THE PHILIPPINE REVIEW OF ECONOMICS
VOL. XLV NO. 2 DECEMBER 2008 P. 161-183

Socioeconomic determinants of childhood injury*

Clarissa V. Buenaventura and Ria F. Campos
University of the Philippines School of Economics

Accidents are the major causes of lifetime incapacity and premature deaths of children ages 1-14. While the country is winning in its fight against communicable diseases by showing a decreasing rate of mortality due to pneumonia, diarrhea, nutritional deficiency, measles, and tuberculosis (TB) of all forms in the past 30 years, the rate of mortality due to accidents has been constant and, at the turn of the century, increasing. This study aims to help in improving preventive actions against unintentional child injuries by identifying the socioeconomic risk factors for injury. Socioeconomic data from the records of trauma patients in the UP Philippine General Hospital who applied for medical social service in the year 2006 were analysed using logistic regression. Results of the regression showed that male children living with only one adult and who have a younger, less educated mother are more at risk of getting injured. Paternal characteristics turned out to have an opposite sign than that of maternal characteristics, implying that older and more educated fathers offer less preventive efforts for child injury.

JEL classification: J13, J18, C25
Keywords: child injury, risk, logistic regression

1. Introduction

There is an elusive child killer lurking the streets and stalking the home of every family in the world. Accidents are the major sources of lifetime incapacity and premature deaths of children ages 1-14. Every day, it kills one million children around the world and permanently disables many more [Safe Kids World Wide 2004]. In fact, one out of five Filipino children dies due to accidents (Department of Health, United Nations Children's Fund and the Alliance for Safe Children 2003, cited in Araneta [2006]). Moreover, this issue

has become a major stumbling block for the country in meeting the fourth millennium development goal of decreasing the amount of child mortality. While the country is winning in its fight against communicable diseases by showing a decreasing rate of mortality due to pneumonia, diarrhea, nutritional deficiency, measles, and tuberculosis of all forms in the past 30 years, the rate of mortality due to accidents has been constant and, at the turn of the century, increasing [Consunji et al. 2007].

Despite the gravity of this issue, little attention is given to child injury in the Philippines. The prevention of child injury is, however, a major issue among developed countries. The challenge posed by communicable diseases obviously overshadows the urgency of addressing childhood injury; according to the World Health Organization's (WHO) Injury Chart Book, 90 percent of deaths due to injuries occur in low- to middle-class countries. This proves that both the rich and less developed countries should address this issue.

Until recently, injuries were commonly termed "accidents", suggesting that these events were unpredictable and unavoidable misfortunes befalling unlucky individuals. Today, the term "injury" is favored because it more accurately suggests that this is a problem that can be analysed and avoided. It can also be either fatal or nonfatal, and they can occur unintentionally or as a result of purposeful acts of harm.

Lately there has been an increase in the use of analytic epidemiologic studies like cohort and case-control designs to determine the connection between injuries and potential risk factors. Through the recognition of causal relationships or identification of high-risk characteristics, these studies presented the basis for intervention strategies and evaluation of prevention programs [MacKay et al. 1999]. Gilbride et al. [2006] noted that a limitation of previous works in this area is that most studies of childhood injury have examined either overall rates of injury, specific causes of injury, or one particular type of injury. To date, there is no comprehensive study of childhood injury in the Philippines, and its specific relationship to socioeconomic factors has yet to be definitively established. Only statistical descriptions have been made for the purpose of organizing injury-prevention programs [Arcadio et al. 1992].

This research will corroborate the theories of previous studies relating childhood injury with socioeconomic factors and see if these would apply in the Philippine setting. It will also identify the characteristics or trends that are present in this developing country by examining the relationship between socioeconomic status using ordinal scales (e.g., occupation, educational level attained, etc.) and childhood injuries of lower-income families.

The present study used socioeconomic data from the records of trauma patients in the UP Philippine General Hospital (PGH) who applied for medical social services in 2006. Logistic regression analysis of the data was executed to address the following questions: What is the relationship between childhood

injury and the child's socioeconomic standing? What are the factors that make a child more at risk of childhood injuries? Are these results consistent with those of other countries?

The rest of the paper is organized as follows. Section 2 gives a brief background on childhood injury. Section 3 reviews related literature. Section 4 deals with the conceptual model and the empirical specification that follows. Section 5 discusses the data-gathering methodology and the descriptive statistics of the data; it also presents the results of the empirical specification. Section 6 provides conclusions and recommendations.

2. Background

The WHO Injury Chart Book [Department of Injuries and Violence Prevention, 2002] offers a "geographical overview of the global burden of injuries", relying on a plethora of data; researchers polled country-specific research clusters, utilized data obtained from government agencies, and relied on expert consultants to revise and confirm the accuracy of the WHO findings. Not surprisingly, researchers concluded that there is a high correlative value between injury and socioeconomic status. However, one particularly unique finding is that 90 percent of the world's deaths from injuries occur in low- and middle-class countries; essentially, low- and middle-class nations are forced to bear a grossly disproportionate amount of injury, to the point at which the inverse relationship between injury incidence in poor versus rich nations seems to be exponential.

