Risk Factors for Non-Fatal Injuries Among Children Working in Philippine Agriculture

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Children all over the world are affected by preventable injuries that either result in death or disability compromising their ability to fully develop in later life. The epidemic of injuries to children and adolescents is receiving increased attention in the public health community as unintentional injuries continue to be the leading cause of death for children. The World Health Organization estimated that at least 700,000 injury deaths occurred to children 14 years and younger in 2002 (World Health Organization, 2006). With the International Labor Organization (ILO) placing the worldwide estimate of working children 5-17 years at 218 million in 2004 (Hagemann, Diallo, Etienne, & Mehran, 2006; ILO, 2006), an enormous number of children are vulnerable to occupational injuries. Work-related injuries are important indicators for assessing occupational health and job safety. Yet they are rarely discussed within the broader context of childhood unintentional injuries. In global estimates that point to the magnitude of childhood injuries, rarely are work-related events of children mentioned as contributors to the prevalence of child injuries. The failure to include or make reference to work-related causes in childhood injury estimates, conceals the existence of child labor and the associated occupational hazards and exposures.

Article 3(d) of the ILO's Convention 182 on the Worst Forms of Child Labor and Recommendation 190 calls on member states to undertake tripartite consultations to specify and create a list of "hazardous work" for children. Despite agriculture continually being cited as a hazardous industry (Committee of Injury and Poison Prevention and Committee on Community Health Services, 2001; Doyle, 1989; Human Rights Watch, 2000, 2002a; May & Kullman, 2002), approximately 70 percent of economically active children are working in the sector (ILO, 2006). While recent estimates do not exist, 70 percent of work-related injuries that occur to children happen in agriculture (Ashagrie, 1998). Yet work activities related to agriculture are not necessarily classified as a "worst forms of child labor" by the international community and are left to the determination of each individual country. Because children differ from adults in their anatomical, physiological, and psychological development, their work in poor sanitary conditions; with dangerous machinery , unsafe tools, and heavy loads; exposure to toxic chemicals, and for long hours on farms places their physical and mental safety in precarious situations (Forastieri, 2002; Mull, 2003; Subida, Angluben, Lorenzo, & Prado-Lu, 1997; Wilk, 1993). In addition, labor standards for children working in agriculture are less stringent than in other industries worldwide. As a result, the reduced occupational health and safety protections for children who work in agriculture increase the likelihood of injuries and illnesses (Wilk, 1993).

Studies on child labor have mostly focused on the economic explanations for children's work (Grootaert & Patrinos, 1999; Rosenzweig, 1977), but there is still limited research on the physical impact of work on children. Studying the epidemiology of childhood injuries on the farm (Centers for Disease Control and Prevention, 1998; O'Donnell, Rosati, & Doorslaer, 2002), is important for understanding the effects of work on children's development and health outcomes. While ILO Member States are given the flexibility to decide what work activities are detrimental for children, the lack of a common definition and systematic research on hazardous work for children makes it difficult to make a methodical assessment and implement sound public policies to protect children from work activities that compromise their health, safety, or morals. Therefore, the goal of this study was to contribute to policy-oriented research by systematically investigating the occupational safety and health hazards that place working children at increased risk of physical injury. By calculating incidence rates, relative risk estimates, and odds ratios for injury, the objectives of this study were to systematically (1) demonstrate that agriculture is a hazardous industry for children relative to other industries, and (2) uncover risk factors that increase the odds that children working in agriculture may become injured.

METHODS

Data Sources and Collection

Injury data for this study were obtained from the Philippine Survey of Children 2001 (SOC 2001). The SOC 2001 was a topical module attached to the quarterly Labor Force Survey (LFS) conducted from October 2001 to September 2002. Thus, the reference period for the data was the preceding 12 months that covered October 2000 to September 2001. The LFS uses a multi-stage, stratified random sample of the Philippine civilian non-institutionalized population to provide comprehensive, cross-sectional information on the demographic, health, socioeconomic, and occupational characteristics of children ages 5 to17 years and their households. The SOC 2001 multi-stage sampling design involved the selection of sample *barangays* or villages as the primary stratum, and used a core sample of 26,964 households, which allows for a nationally representative sample of 17,454 households with children ages 5 to 17 years (National Statistics Office, 2001, 2003). The SOC 2001 collected data through personal interviews by trained and the respondent was the child.

