls

The costs of falls are well documented in HICs, but few data are available on the costs of falls in LMICs. However, the costs are likely to be substantial. Falls and road traffic injuries accounted for the largest out-of-pocket health care costs for those hospitalized for injuries in Vietnam. Of road traffic victims, 26 percent experience catastrophic expenditure as a result of their injuries (Nguyen and others 2013).

There are no published data showing the cost-effectiveness of fall prevention programs in LMICs. However, growing evidence suggests that some community-based fall prevention programs among older people in HICs can be cost-effective. Data from Australia on older adults living in the community show that the most cost-effective intervention is the practice of Tai Chi; the cost per quality-adjusted life year (QALY) is US$49,119; the incremental cost per fall avoided is US$3,484 (Church and others 2011). And although evidence for effectiveness is still emerging, the data suggest that cataract surgery is potentially extremely cost-effective (the cost per QALY is US$3,818; the incremental cost per fall avoided is US$275. For those taking psychotropic medications, medication withdrawal is also highly cost-effective (with the cost per QALY of $22,711, and the incremental cost per fall avoided of US$1,251 (Church and others 2011).

The evidence on cost-effective interventions in residential care settings in Australia is still emerging. The data suggest that medication review and the use of hip protectors among medium- and high-risk groups are highly cost-effective strategies. The former is more effective and less costly than no intervention; the cost per QALY of the latter is US$2,002, and the incremental cost per fall avoided is US$114 (Church and others 2011). Among all individuals living in residential settings, vitamin D supplementation has the potential to be extremely cost-effective at a cost of US$7,970 per QALY, and an incremental cost per fall avoided of US$444.

Drowning

Cost and cost-effectiveness data for interventions to prevent drowning in LMICs are scarce, given the paucity of

Table 4.5 Promising and Cost-Effective Interventions for Cause-Specific Injuries for HICs and LMICs, US$ 2012

Cause-specific injury	HICs	LMICs
Falls	Tai Chi: cost per QALY—$49,119; incremental cost per fall avoided—$3,484 (Church and others 2011)	—
	Cataract surgery: cost per QALY—$3818; incremental cost per fall avoided—$275 (Church and others 2011)	—
	Psychotropic medication withdrawal: cost per QALY—$22,711; incremental cost per fall avoided—$1,251 (Church and others 2011)	—
	In residential settings, medication review: more effective and less costly than no intervention (Church and others 2011)	—
	In residential settings, use of hip protectors: cost per QALY—$2,002; incremental cost per fall avoided—$114 (Church and others 2011)	—
	In residential settings, vitamin D supplementation: cost per QALY—$7,970; incremental cost per fall avoided—$444 (Church and others 2011)	—
Drowning	Fencing of residential swimming pools in homes with children younger than age 18 years: cost per QALY—$35,212 to $43,663 (Segui-Gomez 2001)	Supervision of children: $256 per DALY averted and $8,703 per death averted (Rahman and others 2012)
	Purchase of personal flotation devices for boats: cost per QALY—$5,634 (Segui-Gomez 2001)	Swimming training for children ages four years and older: $27 per DALY averted and $949 per death averted (Rahman and others 2012)
Poisoning		Distribution of child-resistant containers: $127 per DALY averted; $3,329 per death averted (Norton and others 2006)

Note: — = not available; DALY = disability-adjusted life year; HICs = high-income countries; LMICs = low- and middle-income countries; QALY = quality-adjusted life year.

information on effective interventions in these settings. However, data have been published on the cost-effectiveness of the PRECISE study in Bangladesh (Rahman and others 2012). Cost-effectiveness was calculated using the WHO-CHOICE guidelines (CHOosing Interventions that are Cost Effective), by determining the numbers of DALYs and deaths averted and the costs associated with both (http://www.who.int/choice/interventions/en/?)

The cost-effectiveness of Anchal—the component of the intervention that involved supervision of children ages one to five years in a community crèche—in reducing mortality was US$256 per DALY averted and US$8,703 per death averted. The cost-effectiveness of SwimSafe—the component of the intervention that involved children ages four years and older receiving swimming training—was US$27 per DALY averted and US$949 per death averted. Overall, the cost-effectiveness of PRECISE was US$114 per DALY averted and US$3,970 per death averted.