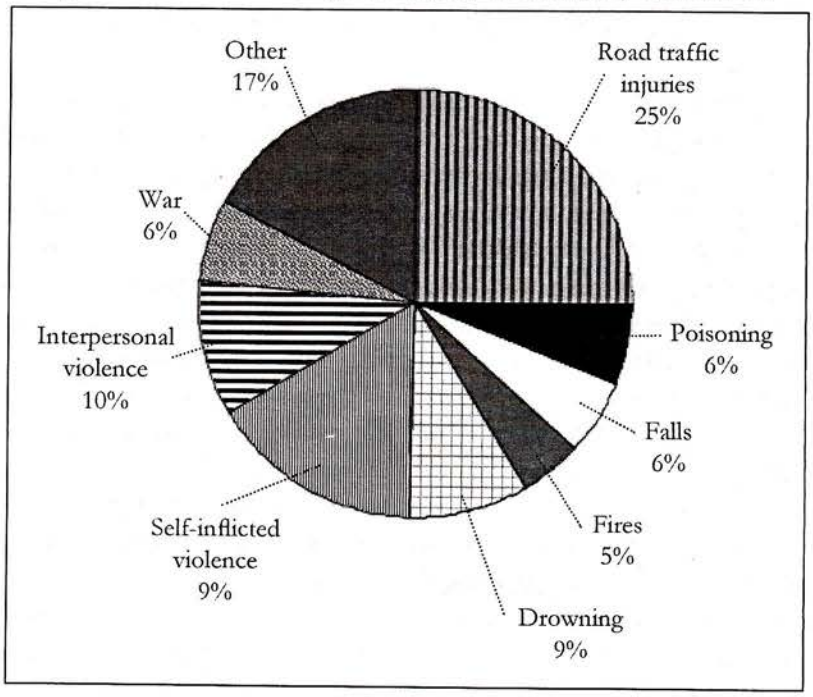
More specifically, the WHO report noted current trends in injury statistics. The distribution of global injury mortality by cause in 2000 was presented in Figure 1. Road traffic injuries (25 percent), other injuries (17 percent), self-inflicted injuries (16 percent), and interpersonal violence (10 percent) gained significant headway in cause-of-injury rankings. Within the realm of socioeconomic class relativity, this trend is extremely important since the aforementioned causes affect the poor most severely; for example, stress about monetary concerns is a recurring ancillary factor in cases of suicide and domestic abuse. Incidentally, road traffic injuries accounted for the highest cause of accidental death injury; not surprisingly, this also affects poorer nations with increased severity due to the lack of sophisticated infrastructure. Regarding children, in particular, the 1-14 year-old age group accounts for the highest proportion of the world's fire-related mortality rate; further, the Southeast Asian region accounted for the highest proportion of the world's fire-related deaths. Drowning was also noted as a leading cause of injury among children; the 1-14 year-old age group accounts for more than half of the world's drowning mortality, with poor nations likewise accounting for majority of drowning-related deaths. The same trend is seen in cases of poisoning mortality; majority of cases occur in poorer

countries. Majority of the disability-adjusted life years (DALYs) lost are among young children and young adults. The two leading factors of global injury with little correlation to children were suicide and interpersonal injury.

To more closely examine unintentional injury within the local sphere, we now turn to a preliminary report on childhood injuries by Consunji et al. [2007]. In the Philippines, accidents have always been included in the ten leading causes of mortality from 1980 until now. They concluded that accidental injury is the second leading cause of child mortality within the 1-4 year-old age group (after pneumonia), and is the leading cause of child mortality within the 5-14 year-old age group (refer to Figure 2).

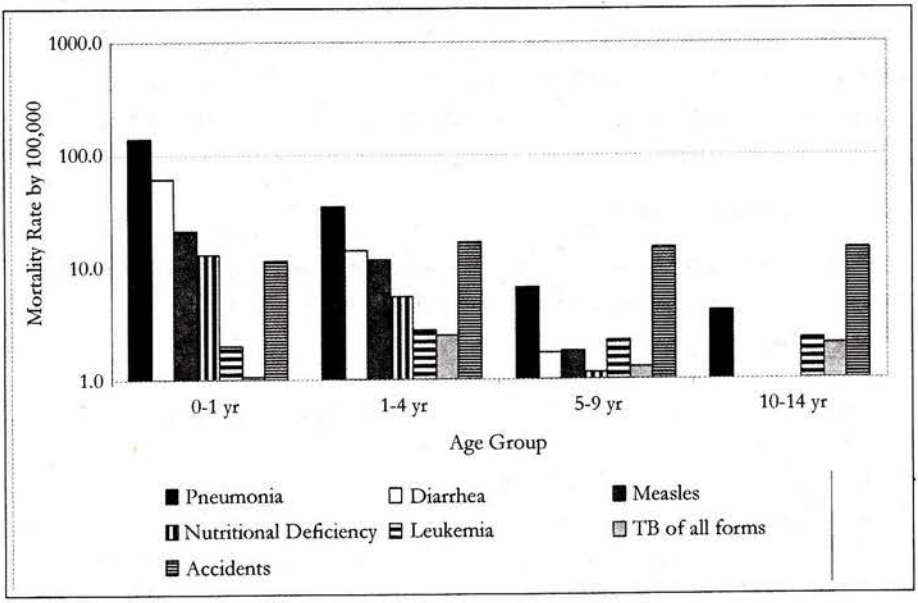
Furthermore, accidental injury as the primary cause of childhood mortality is on the rise, from about 3 percent in 1970 to nearly 10 percent in 2000 (refer to Figure 3). Childhood mortality rates have also remained constant and increasing for the past three decades while all the other mortality rates are decreasing. This shows that while the country is winning in its fight against communicable diseases, it has not been addressing childhood injuries well. Interestingly, Consunji's [2007] report is fairly consistent with WHO findings with drowning (33 percent), other accidental causes (27 percent), transport accidents (27 percent), falls (6 percent), fire burns (5 percent), and poisoning (2 percent) as cited causes of unintentional injuries.

Figure 1. Distribution of global injury mortality by cause, 2000



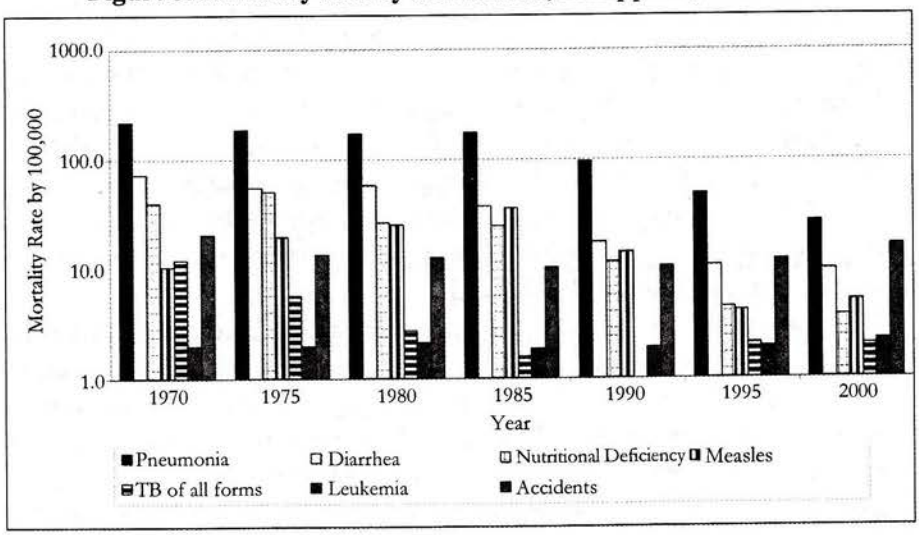
Source: Department of Injuries and Violence Prevention, World Health Organization [2002].