The survey had a successful response rate of 99.9 percent with 17,444 households responding to the survey. Out of the 17,444 households who had at least one child 5 to 17 years old, 6,523 households reported that they had at least one child who worked at least one hour during the 12-month reference period. From the number of households with children 5 to 17 years reported working, 6,351 working children were successfully interviewed, with a high 97.4 percent response rate (National Statistics Office, 2003). Enumerators were instructed to make return visits to households they were unable to interview during their initial visits. The verification of data was conducted at the provincial level and processed using computer programs created by the U.S. Bureau of the Census (National Statistics Office, 2003).

The final sample for analysis included a total of 6,058 children, 5 to 17 years, working in the Philippines; 3,063 children were working in agriculture, and 2,995 children were working in non-agricultural industries. Children who reported working for different employers or "other" were excluded from the sample because of the lack of information available on their number of work months. In addition, a child whose industry classification was not included was also left out from the sample. Thus, 307 economically active children were omitted from the final sample.

Data Analysis

Descriptive and analytic methods were used to examine the frequency, distribution, and possible determinants of non-fatal injuries in the SOC 2001. The descriptive part of the study focused on characterizing the population of all working children and the number of occupational injuries by industry. In addition, injury incidence rates were calculated taking into account the number of person-hours a child worked per year. The analytic part of the study demonstrated the relative risk of injury between children working in agriculture compared to children working in other industries, and identified potential causative and protective factors for work-relatedness of injuries among children working in agriculture. Details related to creating the case definition for an injury occurrence; assumptions regarding person-hours; and calculations of incidence rates and relative risk measures are described in previously published article (Castro, Gormly, & Ritualo, 2005).

Multivariate logistic regression was to simultaneously ascertain the association of various exposures to the occurrence of work-related injuries in agriculture. Therefore, the regression was only conducted on the sample of children working in agriculture. The logistic regression produces beta coefficients or odds ratios that approximate the relative risk estimate for developing a disease. Odds ratios (OR) are interpreted in the same way as the relative risk. Therefore, where OR > 1, OR < 1, or OR=1, the odds of a child experiencing a work-related injury is increased, decreased, or is not affected by X factor, respectively.

In order to specify a best-fit model that produced meaningful results and minimized the potential for specification error, the selection of independent variables was based on the primary principles of (1) theoretical relevance; (2) statistical contribution to the overall fit of the equation; and (3) non-multicollinearity (Studenmund, 2001, 2006). After completing a thorough literature review on occupational safety and health in agriculture for adults and children, particularly in the context of injury epidemiology, a theoretical, or *a priori,* model was developed from data collected by the SOC 2001.

Once all relevant explanatory variables were chosen from the SOC 2001, a series of statistical tests for multicollinearity were carried out to determine the degree to which explanatory variables exhibited a high-degree of association or correlation. Specifically, chi-square tests were performed to test the association between nominal variables, and simple correlation coefficients and variance inflation factors (VIF) were analyzed to detect multicollinearity among ordinal variables. The chi-square test between agricultural industry and region exhibited a high degree of association ($p < 0.0001$). Dominant agricultural sectors, such as the growing of bananas, coconuts, and sugarcane, were particular to some regions while unrepresented or barely represented in other regions. As a result, region was not included in the final model.

For age category and grade in school, the correlation coefficient revealed a mild degree of correlation (r=0.55). When grade in school was added to the model, the statistical fit of the equation decreased, and its contribution to the model was negligible. There was also no substantial change in the coefficients or the direction of the results. Thus, grade was not included in the final model to protect from potential multicollinearity.