By comparison, earlier research focusing on interventions in HICs has shown that the cost-effectiveness of fencing around residential pools in homes with children younger than age 18 years ranged from US$35,212 to US$43,663 per QALY gained, depending on whether the fenced pools belonged to homes with children of different age subgroups and whether an incremental installation was considered (Segui-Gomez 2001).

Modeling of the cost-effectiveness of PFDs resulted in figures of US$5,634 per QALY gained. Sensitivity analyses were also conducted, suggesting that installing fencing around in-ground pools in homes with children younger than age 18 years and purchasing PFDs for recreational boats resulted in cost-effectiveness figures well below those of many interventions implemented in the clinical and public health realms.

Burns

Many burn injuries lead to prolonged hospital stays. In addition to acute burn care, patients often require a protracted period of rehabilitation. Only recently has the cost of providing reasonable burn care in LMICs been reported. Ahuja and Goswami (2013) calculated the cost per patient (all medications and consumables, dressing

material, investigations, blood products, dietary costs, and salaries of all personnel) in a third-level teaching hospital in northern India to be US$1,102.

Although the cost of burn care is relatively easy to calculate and reflects the cost of survival from a major injury, albeit with disability, the cost-effectiveness of prevention programs is not easy to calculate. National or regional statistics need to be available to measure the effectiveness of prevention interventions. Interventions need to be combined with educational campaigns to institute safe behavioral practices, and studies evaluating all costs against all benefits with regard to burn injuries are not available. Also, to establish the cost-effectiveness of any action for preventing burns, one needs to factor in the elimination of the high cost of burn care and the prevention of disability, in addition to the decrease in burn incidence.

Poisoning

Limited data exist on the cost of unintentional poisonings in LMICs. A study in Pakistan revealed that the costs of treatment to patients were considerable; approximately 37 percent had to pay out of pocket. However, only 9 percent of the patients were able to obtain government support to cover the treatment cost (Zia and others 2012).

A detailed analysis of the cost-effectiveness of providing child-resistant containers in 2006 showed that, as a means of preventing paraffin poisoning among children in South Africa, the intervention had a cost-effectiveness ratio of $3,329 per death averted (Norton and others 2006). The impact of this intervention was calculated to be 263 DALYs averted, and cost-effectiveness was estimated to be US$127 per DALY at a 3 percent discount rate.

CONCLUSIONS

Burden of Unintentional Injuries

Recent global estimates provide a strong foundation for understanding the burden of death and disability associated with nontransport unintentional injuries. Falls, which are the most important cause of death and disability, are likely to become even more important as populations in LMICs continue to age. Drowning and burns are important contributors to the burden and predominantly affect LMICs, especially younger children. Poisonings constitute the next leading contributor to the unintentional injury burden and affect both HICs and LMICs, and particularly adults ages 70 years and older. With the exception of burn injuries, and to a lesser extent falls, men and boys account for a much higher proportion of all injuries than women and girls. However, the reliability and validity of data from LMICs remain uncertain, and improved data collection in these countries needs to be prioritized.

Risk Factors, Interventions, and Cost-Effectiveness

Falls

Despite evidence of a rising burden of falls in older people in LMICs worldwide, few evidence-based prevention programs have been implemented in these countries. Governments have failed to recognize the costs of this burden, resulting in inadequate policy development and investment in prevention programs or prevention research.

Although HICs have an increasingly strong evidence base for effective and cost-effective programs to prevent falls in older people, policymakers in these countries need to better understand how such programs may be put into practice, both at the community level and in residential care settings. Further, significant work needs to be undertaken by health care providers to adapt fall prevention programs from HICs to LMICs, where risk factors may vary. Such programs will likely have to be substantially modified for LMIC environments.

Consequently, more research is needed to enhance understanding of the likely contextual factors and unique contributors to falls among older people in LMICs. Such factors include the influence of diet, physical activity, environment, and transportation, and the role of health services. Fall prevention programs that target the physical environment, inside and outside the home, may significantly affect the success of such programs in older people in those countries.