Figure 2. Mortality rate by age group and mechanism, Philippines 2002



Source: National Institute of Health [2007].

Figure 3. Mortality rate by mechanism, Philippines, 1970-2000



Source: National Institute of Health [2007].

3. Review of related literature

It has been established that accidents are not random occurrences but preventable events. To determine the risk factors of injuries, it is necessary that various disciplines such as psychology, medicine, epidemiology, and economics be used. In this section, a review of literature from these branches of knowledge is carried out to build the foundations of a theoretical framework on the mechanism of unintentional childhood injury.

3.1. The mechanism of injury

Three main approaches on injury are worth discussing in this review. Each approach clarifies the nature or mechanism of childhood injury.

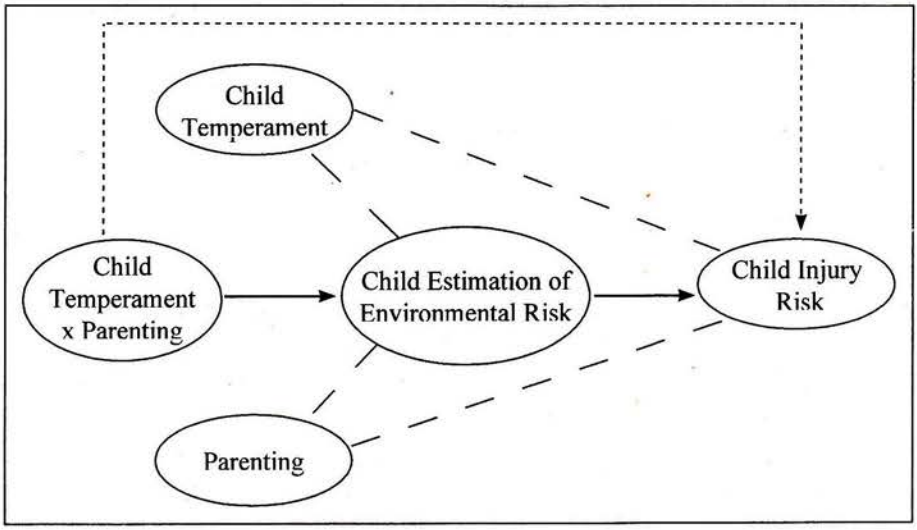
3.1.1. Psychological approach

Injury is an outcome of multiple events. The path toward injury as an outcome is mediated and predicted by various factors. The findings in psychology become an essential basis for uncovering the risk factors of childhood injuries. The work of Peterson, Farmer, and Mori [1987] paved the way for the use of process analysis in understanding the said multiple events that lead to the occurrence of injury [Schwebel and Barton 2005]. Process analysis lets one view injury as a "series of person-environment interactions rather than as a discrete event" [Peterson et al. 1987]. By using this approach in explaining injury, it becomes apparent that risk factors for injury cannot be attributed to a single factor or event; it is a product of the "multiple intricacies of human behavior" [Schwebel and Barton 2005].

Peterson et al.'s [1987] study on process analysis begot other studies in psychology on the effect of multiple risk factors for injury. Baron and Kenny [1986] proposed three models (refer to Figure 4). The first moderator, predictor and mediation model, involved the roles of the child's temperament, the child's estimation of risk in the environment, and parenting. They posit that there are six paths (A, B, C, D, E, and F) toward the outcome of injury. Child temperament, child estimation of risk in the environment, and parenting were proposed as the three variables with direct paths to child injury risk.

There are two kinds of indirect paths to injury risk: mediating paths and moderating paths. Mediating paths are indirect paths wherein one variable becomes the link (the mediator) between the other variable and the end result. For example, child temperament may not be the direct reason behind increased injury rates, but rather the estimation of risk of the child, which is influenced by child temperament. The second indirect path is called moderating path. In this situation, the moderating variable increases the risk for child injury. As observed, children with impulsive temperaments and parents who do not possess good parenting skills have higher injury rates. In this case, having an impulsive temperament is already a risk factor, but it is worsened by the fact that the child's parents do not possess good parenting skills.

Figure 4. Baron and Kenny's process analysis of child injury



3.1.2. Economic approach

Economic papers on child injury used child injury as an estimator of parenting quality. Currie and Hotz [2001] used mother characteristics to estimate its effect on child injury incidence. They used Ribar's [1992] conceptual model where parents maximized their utility as a function of goods, leisure, and child quality, taking family characteristics and random shocks as given. The constraints for the maximization of utility were the wage of the parents and the prices of goods. Increasing the time for work increases the wage of the parents and increases the goods (child safety being one of the goods) while decreasing the leisure time and the quality time the parents have for the children. Data regarding maternal and child characteristics, like the work status of the mother and the child's age and sex, were used as the factors affecting demand for safety. Logistic regression was used to analyse the data. The results of the empirical specification showed that males had higher accident rates. Accident rates rose with age and were higher during the fall and the summer. The presence of older siblings increased accident rates for the younger siblings. However, maternal education was not significantly correlated with injury rates, and maternal employment had no significant effect on accidents except among African-Americans.

3.1.3. Socioeconomic approach

The socioeconomic background of the child involved could be considered a catchall classification for risk factors of injuries. Socioeconomic status (SES) refers to an individual's social and economic position, which is often expressed on an ordinal scale using such criteria as income, occupation, or educational level obtained [MacKay et al. 1999].

One important contribution to the literature on socioeconomic status and child injury was a Canadian systematic review of the literature on the relationship between childhood injury and socioeconomic status done by MacKay et al. [1999]. In an effort to consolidate the findings of existing studies on SES and child injury, they used an international electronic search for published papers relevant to the field. They were able to determine 57 relevant studies on the topic.

The study grouped the measures of SES relevant to injury into three: parenting, economics, and environment. Parenting and economic factors were usually measured through parental age, occupation, civil status, family size, family income, and education. On the other hand, environmental factors were measured through housing quality, multifamily residences, crowding in the neighborhoods, and traffic conditions in the area.

Results regarding the influences of these factors in the mechanism of injury are varied and even contending. The review also noted that literature in the injury field is mostly composed of descriptive epidemiology. It is only recently that there has been an increase in the use of analytic epidemiologic studies such as cohort and case-control designs.

3.2. Empirical studies

Psychology and behavioral science literature regarding child injury provided empirical studies the foundation and the explanation for its research design. Gender differences in temperaments, parenting decisions, and other environmental factors have been used to explain differences in rates of injury in populations. For years it has been noted that some groups experience higher rates of injuries compared to others. Statistical methods and empirical specifications were used to prove the significance of these differences.