Finally, the literature suggests that work experience in terms of years of job or farming experience can be a predictor of injury occurrence (Breslin et al., 2006). While it would have been valuable to include this variable in the model, the questionnaire did not collect the data in such a way as to capture years of work experience in the primary industry reported in the survey. For example, Question C1 in SOC Form 2 asks the child, “At what age did you start working?” A child’s work experience could be calculated based on a child’s current age less their start age for employment. However, this variable does not necessarily guarantee that the years of work experience was related to a child’s current job nor does it take into account any possible breaks in employment. Therefore, the final model also excluded a work experience variable because the current data were inadequate to predict injury risk.

The dependent variable for the model used the lower-bound estimates (LBOUND) for injury occurrence, where LBOUND=1 if a child working in agriculture reported one or more injuries, and LBOUND=0 if a child working in agriculture reported no injuries. For the 14 explanatory variables included in the final model, 1 variable was continuous (person-hours), 2 variables were categorical (age category and agricultural industry), and the remaining 11 variables were binary. The three categories for age included children (1) 5 to 9 years; (2) 10 to 14 years; and (3) 15 to 17 years. Agricultural industries were classified according to the 17 major industrial divisions of the 1994 Philippines Standard Industrial Classification (PSIC), and were grouped to ensure an appropriate sample size (Philippine National Statistical Coordination Board). In general, cell sizes included no less than 5 unweighted counts.

In running the logistic model, dummy variables were created for both binary (1,0) and categorical variables. For categorical variables, a CLASS statement in SAS was used to create dummy variables. Unless otherwise specified, the reference group for a dummy variable with multiple categories was the first ordered category, which was also the lowest risk stratum. The statistical computer application SAS was used to generate results for the study. Confidence intervals and p-values used to determine levels of significance are presented in the results section.

Data for this study were weighted and analyzed using a design-based approach to reflect population-based estimates. Results of both descriptive and analytic analyses are presented as weighted counts of the population using a final weight adjustment factor. The NSO calculated the weights to obtain survey estimates of the total population (National Statistics Office, 2003). Because data from the SOC 2001 were collected based on a multi-stage stratified random sample to obtain population-based estimates, the design-based approach was the most appropriate method for carrying out the analysis. The design-based approach incorporates the stratification design of the survey by including *barangay* or village as the primary stratum in the calculation of results. While there are varying practices in employing sampling weights in modeling etiologic relationships from complex survey data (Korn & Graubard, 1995; Pfeffermann, 1993; Reiter, Zanutto, & Hunter, 2005), weighted estimators in the SOC 2001 account for the survey design to effectively represent the number of children in the population. Including the stratification design by weighting results and specifying the stratum variable corrects for standard errors, so that the model does not assume a simple random sample, underestimate the standard errors, and reflect erroneous statically significant results. Population-based estimates of relative risk and odds ratio calculations used the appropriate statistical software and commands to appropriately correct for sampling design (Brogran, 1998; Cassell, 2006; Lemeshow et al., 1998).

RESULTS

Relative Risk of Injuries for Major Industrial Divisions

Table 1 presents the number of working children and the relative risks for injury by key industries in the Philippines. For each industrial division listed as the exposed group, children working in all other industries are the non-exposed group. Relative risk estimates examine the rate of injury in the exposed group compared to the unexposed group. In this case, the rates of injuries were being compared across industry divisions, so each respective industry was compared to all other industries as the reference group. Major Division M (80-81), Public and private education, and Major Division Q (99), Extra-territorial organizations and bodies, were excluded since no children were found working in these industries. Children working in agriculture are approximately five times more likely (RR=4.72) to experience an injury than children who work in other industries. The data also reveal an elevated risk of injury (RR=2.92) for children who work in mining and quarrying.