Falls are also a significant cause of death and injury in children and working-age adults in HICs and LMICs. Although HIC studies suggest that environmental factors, including urban and street design as well as building design, contribute significantly to falls in these population groups, the evidence base is weak. Nevertheless, fall prevention programs involving environmental modification may have more of an impact in LMICs, particularly in countries with rapid urbanization or areas with high levels of poverty. Similarly, focusing on building design and safety standards for construction sites and workplaces is likely to reduce falls for people of working age. Increasing regulation of consumer products by governments, as well as community education on the appropriate use of such products, will be relevant as the use of these products increases in LMICs.

Drowning

The need to address the burden of drowning in LMICs is a neglected health issue in many countries, with very

few researchers focused on identifying effective interventions or on examining differences in risk factors between HICs and LMICs. The development of successful drowning prevention strategies in LMICs faces a number of obstacles:

- The absence of and need by researchers to better identify risk factors for drowning, not only among young children, but also among other age groups
- The absence of and need by researchers to identify effective intervention strategies, especially for older age groups
- The need by governments and other stakeholders to scale up effective drowning interventions into national, regional, and global programs
- Capacity building for implementing drowning prevention at all levels of program development
- The need to stimulate and sustain investment in drowning prevention interventions and activities
- Incorporation of research into program design and implementation.

Burns

Major causes of burn injuries in LMICs include poverty and hazardous work environments, including in the home. Therefore, progress on burn prevention can be expected with countries' socioeconomic growth and government enforcement of regulations. In HICs, the introduction of smoke detectors and flame-retardant sleepwear, along with enforced safety practices in the workplace, have led to significant reductions in fire injuries. These efforts will be less effective in LMICs until the infrastructure improves.

In the meantime, policymakers and health providers need to develop a better understanding of (1) risk factors for burn injuries in LMICs, (2) the economic impact of burn injuries on survivors, and (3) the effectiveness and cost-effectiveness of burn prevention programs. Sufficient data are available from HICs to support the claim that burn injuries can be successfully prevented using education, engineering changes, enforcement of legislative protections, and environmental modifications (Peck, Molnar, and Swart 2009).

In addition to focusing on prevention strategies, health care organizations should encourage providers to be involved in specialized burn treatment at a local level. Moreover, encouraging participation with global initiatives, such as the Global Alliance for Clean Cookstoves, can further the success of local initiatives.

Poisoning

Most of the available studies on risk factors associated with unintentional poisoning in LMICs focus on young children, despite the fact that older adults are at highest risk. Data on the cost of unintentional poisoning are limited, so the true economic burden of this public health problem is unknown. Few researchers have investigated the effectiveness of interventions in these settings; even fewer have studied their cost-effectiveness. More studies are urgently needed. Cost studies, as well as benefit-cost analysis of successful behavioral programs, for example, can be vitally important. Findings could encourage donors and governments to invest in preventive measures in LMICs.

Summary Conclusions

Nontransport unintentional injuries are comparable to transport injuries in terms of the burden of death and disability, but they have not received the same attention from government agencies or researchers. Recognition of the need to prevent falls and fall-related injuries among older people is likely to grow in LMICs as governments in these countries begin to address the growing numbers of older people and the potential cost-effectiveness of prevention strategies. However, given the observed declines in the burden of other unintentional injuries, it seems less likely that government initiatives will drive a strengthened evidence base or facilitate prevention initiatives for these injuries. Consequently, global support from the United Nations, WHO, academia, nongovernmental organizations, and commercial enterprises, in tandem with the injury control community and health practitioners, will be important to move the unintentional injury agenda forward.

NOTE

World Bank Income Classifications as of July 2014 are as follows, based on estimates of gross national income (GNI) per capita for 2013:

- Low-income countries (LICs) = US$1,045 or less
- Middle-income countries (MICs) are subdivided:
  a) lower-middle-income = US$1,046 to US$4,125
  b) upper-middle-income (UMICs) = US$4,126 to US$12,745
- High-income countries (HICs) = US$12,746 or more.