3.2.1. Studies in the developed world

A recent study involving injury and socioeconomic factors in Alberta, Canada, by Gilbride et al. [2006] further affirmed the influence of these factors on the risk for child injury. The researchers used the records of the local insurance plan to trace all the children registered who have been treated for injuries for the fiscal year 1995-1996. Using insurance payment information, the patients were classified as low-, middle-, or upper-economic standing. The model also included dummy variables for whether the child comes from an urban or rural area. The data were then analysed with the use of logistic regression. The results of this study showed that boys were significantly more likely than girls to experience all types of injury. Children of lower economic standing had odds ratios significantly greater than 1 for risk of all types of injury compared with children of higher economic standing, with a maximum odds ratio of 1.60 for poisoning and 1.35 for burns. The results of the study

showed that injuries were more frequent among male children, less frequent among children below one year old and becomes more frequent until its peak with children of 15-17 years old, and more frequent in urban settings and to children with low economic standing.

Another population-based study by Petridou et al. [2005] in a small Greek town of Velestino used more measures of socioeconomic status and risk factors for child injury. During a 12-month study period, all identifiable injuries regardless of severity were monitored through health-care outlets or educational institutions. Variables taken in consideration for socioeconomic factors and other patient characteristics were the number of cohabitants in the house, total number of injuries that took place during the previous year, circumstances of the accident and characteristics of the injury, age and education of the father. Somatometric characteristics of the child like vision problem, body mass, and height were not significant risk factors, and other sociodemographic characteristics of the family members. All 748 children in the population of the town were monitored throughout the year. The data collected were analysed for incidence rates with estimated confidence interval calculated under the Poisson assumption. The case-control data were cross-tabulated, and a univariate testing was undertaken. The data were also modeled using logistic regression. Consistent with theory and the findings of Gilbride et al. [2006], the results of the logistic regression showed that boys were more likely to experience injury than girls, and that this difference in gender becomes even more pronounced in higher age brackets. They also found out that the peak incidence of injuries was during the summer months. There was no trend as to which day of the week injuries were encountered. The data also showed that children of less-educated and younger fathers had a considerable higher risk of injury. Children from families with more than one injury reported were more likely to be involved in another injury. Also, children with more family members were significantly at higher risk for injury than those with smaller families. Children who were employed partially also had a higher rate of injury.

An earlier study by Carter and Jones [1993] of patients of the North Staffordshire Hospital Center in Britain explored the characteristics of injury patients compared to non-injured children in the area of the hospital. It also gathered insight about the safety practices of households. This research focused on children less than five years old to narrow down on hazards that a home offers to a child. The sample comprised children under five years old who were treated for emergency and surgery in the year 1991. The authors gathered family social characteristics of both cases and controls, accident details of all children less than five years of age in the family, and safety devices they used at home. Two hundred cases and controls were able to respond to the postal questionnaire. The data were analysed using confidence intervals. The results of their statistical analysis concluded that the age of the mothers of injured

children was significantly lower than that of the controls. Contrary to other findings, the median family sizes of the case and control group did not have a significant difference. Siblings of children who got injured had significantly more accidents than the control, signifying that some households are more prone to injuries. Interestingly, in the case group, a higher percentage of mothers were employed and higher percentage of parents smoked and lived in rented accommodations.

3.2.2. Studies in the developing world

Mock et al. [1995] authored one of the earlier contributions to studies of injury in the developing world. The study took place in a small village of Ghana where the authors monitored the injury admissions of a rural hospital. During the four-year study period, 614 patients were admitted to the hospital. The leading types of injury were motor vehicle crashes, burns, agricultural injuries due to lacerations, and injuries from falling trees. There were also few blunt or penetrating assaults and non-assaultive injuries. The data also showed that burns accounted for 61 percent of all injuries in children less than five years of age. Eighty-five percent of these burn accidents were due to scalding from cooking pots. For children aged 5-14, transport was the leading mechanism for injury. Males also predominated in all types of injury except in pedestrian injuries.

Celis et al. [2003] explored the relationship between family characteristics and pedestrian injury risk. This study was set in the Metropolitan Area of Guadalajara, Mexico. Socioeconomic characteristics of children aged 1-14 who were injured or killed due to pedestrian-motor collision and admitted to a hospital or emergency room were pitted against two neighborhood controls of the same age and sex as the injured child. Multivariate odds ratio was calculated by conditional logistic regression. There were 131 cases of fatal and nonfatal child pedestrian injuries in the area during the study period. The results showed that children with working mothers were at more risk, although parent age, education, and whether the father was working or not did not elevate risks. Males younger than ten years old and who spent more time playing in streets were more likely to have encountered a pedestrian injury. The risk for injury increased as the number of siblings increased. Also, the larger number of nonsiblings or nonparents elevates the risks for pedestrian child injury. Single motherhood was not associated with increased risk in this study.

Burns, being one of the most common household injuries for children, became the focus of the study done by Delgado et al. [2002]. This study gathered data from patients in the burn unit of the National Institute of Child Health, a major hospital in Lima, Peru. Majority of the patients were of low- and mid-low socioeconomic status. Age, gender, birthplace, race, and birth order of the child were considered as the child's socioeconomic characteristics. The level of education, occupation, and monthly income of the parents and the relation of

the child to the head of the household were used for parent SES characteristics. One age control was chosen for each burn case. A total of 1,480 cases and controls were surveyed. With the use of simple and multivariate analysis they showed that parent education beyond high school was associated with a decreased risk for burns with paternal education having a weaker association with injury. All in all, the most important risk factors were salary, water supply, and crowding in the house.

3.2.3. Studies in the Philippines

Arcadio et al. [1992] sparked local interest in childhood injuries in 1992 with their hospital-based epidemiological survey of childhood accidents. They used all the available charts of patients less than 21 years of age at the UP PGH Emergency Room Complex, which includes cases for pediatrics, surgery, EENT, and orthopedic. The study period was from July to December 1989. From the charts they were able to lift the identity of the child (name, age, sex, and address) and the circumstances surrounding the injury (the date, time, place, activity at the time of injury, whether the injury was intentional or not, and the outcome of the injury). Their survey also collected 3,660 patient charts. From these charts they saw that the 13-18 year-old bracket had the highest rate of injury occurrence comprising 30 percent of the sample. Males made up 70 percent of the sample and, although the PGH is located in the heart of Metro Manila, 8.3 percent of the injured-patient sample came from outside Metro Manila. Most of the accidents happened from 1:00 pm to 6:00 pm, and the places of accidents in most cases were the streets, the patient's house, and inside school buildings; only a very small percentage happened in playgrounds. For the types of accidents, the most predominant accident in the less than 1, 5-7, and 8-12 year-old groups is falls. Lacerations, contusions, abrasions, hematoma, and fractures were also common injuries. Vehicular cases totaled 530; of these, 71 percent were pedestrian victims while the rest were passenger victims.