Risk Factors for Non-Fatal Occupational Injuries to Children Working in Agriculture

Table 2 presents logistic regression results from the *a priori* model specified in the methods section. The model simultaneously assessed the relationship between hypothesized risk and protective factors and injury occurrence. Several explanatory variables indicate a statistically significant relationship with injury occurrence at the $p < 0.05$ level. The risk factors that demonstrated the greatest odds of injury for children working in agriculture include the use of tools/equipment at work (OR= 3.12) and exposure to biological hazards (OR=2.56). Night work, heavy work, and exposure to physical hazards each increased the odds of injury by 40 percent. Three agricultural sub-sectors with the lowest injury rate were chosen as the reference group for comparing injury risk across agricultural sectors. Apart from the growing of fruits (except bananas) and nuts, injury risks were significant and elevated in all agricultural sectors examined. Children working in hunting and logging, the highest risk group, have a 4.4 times increased odds of injury compared to the reference group. Other agricultural sectors that were highly significant for injury risk at $p < 0.001$ included children growing rice (OR= 1.99), corn (OR= 2.72), coconut (OR= 2.50). Children involved in livestock farming (OR= 2.66) also were also significant at the $p < 0.001$ level. Adult supervision and the use of personal protective equipment (PPE) were hypothesized to be protective factors. However, results were not significant in protecting children from an injury occurrence.

DISCUSSION

Using data from the Philippine SOC 2001, this study sought to confirm that agriculture is a relatively hazardous industry for working children by investigating the *occurrence* of injuries, *incidence* of injuries, *relative risk* of injury, and *odds* of injury to children working in agriculture. In 2001, there were an estimated 3.7 million children, 5-17 years, working in the Philippines, with approximately 2 million (or 54 percent) of these children involved in agricultural work. Roughly 637,000 childhood agricultural injuries occurred during the year for an incidence rate of 0.08 injuries per 100 person-hours worked or 56.8 injuries per 100 full-time equivalents. Confirming the hazardous nature of the industry, children working in agriculture had a five times relative risk of injury compared to children working in other industries.

While the SOC 2001 did not collect information on the injury mechanism or injury event, other variables included in this study provide important insight into the risk factors for agricultural work-related injuries to children. Most importantly, the adjusted odds ratios from this study demonstrate the value of employing multivariate techniques to control for confounding when evaluating injury risk. For example, descriptive studies on childhood farm injuries have consistently demonstrated that the proportions or rates of injuries are doubled to tripled in male compared to female children (Davis & Leonard, 2004; Dufort, Kotch, Marshall, Waller, & Langley, 1997; Hard et al., 1999; Mitchell, Franklin, Driscoll, & Fragar, 2001; Pryor, Caruth, & McCoy, 2002; Rivara, 1985, 1997; Salmi et al., 1989; Stueland, Lee, Nordstrom, Layde, & Wittman, 1996). The results from this study revealed that that there was no statistically significant relationship for sex, and being male only slightly increased the odds of injury (OR=1.18) when controlling for other factors.

With data from the Regional Rural Injury Study-I (RRIS-I), Gerberich et. al (2001) carried out multivariate analyses to identify potential risk factors for farm-related injuries in children younger than 20 years. That study discovered a 40 percent increased odds of injury among males. The study assessed other risk factors similar to the ones included in this analysis, including: age group; handling of chemicals; and work hours. There were no important differences observed in adjusted odds ratio for the different age groups. Children who handled chemicals demonstrated only slight increased odds of injury. The results for these risk factors are also similar to the findings of this study.

The main occupational risk factor in this study with highest elevated odds of injury was the use of tools/equipment at work (OR=3.12). It is not unexpected to see that children working in agriculture who use tools/equipment on the farm have a 3.1 times increased odds of injury; this confirms the principal mechanism of work-related injuries in children found in other studies. Whether children are involved in agricultural production heavily-reliant on manual labor in a developing country or whether they work on a mechanized farm environment in an industrialized country, the presence and use of farming implements (motorized or non-motorized) is a key risk factor of injury occurrence. Children in the Philippines and other parts of the developing world are known to suffer from farm injuries caused by the use of sharp knives, machetes, sickles, and grain threshers designed for adult use (Boer, 2005; Human Rights Watch, 2002b, 2004; International Labor Office, 2004; Rollolazo & Logan, 2004). In industrialized countries, technological advancements in the mechanization of farming has not meant reduced hazards for children who operate or come into contact with agricultural machinery and farm transport (e.g., augers, balers, harvesters, wagons, tractors) (Centers for Disease Control and Prevention, 1999; Cogbill, Busch, & Stiers, 1985; Doyle, 1989; Hard et al., 1999; Hubler & Hupcey, 2002; Marlenga, Pickett, & Berg, 2001; Mitchell et al., 2001; Myers & Adekoya, 2001; Reed & Claunch, 2000; Rivara, 1985; Salmi et al., 1989; Schenker, Lopez, & Wintemute, 1995; Zietlow & Swanson, 1999).