REFERENCES

Ahmed, B., Z. Fatmi, and A. R. Siddiqui. 2011. "Population Attributable Risk of Unintentional Childhood Poisoning in Karachi Pakistan." *PLoS One* 6 (10): e26881.

Ahuja, R. B., and S. Bhattacharya. 2002. "An Analysis of 11,196 Burn Admissions and Evaluation of Conservative Management Techniques." *Burns* 28 (6): 555–61.

Ahuja, R. B., S. Bhattacharya, and A. Rai. 2009. "Changing Trends of an Endemic Trauma." *Burns* 35 (5): 650–56.

Ahuja R. B., J. K. Dash, and P. Shrivastava. 2011. "A Comparative Analysis of Liquefied Petroleum Gas (LPG) and Kerosene Related Burns." *Burns* 37 (8): 1403–10.

Ahuja, R. B., and P. Goswami. 2013. "Cost of Providing Inpatient Burn Care in a Tertiary Teaching Hospital of North India." *Burns* 39 (4): 558–64.

Akbaba, M., E. Nazlican, H. Demirhindi, Z. Sütoluk, and Y. Gökel. 2007. "Etiological and Demographical Characteristics of Acute Adult Poisoning in Adana, Turkey." *Human and Experimental Toxicology* 26 (5): 401–6.

American Burn Association. 2012. National Burn Repository. Chicago, IL: American Burn Association.

Balan, B., and L. Lingam. 2012. "Unintentional Injuries among Children in Resource Poor Settings: Where Do the Fingers Point?" *Archives of Disease in Childhood* 97 (1): 35–38.

Balme, K. H., J. C. Roberts, M. Glasstone, L. Curling, and M. D. Mann. 2012. "The Changing Trends of Childhood Poisoning at a Tertiary Children's Hospital in South Africa." *South African Medical Journal* 102 (3): 142–46.

Bell, G. S., A. Gaitatzis, C. L. Bell, A. L. Johnson, and J. W. Sander. 2008. "Drowning in People with Epilepsy: How Great Is the Risk?" *Neurology* 71: 578–82.

Bierens, J. J. L. M. 2006. *Handbook on Drowning: Prevention, Rescue, Treatment.* Berlin: Springer-Verlag.

Brenner, R. A., G. Saluja, and G. S. Smith. 2003. "Swimming Lessons, Swimming Ability, and the Risk of Drowning." *Injury Control and Safety Promotion* 10 (4): 211–16.

Brenner, R. A., G. S. Taneja, D. L. Haynie, A. C. Trumble, C. Qian, and others. 2009. "Association between Swimming Lessons and Drowning in Childhood: A Case-Control Study." *Archives of Pediatrics and Adolescent Medicine* 163 (3): 203–10.

Bugeja, L., E. Cassell, L. R. Brodie, and S. J. Walter. 2014. "Effectiveness of the 2005 Compulsory Personal Flotation Device (PFD) Wearing Regulation in Reducing Drowning Deaths among Recreational Boaters in Australia." *Injury Prevention* 20 (6): 387–92. doi:10.1136/injuryprevention-2014-041169.

Cameron, I. D., L. D. Gillespie, M. C. Robertson, G. R. Murray, K. D. Hill, and others. 2012. "Interventions for Preventing Falls in Older People in Care Facilities and Hospitals." *Cochrane Database of Systematic Reviews* 12: CD005465.

Chalmers, D., B. McNoe, and S. Stephenson. 2004. *Drowning, Near-Drowning and Other Water-Related Injury: Literature Review and Analysis of National Injury Data. A Report to the Accident Compensation Corporation.* Dunedin: Injury Prevention Research Centre.

Chatsantiprapa, K., J. Chokkanapitak, and N. Pinpradit. 2001. "Host and Environment Factors for Exposure to Poisons: A Case-Control Study of Preschool Children in Thailand." *Injury Prevention* 7 (3): 214–17.

Church, J., S. Goodall, R. Norman, and M. Haas. 2011. *An Economic Evaluation of Community and Residential Aged Care Falls Prevention Strategies in NSW.* Sydney: NSW Ministry of Health.