In another study by Arcadio et al. [1992], a community-based epidemiological methodology was utilized. Baclaran, Parañaque, in Metro Manila, was the community surveyed for one month. Household members were interviewed using a standard survey form by a group of investigators. Three thousand fifteen households were interviewed, of which 319 experienced accidents within one year prior to investigation. More than half of the accidents occurred to the 1-4 and 13-18 age brackets. Boys outnumbered the girls in all age brackets. They found out that the presence of physical and mental difficulty did not show any significant correlation with the frequency of accidents. The most common types of accidents in this community were falls, burns, traffic accident, and bites. Falls were the number-one type of accident, while burns and traffic accidents were the second most frequently occurring. Childhood accidents peaked during the months of September, December, and October. Most accidents occurred in the child's home or in the street.

Even if child injury has replaced communicable diseases as the number-one child killer in the Philippines, a work on this field has yet to be published. Nevertheless, child injury has recently been able to gain some attention both from government and nongovernment groups. In the past three years, child-injury prevention programs have been launched by agencies like Safe Kids Philippines. However, these programs are lacking in effectiveness if the target audiences are not well identified. Contributions to the literature on child-injury prevention are therefore much needed. However, both the attention and the funding granted to this phenomenon will only increase if further studies are made on this issue.

4. Theoretical framework

The utility models of Becker and Lewis [1973] on the interaction between the quantity and quality of children were the bases for studies on child quality, being a part of the household's utility function. Consider the following model of childcare choice of Currie and Hotz [2001], based on the economic paper of Blau and Hagy [1998], on child-care choice. Parents are assumed to maximize a utility (U) function

$$U = f(X, L, Q : c, e) \tag{1}$$

by preferring goods (X), leisure (L), and child quality (Q), taking child and family characteristics (c) and random shocks (e) as given.

The mentioned variables maximize the function, subject to the following budget constraint:

$$pX + wL = Y + (T - L)w \tag{2}$$

where w is the wage, p is a vector of prices, Y is nonlabor income, and T is the total endowment of time. Households also face a production function that describes the way that goods and nonworking time (leisure) can be combined to produce child quality:

$$Q = g(X, L : c, v) \tag{3}$$

in which goods and services and nonworking time (leisure) are combined with random factors, v, produce child quality. Child quality consists of the safety of children or, otherwise, the risk of injury to children.

The framework illustrates that an increase in work activity can reduce the amount of L obtainable for investment in child quality, but can increase the amount of X that could be invested. An example of X variable that can be purchased by parents is childcare. Suppose there are two kinds of childcare: X_r, which is regulated and subject to minimum standards; and X_u, which is

unregulated. Let these inputs have unit prices of p_r and p_u, respectively. We assume here that parents have full information on the inputs that they purchase and the quality of care these inputs generate. We also assume that they are knowledgeable of the risk of injury to their children.

Binding child-care regulations that regulate quality and safety are likely to increase p_r relative to p_u, to the point that higher quality and safer child-care arrangements are costly to produce. In a world of full information about child-care settings and the risk of injuries to children, and while parents may prefer safer child-care arrangements, all else being equal, imposing more strict or stringent regulations will tend to "price" or "crowd" some parents—specifically those with a lower willingness to pay for higher quality care—"out" of regulated care due to higher price. As a result of this "crowd-out" effect, it is uncertain whether imposing more stringent standards on regulated child care will essentially increase the quality of care, including safety, to which children are exposed.

5. Empirical results

5.1. Empirical model

Particular characteristics of the child, the parents, and the family itself are analysed against the occurrence of unintentional injury to children. The significance of the relation can be shown as

$$\begin{aligned} INJURED_I = {} & \beta_1 + \beta_2 MALE_i + \beta_3 AGE_i + \beta_4 FAMSIZE_i \\ & + \beta_5 BIRTHORD_i + \beta_6 ONEHEAD_i - \beta_7 MOTHER40_i \\ & + \beta_8 FAGE_i - \beta_9 MEDUC_i - \beta_{10} FEDUC_i \end{aligned} \tag{4}$$

where *INJURED* is the dependent variable; *MALE* is the dummy variable indicating the sex of the child; *AGE* is the age of the subject; *FAMSIZE* is the number of members of the family; *BIRTHORD* is the rank of child within the siblings; *ONEHEAD* is a dummy variable, with 1 representing a single parent household; *MORTHER40* is a dummy variable equal to 1 if age of mother is greater than 40; *FAGE* is the age of the father; and *MEDUC* and *FEDUC* are the years of education of the mother and the father of the child, respectively.

The relationship between child age and sex of the child is the most established among the different socioeconomic factors being investigated. Intuitively speaking, it is easy to understand that a child upon acquiring locomotive skills is more prone to meet an accident than a child who has yet to learn how to walk. Behavioral differences between boys and girls in games played, risk-taking decisions, and interests that make young boys more at risk

to meet accidents than young girls are also readily observable [Carter and Jones 1993].

Parents' characteristics such as age, education, occupation, and civil status, which are used in determining parent quality, may play a part in the relationship between SES and childhood injury. Parental age is considered a risk factor for child injury. The younger the parents are, the higher the expected risk for the child to obtain injuries. Parental education may not necessarily estimate intelligence or the love and care that a parent gives to a child. However, it is safe to assume that parents' education will play a role in their ability to parent their children. The education of the parents is intertwined with their occupation. The study of Petridou et al. [2005] also showed that children whose parents are working tend to be more at risk than those whose parents are not working. The correlation of the civil status of the parents to the higher risk of child injury is a more controversial issue. Some assert that certain environmental factors to which children from single-headed households are exposed put these children at a higher risk of unintentional injuries. Parenting quality may be negatively affected by the presence of only one adult in a family.

The underlying trend among almost all the factors discussed is their effect on the economic standing of the families. Education and occupation of parents could readily translate to income. Economic standing has two mechanisms in affecting child injury risk. One is through the quality of parenting; the other through the ability to afford safety. Safety for children could mean the equipment that could be bought to ensure a child's safety while playing, e.g., helmet or proper shoes.