The hazards of agrichemicals to children working in agriculture have been clearly documented (Solomon & Motts, 1998). However, the results from this and Gerberich's (2001) study did not find a strong relationship between chemical exposure and injury occurrence. This lack of association may be due to children's lack of awareness that they are being exposed to a chemical substance. For instance, children working in agriculture reported higher percentages of tangible workplace exposures. The proportion of children working in agriculture who reported the use of tools/ equipment at work was 81.8 percent compared to 20.1 percent who reported chemical exposure. The lack of association may also be due to the outcome being injury rather than illness. Chemical hazards for injury risks are typically associated with chemical skin or eye burns and other eye injuries. Otherwise, chemical hazards increase the risk for skin rashes and poisoning/systemic illnesses.

Cooper et al.'s (2001) study researching pesticide exposure to migrant and seasonal farmworker children verified that children may underestimate chemical exposure. Initial focus group questions revealed that children and their mothers had none to minimal contact with chemicals in initial inquiries. However, through a series of follow-up questions, trained facilitators were able to glean that children themselves were involved in a variety of activities that increased pesticide exposure, which included spraying weeds and insects and harvesting crops in the field (Cooper et al., 2001). Yamanaka and Ashworth (2002) and various other studies (Boer, 2005; Human Rights Watch, 2002b; Mull, 2003) have also documented children preparing, carrying, and applying fertilizers in the field.

In selecting the variables for the *a priori* logistic regression model, it was hypothesized that adult supervision and the use of personal protective equipment (PPE) would be protective factors in the occurrence of non-fatal agricultural injuries to children in the Philippines. However, findings from this study did not find a statistically significant relationship for adult supervision and reported PPE. The increase in odds for both variables was rather small, and did not lead to a convincing case that they were instead risk factors for injury. However, it is possible that children who are supervised or wear PPE are more likely engaged in hazardous work than other working children, and these variables may serve as proxies for more hazardous work environments.

It is, however, not surprising that PPE was not found to support the hypothesis that the variable was a protective factor. While children in the Philippines use PPE, the types of equipment or clothing used are often inadequate to protect against injury. Children working in the fields use hats, long-sleeve t-shirts, and pants to cover themselves. The gloves children are provided with are either cloth or plastic, and children often opt not to use them for reasons of inconvenience. Rarely do children cover their feet with appropriate footwear. Children commonly wear thongs/slippers and their feet are often exposed.

Finally, it is important to draw attention to the increased adjusted odds ratios for many of the agricultural sectors included in the *a priori* analyses. The logistic model controlled for broad categories of known hazards, giving a cursory assessment of risk factors. Yet there are uncaptured risk factors that are likely to explain the elevated odds of injury associated with the respective agricultural sectors. Without knowing the specific occupational practices, it is difficult to ascertain definitive risk factors for injuries associated with each sector. Additional research is needed to identify particular occupational environments, tasks, and processes that will explain nuanced hazards and risk factors for injury occurrence in a given agricultural industry.