Dandona, R., G. A. Kumar, R. Ivers, R. Joshi, B. Neal, and others. 2010. "Characteristics of Non-Fatal Fall Injuries in Rural India." *Injury Prevention* 16 (3): 166–71.

Diplock, S., and K. Jamrozic. 2006. "Legislative and Regulatory Measures for Preventing Alcohol-Related Drownings and Near-Drownings." *Australian and New Zealand Journal of Public Health* 30 (4): 314–17.

Giashuddin, S. M., A. Rahman, F. Rahman, S. R. Mashreky, S. M. Chowdhury, and others. 2009. "Socioeconomic Inequality in Child Injury in Bangladesh—Implication for Developing Countries." *International Journal for Equity in Health* 8: 7.

Gillespie, L. D., M. C. Robertson, W. J. Gillespie, C. Sherrington, S. Gates, and others. 2012. "Interventions for Preventing Falls in Older People Living in the Community." *Cochrane Database of Systematic Reviews* 9: CD007146.

Gururaj, G., V. Sateesh, and A. Rayan. 2008. *Bengaluru Injury/Road Traffic Injury Surveillance Programme: A Feasibility Study.* Bengaluru: National Institute of Mental Health and Neuro Sciences.

Haagsma, J. A., N. Graetz, I. Bolliger, M. Naghavi, H. Higashi, and others. 2015. "The Global Burden of Injury: Incidence, Mortality, Disability-Adjusted Life Years and Time Trends from the *Global Burden of Disease Study 2013*." *Injury Prevention.* 0: 1–15. E-published 3 December 2015. doi:10.1136/injuryprev-2015-041616.

Harris, V. A., L. M. Rochette, and G. A. Smith. 2011. "Pediatric Injuries Attributable to Falls from Windows in the United States in 1990–2008." *Pediatrics* 128 (3): 455–62.

Hestekin, H., T. O'Driscoll, J. S. Williams, P. Kowal, K. Peltzer, and others. 2013. "Measuring Prevalence and Risk Factors for Fall-Related Injury in Older Adults in Low- and Middle-Income Countries: Results from the WHO Study on Global AGEing and Adult Health (SAGE)." SAGE Working Paper 6, World Health Organization, Geneva. http://cdrwww.who.int/healthinfo/sage/SAGEWorkingPaper6_Wave1Falls.pdf.

Hyder, A. A., N. N. Borse, L. Blum, R. Khan, S. El Arifeen, and others. 2008. "Childhood Drowning in Low- and Middle-Income Countries: Urgent Need for Intervention Trials." *Journal of Paediatrics and Child Health* 44 (4): 221–27.

Hyder, A. A., D. E. Sugerman, P. Puvanachandra, J. Razzak, H. El-Sayed, and others. 2009. "Global Childhood Unintentional Injury Surveillance in Four Cities in Developing Countries: A Pilot Study." *Bulletin of the World Health Organization* 87 (5): 345–52.

International Life Saving Federation. 2007. *World Drowning Report.* Gemeenteplein, Belgium: International Life Saving Association.

Jagnoor, J., L. Keay, N. Jaswal, M. Kaur, and R. Ivers. 2014. "A Qualitative Study on the Perceptions of Preventing Falls as a Health Priority among Older People in Northern India." *Injury Prevention* 20 (1): 29–34.

Jiang, X., Y. Zhang, Y. Wang, B. Wang, Y. Xu, and others. 2010. "An Analysis of 6215 Hospitalized Unintentional Injuries among Children Aged 0–14 in Northwest China." *Accident Analysis and Prevention* 42 (1): 320–26.

Jitapunkul, S., P. Yuktananandana, and V. Parkpian. 2001. "Risk Factors of Hip Fracture among Thai Female Patients." *Journal of the Medical Association of Thailand* 84 (11): 1576–81.

Kalula, S. Z., V. Scott, A. Dowd, and K. Brodrick. 2011. "Falls and Fall Prevention Programmes in Developing Countries: Environmental Scan for the Adaptation of the Canadian Falls Prevention Curriculum for Developing Countries." *Journal of Safety Research* 42 (6): 461–72.