Furthermore, family characteristics may also contribute to the elucidation of the relationship between childhood injury and SES. Some children may be at increased risk in injury due to family characteristics such as number of siblings, parental supervision, and scarcity of resources such as safety equipment inside the home. Some studies found that children from households with multiple children or households with younger children were at increased risk of injury (e.g., Celis et al. [2003]).

5.2. Data

Data utilized in the study were gathered from the Medical Social Service division of the UP PGH.[1] Application for social services requires an interview of the patient's guardian with a social worker of the hospital. This standardized interview elicits socioeconomic information (e.g., parent age, education, occupation, and the number of children in the family) from the patients applying for social service. The informant was usually one of the parents of the patient. Information from the interview is transcribed in the application form for medical social service grants. Application forms for the year 2006 were

[1]We would like to express our gratitude to the PGH for letting us use their data.

utilized for the study. A total of 154 patient application forms were encoded and analysed for the empirical specification. PGH, being a government hospital, creates a certain bias in the results in that most of the patients were poor. This problem shall be discussed further later in the paper.

The data for cases of injury were gathered from patients of the trauma ward and burn unit who applied for MSS. There were 93 pediatric patients in 2006. Control data were gathered from pediatric patients who were not treated for injuries in the same year. Sixty-one patient files from the pediatric ward were randomly selected to be used as control data.[2] Diseases in this ward range from genetic to infectious diseases. There were generally four types of injuries found in the data: road traffic incidents, burns, falls, and others. Table 1 summarizes the number and type of accidents and the occurrence in the sample.

5.2.1. Data definition

Table 2 shows the variables and the variable definitions utilized in the study. *INJURED* is the binary dependent variable that denotes whether the child was injured or not. Explanatory variables in the specification are either continuous or discrete, taking on certain values or dummies. *FAMSIZE* is the number of family members from the parents. *BIRTHORD* is the rank of the child in terms of birth within the siblings, with the eldest being number 1. *ONEHEAD* signifies whether a household is headed by a single parent, which is directly indicated in the MSS application forms. The mother's age is dummy coded with *MORTHER40*, indicating whether the mother's age is greater than 40 years. *FAGE*, the father's age, on the other hand, took on its real values. The parents' education is measured by the number of years of education denoted as *MEDUC* for mother education and *FEDUC* for the father education. Variables expressed in the final regression with an *LN* (e.g., *LNFAGE*, *LNFEDUC*, *LNAGE*) before the variable name are in logarithmic form.

Table 1. Summary of injuries

Type of injury	*Number*
Road traffic injury (RTI)	32
Burns	40
Falls	11
Others	20
Total	103

[2]Based on the methodology of Delgado et al. [2002] that used a case-control method to find risk factors for injury in a hospital in Lima, Peru.

5.2.2. Descriptive statistics

Table 3 provides the descriptive statistics of the variables used in the study. The columns show the mean computed over all the variables, the standard deviation of each variable, and the total minimum and maximum counts. The dependent variable *INJURED*, being a binary having values of either 1 or 0 (with 1 indicating that a child has been injured), has 93 childhood injury count (60 percent of the total), with the rest being included in the control group. Statistically, there are more *MALE* than female children in the data (94 and 60, respectively). The mean *AGE* of the children is five, while the age range is from zero to 12 years old, which is the age bracket of children that are relatively still dependent on their parents. There is a good deal of variation in the frequency of the children's ages. The concentration of *FAMSIZE* is from three to seven members of the family, which can be explained by the fact that majority of the observation came from large low-income families. The distribution of *BIRTHORD* is three to six, which represents the child's rank within the siblings of the family. There are 26 count for mothers aged 40 and above (*MOTHER40*) out of the 148 mothers who indicated their ages in the medical social service forms. The mean *FAGE* (father's age) is 35. *MEDUC* and *FEDUC* are both concentrated from two to five years.

5.3. Estimation procedure

Even though cohort studies can be utilized in the study, the binary characteristic of the dependent variable induced the researchers to apply the logit model. Logistic regression analyses binomially distributed data of the form

$$Y_i \sim B\left(p_i, n_i\right) \text{ for } i = 1, \ldots, m. \tag{5}$$

where the numbers of Bernoulli trials n_i are known and the probabilities of success p_i are unknown.

The logistic model takes the form [Gujarati 2003]:

$$P_i = E\left(Y_i = 1 \middle| X_i\right) = \frac{1}{1+e^{-(\beta_1+\beta_2 X_i)}} = \frac{1}{1+e^{-Z_i}} \tag{6}$$

where $Z_i = \beta_1 + \beta_2 X_i$ and P_i is a nonlinear function of Z_i.

And for estimation purposes, we rewrite equation (6) as follows:

$$\left(p_i\right) = \ln\left(P_i/(1-P_i)\right) = \beta_1 + \beta_2 X_i + u_i \tag{7}$$

Table 2. Definition of variables

Variable	*Definition*
INJURED	Whether subject was treated for injury, 1 if injured
MALE	Sex of subject, 1 if male
AGE	Age of subject
FAMSIZE	Number of members of the family
BIRTHORD	Rank of child in the siblings
ONEHEAD	Single parent household, 1 if single household
MOTHER40	Mother age, 1 if age of mother is greater than 40
FAGE	Age of father
MEDUC	Years of education of mother
FEDUC	Years of education of father

Table 3. Descriptive statistics of variables

Variable	*Obs*	*Mean*	*Std. dev.*	*Min*	*Max*
INJURED	154	0.6038961	0.4906822	0	1
MALE	154	0.6103896	0.489253	0	1
AGE	154	5.38961	3.838763	0	12
FAMSIZE	154	5.324675	1.902469	2	12
BIRTHORD	154	4.545455	1.703863	1	12
ONEHEAD	154	0.2077922	0.407051	0	1
MOTHER40	148	0.1756757	0.3818362	0	1
FAGE	143	35.72727	7.603911	20	54
MEDUC	143	3.468531	1.271598	0	6
FEDUC	139	3.374101	1.331194	0	6

In interpreting the regression result, we must take note that each slope coefficient in the equation is a partial slope coefficient and that it measures the change in the estimated logit for a unit change in the value of the given regressor (holding other regressors constant) as described by Gujarati [2003]. For example, if *AGE* increases by one unit, on average the estimated logit increases by about the slope coefficient's value multiplied by the one unit increase, suggesting a positive relationship between age and childhood injury.