Strengths and Limitations of Study

The findings of this present study address most of the identified research gaps on non-fatal farm injuries to children. The key strengths of this study include its: (1) statistical power from a nationally-representative, homogeneous weighted sample of economically active children 5-17 years (however, this does result in some inconsequential differences which are nonetheless statistically significant); (2) application of a person-hour component to reflect on-the-job exposure time for injury rate calculations; (3) a multivariate approach to account for numerous suggested risk factors for non-fatal injuries; and (4) evaluation of the risks to working children in a developing country context. This study was also able to preliminarily assess the severity and disabling outcome of the injury. Another important aspect of this study is that results are based on a child's perspective. Parents may not always be aware of the nature of their children's work involvement and related occupational exposures (Cooper et al., 2001), so recognizing children's economic agency, or knowledge about their own work, assists in giving them a voice to identify hazardous work (Levison, 2000).

Table 1. Estimated Lower-Bound Non-Fatal Occupational Injuries, Person-Hours Worked, Injury Incidence Rate, and Relative Risk by Major Industrial Divisions in the Philippines, Economically Active Children 5-17 years, 2001

Major Industrial Division	Population of workers	Occupational Injuries in the last 12 months[a]	Person-hours worked in last 12 months (in thousands)[b]	Injury Incidence Rate (per 100 person-hours worked)	Relative Risk [c]	95% Confidence Interval
Philippines	**3,712,515**	**882,440**	**2,243,599.61**	**0.039**	–	
Major Division A (01-05): Agriculture, hunting, & forestry	2,010,481	636,908	796,006.45	0.080	4.72	[4.12 - 5.40]*
Major Division B (06): Fishing	205,259	50,262	183,054.45	0.027	0.68	[0.53 - 0.87]*
Major Division C (10-11): Mining and quarrying	17,980	7,845	6,869.38	0.114	2.92	[1.78 - 4.78]*
Major Division D (15-39): Manufacturing	178,746	41,431	117,742.02	0.035	0.89	[0.69 -1.15]
Major Division E (40-41): Electricity, gas, and water	2,693	0	815.30	0.000	0.00	
Major Division F (45): Construction	52,158	9,290	37,444.03	0.025	0.63	[0.37 - 1.08]
Major Division G (50-52): Wholesale/ retail trade; repair of motor vehicles, motorcycles, personal and household goods	745,801	48,998	437,975.67	0.011	0.24	[0.19 - 0.31]*
Major Division H (55): Hotels and restaurants	89,618	13,040	75,882.28	0.017	0.43	[0.27 - 0.69]*
Major Division I (60-64):Transport, storage, communication	97,983	21,950	102,359.20	0.021	0.53	[0.36 - 0.80]*
Major Division J (65-68): Financial intermediation	1,706	0	1,355.96	0.000	0.00	
Major Division K (70-74): Real estate, renting, and business	13,305	2,491	12,732.13	0.020	0.50	[0.19 - 1.26]
Major Division L (75): Public administration and defense; compulsory SS	7,755	764	4,676.20	0.016	0.41	[0.12 - 1.41]
Major Division N (85): Health and social work	2,237	0	1,816.11	0.000	0.00	
Major Division O (90-93): Other community, social, and personal activities	61,245	9,330	41,953.42	0.022	0.56	[0.32 - 0.97]*
Major Division P (95): Private households with employed persons	222,907	40,132	421,684.51	0.010	0.21	[0.15 - 0.28]*

Source: Author's calculations using SOC 2001 data.

*Note: Asterisk (*) indicates that underlying coefficient is significant at the $p < 0.05$ level.
[a, b] Note: Estimates of non-fatal occupational injuries represent lower-bound counts of occupational injuries that occurred in the last 12 months.
[b] Note: Person-hours are estimated using the primary time estimates as outlined in the research methodology.