Kendrick, D., C. Coupland, C. Mulvaney, J. Simpson, S. J. Smith, and others. 2007. "Home Safety Education and Provision of Safety Equipment for Injury Prevention." *Cochrane Database of Systematic Reviews* 1: CD005014.

Kendrick, D., M. C. Watson, C. A. Mulvaney, S. J. Smith, A. J. Sutton, and others. 2008. "Preventing Childhood Falls at Home: Meta-Analysis and Meta-Regression." *American Journal of Preventive Medicine* 35 (4): 370–79.

Kendrick, D., B. Young, A. J. Mason-Jones, N. Ilyas, F. A. Achana, and others. 2012. "Home Safety Education and Provision of Safety Equipment for Injury Prevention." *Cochrane Database Systematic Reviews* 9: CD005014.

———. 2013. "Home Safety Education and Provision of Safety Equipment for Injury Prevention (Review)." *Evidence-Based Child Health* 8 (3): 761–939.

Khambalia, A., P. Joshi, M. Brussoni, P. Raina, B. Morrongiello, and others. 2006. "Risk Factors for Unintentional Injuries Due to Falls in Children Aged 0–6 Years: A Systematic Review." *Injury Prevention* 12 (6): 378–81.

Kohli, U., V. S. Kuttiat, R. Lodha, and S. K. Kabra. 2008. "Profile of Childhood Poisoning at a Tertiary Care Centre in North India." *Indian Journal of Pediatrics* 75: 791–94.

Kool, B., S. Ameratunga, M. Lee, E. Robinson, S. Crengle, and others. 2010. "Prevalence of Risk and Protective Factors for Falls in the Home Environment in a Population-Based Survey of Young and Middle-Aged Adult New Zealanders." *Australian and New Zealand Journal of Public Health* 34 (1): 63–66.

Kool, B., S. Ameratunga, E. Robinson, S. Crengle, and R. Jackson. 2008. "The Contribution of Alcohol to Falls at Home among Working-Aged Adults." *Alcohol* 42 (5): 383–88.

Krug, A., J. B. Ellis, I. T. Hay, N. F. Mokgabudi, and J. Robertson. 1994. "The Impact of Child-Resistant Containers on the Incidence of Paraffin (Kerosene) Ingestion in Children." *South African Medical Journal* 84 (11): 730–34.

Laloë, V. 2002. "Epidemiology and Mortality of Burns in a General Hospital of Eastern Sri Lanka." *Burns* 28 (8): 778–81.

Lau, E. M., P. Suriwongpaisal, J. K. Lee, S. Das De, M. R. Festin, and others. 2001. "Risk Factors for Hip Fracture in Asian Men and Women: The Asian Osteoporosis Study." *Journal of Bone and Mineral Research* 16 (3): 572–80.

Lifshitz, M., and V. Gavrilov. 2000. "Acute Poisoning in Children." *The Israel Medical Association Journal* 2 (7): 504–6.

Linnan, M., A. Rahman, J. Scarr, T. Reinten-Reynolds, H. Linnan, and others. 2012. "Child Drowning: Evidence for a Newly Recognized Cause of Child Mortality in Low and Middle Income Countries in Asia." Working Paper 2012-07, Special Series on Child Injury 2, UNICEF Office of Research, Florence.

Lord, S. R., C. Sherrington, H. B. Menz, and J. C. T. Close. 2007. *Falls in Older People: Risk Factors and Strategies for Prevention*. 2nd ed. Cambridge, U.K.: Cambridge University Press.

Lozano, R., M. Naghavi, K. Foreman, S. Lim. K. Shibuya, V. Aboyans, and others. 2012. "Global and Regional Mortality from 235 Causes of Death for 20 Age Groups in 1990 and 2010: A Systematic Analysis for the Global Burden of Disease Study 2010." *The Lancet* 380 (9859): 2095–128.

Mabrouk, A., A. El Badawy, and M. Sherif. 2000. "Kerosene Stove as a Cause of Burns Admitted to the Ain Shams Burn Unit." *Burns* 26 (5): 474–77.