The conventional measure of goodness of fit is R^2. Pseudo R^2, a similar measure to the R^2, which the regression results specified is not particularly meaningful in binary regressand models. This goodness of fit is of secondary importance as explained earlier. The essential components of the regression are the expected signs of the regression coefficients and the statistical or practical significance of each variable.

5.4. Results

Table 4 presents the results of the logit regression of the dependent variable, *INJURED*, with the socioeconomic explanatory variables. Regression 1 shows the model in which age and the square of the age are used to express the effect of age on childhood injury. Regression 2 drops the square of the age variable. Regressions 3 and 4 use the logarithmic form of the variable *AGE*. The signs of the coefficients remain unchanged in the different runs. Further, it is observed that the variables male and age are alternately significant. In Regression 1, the coefficient of the variable *AGE* is significant up to 5 percent level while that of *MALE* is not. On the other hand, the converse is true for the rest of the runs; the variable *MALE* is significant while *AGE* is not. The model, therefore, is stable and systematic.

We consider child age, sex, and birth rank as the characteristics of the child in our empirical specification. The coefficient of the *AGE* variable shows that as the child approaches 12 years of age he becomes more likely to be injured. In the first regression, the coefficient for child age is 0.3909552 and that of *AGESQUARED* is -0.0307609. This means that, ceteris paribus, for every one unit increase in age of the child there is an expected 0.3909552 - 0.0307609 *AGE* increase in the log-odds of the dependent variable. This shows that as the *AGE* of the child increases, the increase in the log-odds of becoming injured increases at a rate also dependent on the *AGE* of the child.

The results also show that males are more at risk than females of obtaining injuries. The coefficient of the variable male in Regression 1 is 0.6604657. This means that going from female to male provides an expected increase in the log-odds of being injured by 0.6604657, holding all things constant. Transforming the logit into an odds ratio we get 1.935694 for the variable *MALE*, which means that being male increases the odds of getting injured by about 94 percent, controlling for other variables in the model.

Two variables in the regression pertain to family characteristics: *FAMSIZE* and *ONEHEAD*. *FAMSIZE* was not statistically significant in any of the regressions. This means that nothing can be concluded about the relationship of the childhood injury and family size. Children of households headed by single parents are shown to be significantly more likely to experience injuries. Again, taking into consideration Regression 1, the coefficient of this variable is 1.195015. This demonstrates that going from a household with both parents present to a household with only one parent present increases the log-odds of the dependent variable injured by 1.195015, keeping all things constant. This may be due to the effect in the quality of parenting and household income of being single parents.

Table 4. Results

Variable	*Regression 1*	*Regression 2*	*Regression 3*	*Regression 4*
AGE	.3909552**	.0386555	-	-
	(1.98)	(0.58)		
LNAGE	-	-	.674515	.0304776
			(0.65)	(0.09)
LNAGESQUARED	-	-	-.2627047	-
			(-0.66)	
AGESQUARED	-.0307609*	-	-	-
	(-1.91)			
MALE	.6604657	0.7599326*	.88805098**	.9244258**
	(1.63)	(1.91)	(1.97)	(2.07)
LNFAMSIZE	1.234824	1.325455	1.213725	1.083937
	(1.02)	(1.12)	(0.97)	(0.88)
LNBIRTHORD	-.8169952	-0.861685	-.7892496	-.6969225
	(-0.79)	(-0.84)	(-0.76)	(-0.68)
ONEHEAD	1.195015*	1.167071*	1.430196*	1.403486*
	(1.67)	(1.66)	(1.72)	(1.70)
MOTHER40	-1.568877**	-1.287975**	-1.685772***	-1.67095***
	(-2.53)	(-2.48)	(-2.60)	(-2.59)
LNFAGE	1.835681	1.678577	2.096161*	1.966928
	(1.63)	(1.53)	(1.68)	(1.60)
LNMEDUC	-1.331413*	-1.287975*	-1.471658*	-1.485192*
	-1.82	(-1.82)	(-1.86)	(-1.87)
LNFEDUC	1.528941**	1.316527*	1.47654**	1.446526**
	(2.24)	(1.99)	(2.12)	(2.08)
CONSTANT	-8.338766	-7.013038	-8.373827	-7.543715
	(-1.97)	(-1.74)	(-1.76)	(-1.65)
Pseudo R-squared	0.1336	0.1129	0.1329	-67.577978
Log Likelihood	-77.827689	-79.679309	-67.577978	0.1329

Z-stat in parentheses

Note: * significant at 10 percent level; ** significant at 5 percent level; *** significant at 1 percent level.

Maternal characteristics and their effect in the risk for injuries were all significant in the regression results. Maternal age, coded by *MOTHER40*, shows that children of mothers greater than 40 years old are less at risk of being injured. The coefficient of the variable *MOTHER40*, 1.568877, shows that as we go from a child with a mother who is less than 40 years old to a child with a mother who is 40 or older, the log-odds of the child being injured decreases by the coefficient. This translates to an 80 percent decrease in the odds of getting injured for children of mothers more than forty years old. Children of mothers who have more years of education are at less risk of being injured. The variable *INJURED* with its coefficient of -1.331413 tells us that an increase of one unit in the log of the years of education of the mother is expected to decrease the log-odds of the dependent variable *INJURED* by 1.331413.

Paternal characteristics turned out to have an opposite sign than that of maternal characteristics. The age of the father, expressed in logarithmic form (*LNFAGE*), has a coefficient -1.835681, which means that an increase of one in the age of the father decreases the log-odds of the child becoming injured by the same amount. The reason may be that as the father progresses in age, the level of protection that he actively offers to children decreases. The coefficient of *LNFEDUC* is 1.528941. This means that a unit increase in the log of paternal education years leads to an expected 1.528941 increase in the log-odds of the dependent variable *INJURED*. As the level of education increases, the level of responsibility of the father's career also increases, leaving less time and energy of the father available for child caring.

In sum, the socioeconomic factors tested in the empirical specification that showed a significant result pertain to child and parent characteristics. The only variable with statistical significance pertaining to family characteristics was whether the household is headed by a single parent. Interpretation of the coefficients of Regression 1 is sufficient because of the stability of the model.