Mashreky, S. R., A. Rahman, T. F. Khan, L. Svanström, and F. Rahman. 2010. "Determinants of Childhood Burns in Rural Bangladesh: A Nested Case-Control Study." *Health Policy* 96 (3): 226–30.

Mock, C., M. Peck, C. Juillard, D. Meddings, A. Gielen, and others. 2011. *Burn Prevention: Success Stories and Lessons Learned.* Geneva: World Health Organization.

Moran, K. 2006. "Water Safety Knowledge, Attitudes and Behaviours of Asian Youth in New Zealand." In *Proceedings of the Second International Asian Health and Wellbeing Conference*, November 13–14, edited by S. Tse, M. Hoque, K. Rasanathan, M. Chatterji, R. Wee, and others. Auckland, New Zealand: University of New Zealand.

Nguyen, H., R. Ivers, S. Jan, A. Martiniuk, and C. Pham. 2013. "Catastrophic Household Costs Due to Injury in Vietnam." *Injury* 44 (5): 684–90.

Nonyelum, S. C., N. Nkem, C. N. Ofeyinwa, and O. E. Orisakwe. 2010. "Safety Warnings and First Aid Instructions on Consumer and Pharmaceutical Products in Nigeria: Has There Been an Improvement?" *Journal of the Pakistan Medical Association* 60 (10): 801–4.

Norton, R., A. A. Hyder, D. Bishai, and M. Peden. 2006. "Unintentional Injuries." In *Disease Control Priorities in Developing Countries*, second edition, edited by D. T. Jamison, J. G. Breman, A. R. Measham, G. Alleyne, M. Claeson, D. B. Evans, P. Jha, A. Mills, and P. Musgrove. Washington, DC: Oxford University Press and World Bank.

Norton, R., and O. Kobusingye. 2013. "Injuries." *New England Journal of Medicine* 368 (18): 1723–30.

Ozdemir, R., B. Bayrakci, Ö. Tekşam, B. Yalçın, and G. Kale. 2012. "Thirty-Three-Year Experience on Childhood Poisoning." *Turkish Journal of Pediatrics* 54 (3): 251–59.

Peck, M., J. Molnar, and D. Swart. 2009. "A Global Plan for Burn Prevention and Care." *Bulletin of the World Health Organization* 87 (10): 802–03.

Peden, M., K. Oyegbite, J. Ozanne-Smith, A. A. Hyder, C. Branche, and others, eds. 2008. *World Report on Child Injury Prevention.* Geneva: World Health Organization.

Peden, M. M, and K. McGee. 2003. "The Epidemiology of Drowning Worldwide." *Injury Control and Safety Promotion* 10 (4): 195–99.

Peiris-John, R., B. Kafoa, I. Wainiqolo, R. K. Reddy, E. McCaig, and others. 2013. "Population-Based Characteristics of Fatal and Hospital Admissions for Poisoning in Fiji: TRIP Project-11." *Injury Prevention* 19 (5): 355–57.

Rahman, A. 2010. "A Community Based Child Drowning Prevention Programme in Bangladesh: A Model for Low Income Countries." Doctoral thesis, Public Health Science Department, Karolinska Institutet, Solna, Sweden.

Rahman, A., S. R. Mashreky, S. M. Chowdhury, M. S. Giashuddin, I. J. Uhaa, and others. 2009. "Analysis of the Childhood Fatal Drowning Situation in Bangladesh: Exploring Prevention Measures for Low-Income Countries." *Injury Prevention* 15: 75–79.

Rahman, F., S. Bose, M. Linnan, A. Rahman, S. Mashreky, and others. 2012. "Cost-Effectiveness of an Injury and Drowning Prevention Program in Bangladesh." *Pediatrics* 130 (6): e1621–28.

Ramos, C. L., H. M. Barros, A. T. Stein, and J. S. Costa. 2010. "Risk Factors Contributing to Childhood Poisoning." *Jornal de Pediatria* 86 (5): 435–40.

Ranaweera, A. D., P. Fonseka, A. PattiyaArachchi, and S. H. Siribaddana. 2013. "Incidence and Risk Factors of Falls among the Elderly in the District of Colombo." *Ceylon Medical Journal* 58: 100–106.

Rizvi, N., S. Luby, S. I. Azam, and F. Rabbani. 2006. "Distribution and Circumstances of Injuries in Squatter Settlements of Karachi, Pakistan." *Accident Analysis and Prevention* 38 (3): 526–31.

Sanghavi, P., K. Bhalla, and V. Das. 2009. "Fire-Related Deaths in India in 2001: A Retrospective Analysis of Data." *The Lancet* 373 (9671): 1282–88.

Sawalha, A. F., W. M. Sweileh, M. T. Tufaha, and D. Y. Al-Jabi. 2010. "Analysis of the Pattern of Acute Poisoning in Patients Admitted to a Governmental Hospital in Palestine." *Basic and Clinical Pharmacology and Toxicology* 107 (5): 914–18.

Schwebel, D. C., and D. Swart. 2009. "Preventing Paraffin-Related Injury." *Journal of Injury and Violence Research* 1 (1): 3–5.

Schwebel, D. C., D. Swart, J. Simpson, P. Hobe, and S. K. Hui. 2009. "An Intervention to Reduce Kerosene-Related Burns and Poisonings in Low-Income South African Communities." *Health Psychology* 28 (4): 493–500.

Segui-Gomez, M. 2001. "Cost Effectiveness of Interventions to Prevent Drowning and Near-Drowning." Abstract at 129th Annual Meeting of the American Public Health Association, October 23. https://apha.confex.com/apha/129am/techprogram/paper_23731.htm.

Smith, K. R., J. P. McCracken, M. W. Weber, A. Hubbard, A. Jenny, and others. 2011. "Effect of Reduction in Household Air Pollution on Childhood Pneumonia in Guatemala (RESPIRE): A Randomised Controlled Trial." *The Lancet* 378 (9804): 1717–26.

Solomon, R., M. J. Giganti, A. Weiner, and M. Akpinar-Elci. 2013. "Water Safety Education among Primary School Children in Grenada." *International Journal of Injury Control and Safety Promotion* 20 (3): 266–70.

Soori, H. 2001. "Developmental Risk Factors for Unintentional Childhood Poisoning." *Saudi Medical Journal* 22 (3): 227–30.

Stevenson, M. R., M. Rimajova, D. Edgecombe, and K. Vickery. 2003. "Childhood Drowning: Barriers Surrounding Private Swimming Pools." *Pediatrics* 3 (2): e115–19.

Swart, L., A. van Niekerk, M. Seedat, and E. Jordaan. 2008. "Paraprofessional Home Visitation Program to Prevent Childhood Unintentional Injuries in Low-Income Communities: A Cluster Randomized Controlled Trial." *Injury Prevention* 14 (3): 164–69.

Thompson, D. C., and F. P. Rivara. 2000. "Pool Fencing for Preventing Drowning in Children." *Cochrane Database of Systematic Reviews* 2: CD001047.

van der Molen, H. F., M. M. Lehtola, J. Lappalainen, P. L. Hoonakker, H. Hsiao, and others. 2012. "Interventions to Prevent Injuries in Construction Workers." *Cochrane Database of Systematic Reviews* 12: CD006251.

WHO (World Health Organization). 2006. *Guidelines for Safe Recreational Water Environments.* Vol. 2: *Swimming Pools and Similar Environments*. Geneva: WHO.

———. 2012. "Drowning." Fact Sheet, WHO, Geneva. http://www.who.int/mediacentre/factsheets/fs347/en/index.html.

———. 2014. "Global Health Estimates." http://www.who.int/healthinfo/global_burden_disease/en/.

Yang, L., Q. Q. Nong, C. L. Li, Q. M. Feng, and S. K. Lo. 2007. "Risk Factors for Childhood Drowning in Rural Regions of a Developing Country: A Case-Control Study." *Injury Prevention* 13 (3): 178–82.

Zia, N., U. R. Khan, J. A. Razzak, P. Puvanachandra, and A. A. Hyder. 2012. "Understanding Unintentional Childhood Home Injuries: Pilot Surveillance Data from Karachi, Pakistan." *BMC Research Notes* 5: 37.