6. Conclusion and policy implications

This paper has examined the possible socioeconomic variables that could alter the risk of unintentional childhood injuries. A variety of isolated factors affect the risk of childhood injury; those with positive correlation are the child's increasing proximity to the age of 12, larger family size, gender (with males having a higher rate), having a single-family household, father's age, and a higher degree of education of the father. Variables with negative correlation a birth rank, mother's age beyond 40, and a higher degree of education of the mother. This seems to suggest that beyond more instinctive variables concerning childhood injury, the dichotomous roles of the mother and father also have an important role in preventing child injury—i.e., although the mother

becomes a better preventative force as her age and level of education increases (as expected).

Several points of external validity can be found via a set of policy recommendations that we have arrived at. Based on this sample, preventive efforts must be channeled to mothers who are less educated and of younger age. Mothers who stay at home must be given knowledge regarding safety practices. Households who are currently headed by one adult must also be given focus in prevention strategies. Families living near streets should be educated about risks of road traffic injuries to children. Crowding in homes must be discouraged. Large families must be trained in a system wherein the younger children are supervised by their older siblings.

Furthermore, we believe that more trauma centers, in addition to better informative programs designed to educate on preventing childhood injury, would be of immense benefit in this effort. First, the Philippines has an alarmingly low amount of trauma centers adequately prepared to deal with childhood injury; it is important to remember this when we talk about trauma centers as a statistical indicator of emergency preparedness. It is not sufficient to discuss trauma centers in general, but we must speak of such centers with staff trained specifically to deal with childhood injury.

Moreover, the government should sponsor more programs aimed at educating parents about preventing childhood injury. Additionally, we offer two unique points for consideration. The first is that fathers need to be more heavily targeted within the discourse of preventive classes. That is, mothers more clearly dominate child-rearing responsibility, with fathers decreasing the intensity of their role as time progresses; government-sponsored classes need to address this problem. The second is that more classes should be offered to parents in which the mother is pregnant but has yet to give birth; this would give parents the opportunity to learn more about childrearing before their skills are actually engaged.

In conclusion, based on the regressions we have conducted and analysed, socioeconomic factors clearly carry much impact on the ability of parents to prevent childhood injury. However, we must also increase our scope to ensure that fathers equally participate in preventing childhood injury, and we must also focus our attention on increasing the efficacy of trauma centers in the case that injury is not prevented. These two points offer a foundational sounding board that further studies should aim to develop.

References

Agran, P. F., D. G. Winn, C. L. Anderson, and C. Del Valle [1998] "Family, social, and cultural factors in pedestrian injuries among Hispanic children", *Journal of Injury Prevention* **4**: 188-193.

Arcadio, R. L., N. Fajardo, M. G. Agrasada, A. Araba, E. Gabriel, C. Gomez, C. Ancheta, and S. Andong [1992] "Childhood accidents: part I, a hospital-based epidemiological survey", *Philippine Journal of Pediatrics* **41**(1): 62-70.

Arcadio, R. L., N. Fajardo, M. G. Agrasada, A. Araba, E. Gabriel, C. Gomez, C. Ancheta, and S. Andong [1992] "Childhood accidents: part II, a community-based epidemiological survey", *Philippine Journal of Pediatrics* **41**(1): 71-85.

Baron, R. M. and D. A. Kenny [1986] "The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations", *Journal of Personality and Social Psychology* **51**(6): 1173-1182.

Becker, G. and G. Lewis [1973] "On the interaction between the quantity and quality of children", *Journal of Political Economy* **81**(2): 279-288.

Blau, D. and A. Hagy [1998] "The demand for quality in child care", *Journal of Political Economy* **106**(1): 104-156.

Carter, Y. H. and P. W. Jones [1993] "Accidents among children under five years old: a general practice based study in north Staffordshire", *British Journal of General Practice* **43**: 159-163.

Celis, A., Z. Gomez, A. Martinez-Sotomayor, L. Arcila, and M. Villaseñor [2003] "Family characteristics and pedestrian injury risk in Mexican Children", *Injury Prevention* **9**: 58-61.

Consunji, R., R. Camiling, J. L. Carreon, P. M. Chao, and R. Arcadio [2007] "Childhood injuries in the Philippines: an epidemiologic review", Unpublished.

Currie, J. and V. J. Hotz [2001] "Accidents will happen? Unintentional injury, maternal employment and child care policy", NBER Working Paper No. 8090.

Delgado, J., M. E. Ramírez-Cardich, R. H. Gilman, R. Lavarello, N. Dahodwala, A. Bazán, V. Rodríguez, R. I. Cama, M. Tovar, and A. Lescano [2002] "Risk factors for burns in children: crowding, poverty and poor maternal education", *Injury Prevention* **8**: 38-41.

Department of Injuries and Violence Prevention, World Health Organization (WHO) [2002] The injury chartbook. Geneva: WHO.

Gilbride, S. J., C. Wild, D. R. Wilson, L. W. Svenson, and D. W. Spady [2006] "Socio-economic status and types of childhood injury in Alberta: a population based study", *BMC Pediatrics* **6**: 30.

Gujarati, D. N. [2003] *Basic econometrics*. Fourth edition. New York: McGraw-Hill Education.

MacKay M., D. C. Reid, D. Moher, and T. Klassen [1999] "Final report to Health Canada: systematic review of the relationship between childhood injury and socio-economic status", No. H5301-7-CY07. Ontario, Canada: Child and Youth Injury Prevention Center.

Mock, C.N., E. Adzotor, D. Denno, E. Conklin, and F. Rivara [1995] "Admissions for injury at a rural hospital in Ghana: implications for prevention in the developing world", *American Journal of Public Health* **85**(7): 927-931.

National Institute of Health [2007] "Childhood injuries in the Philippines: a preliminary report". National Institute of Health.

Peden, M., K. McGee, and G. Sharma [2002] *The injury chart book: a graphical overview of the global burden of injuries.* Geneva: World Health Organization.

Peterson, L., J. Farmer, and L. Mori [1987] "Process analysis of injury situations: a complement to epidemiological methods", *Journal of Social Issues* **43**: 33-44.

Petridou, E., A. Anastasiou, K. Katsiardanis, N. Dessypris, T. Spyridopoulos, and D. Trichopoulos [2005] "A prospective population based study of childhood injuries: the Velestino town study", *European Journal of Public Health* **15**(1): 9-14.

Ribar, D. [1992] "Child care and the labor supply of married women: reduced form evidence", *Journal of Human Resources* **27**: 134-165.

Safe Kids Worldwide [2004] SKW website, http://www.safekids.org/.

Schwebel, D. C. and B. K. Barton [2005] "Contributions of multiple risk factors to child injury", *Journal of Psychology* **30**(7): 553-561.