Table 2. Logistic Regression Model of Possible Risk Factors for Non-Fatal Injury Occurrence in the Philippines, Economically Active Children 5-17 years in Agriculture, 2001

Variable	Coefficient	Adjusted Odds Ratio	95% Confidence Intervals	P-value
Intercept	-3.585			< 0.0001*
Demographic Characteristics				
Sex				
Male	0.166	1.18	[0.95 - 1.46]	0.1295
Female		1.00	Reference	
Age				
5 to 9 years	0.105	1.11	[0.74 – 1.68]	0.6183
10 to 14 years	-0.227	0.80	[0.65 – 0.98]	0.0282*
15 to 17 years		1.00	Reference	
Workplace and Exposure Characteristics				
Adult Supervision	0.063	1.07	[0.84 - 1.35]	0.6090
Use of Personal Protective Equipment	0.134	1.14	[0.93 - 1.41]	0.2075
Night Work	0.336	1.40	[1.01 - 1.93]	0.0405*
Heavy Physical Work	0.363	1.44	[1.16 - 1.78]	0.0007*
Stressful Work	0.184	1.20	[0.96 - 1.51]	0.1108
Boredom with Work	0.073	1.08	[0.87 – 1.34]	0.5078
Use of Tools/Equipment at Work	1.137	3.12	[2.25 - 4.32]	< 0.0001*
Exposure to Chemicals	0.059	1.06	[0.84 - 1.34]	0.6209
Exposure to Physical Hazards	0.351	1.42	[1.16 - 1.74]	0.0006*
Exposure to Biological Hazards	0.939	2.56	[2.08 - 3.14]	< 0.0001*
Agricultural Industry[a]				
Growing of palay (rice)	0.689	1.99	[1.34 - 2.96]	0.0006*
Growing of corn, except young corn	1.002	2.72	[1.80 - 4.12]	< 0.0001*
Growing of coconut, including copra-making	0.918	2.50	[1.55 - 4.05]	0.0002*
Growing of banana	1.046	2.85	[1.12 - 7.24]	0.0282*
Growing of sugarcane	0.984	2.68	[1.39 - 5.14]	0.0031*
Growing of fruits (except banana) and nuts	0.958	2.61	[0.95 - 7.14]	0.0624
Growing of vegetables, roots and tuber crops	0.653	1.92	[1.18 - 3.13]	0.009*
Hog farming	0.977	2.66	[1.37 - 5.14]	0.0037*
Livestock farming (except hog)	1.097	2.99	[1.61 - 5.57]	0.0005*
Hunting, trapping and game propagation, forestry, logging, including related service activities	1.484	4.41	[2.55 - 7.63]	<.0001*
Other		1.00	Reference	
Per 100 person-hours of work	0.000138	1.0001	[0.9999 - 1.0003]	0.1555

Source: Author's calculations of SOC 2001

*Note: Asterisk (*) indicates that underlying coefficient is significant at the $p < 0.05$ level.

[a]Note: The reference group for agricultural industry was made up of other agricultural sub-sectors with low injury rates. These sub-sectors consisted of: (1) Agricultural and animal husbandry service activities, except veterinary activities; (2) Chicken broiler production, poultry farming, egg production; (3) Growing of beverage crops and spice crops, n.e.c.. In addition, unweighted counts by injury status for these categories produced cell sizes with five observations or less, so these sectors were combined to create a sufficient sample size for the reference group.

However, studying the impact of work on child health can be challenging and pose several limitations (Levison & Murray-Close, 2005), especially with drawbacks of the cross-sectional survey design from this study. There were specific limitations in the design of the survey itself which has some implications in the way some of the independent variables in this study were constructed. The questionnaire does not collect some important information necessary to provide the most complete picture of the actual occurrence or incidence of injury. In this sample, a child may have experienced more than one injury during the reference period, but only a single occurrence of injury per child is documented for the entire sample.

In addition, the survey questionnaire did not collect information on exact time estimates for the duration of work in order to estimate risk. The average number of days a child works per week is the most precise time estimate in the survey, but the pre-coded categories for the normal hours of work per day and the uncertain number of work months per year associated with the nature of employment make it difficult to provide an accurate estimate of risk. Therefore, while several assumptions are made, the construction of the incidence density denominator is the best approximation of exposure risk that can be calculated from the information made available in the survey.

Finally, the cross-sectional design of the survey precludes the ability to establish a temporal association between exposure and injury. Since both hazard information and injury occurrence are collected at the same time for the preceding year, the sequence of the reported hazards and the injury event is indeterminate.

Conclusions

This study presented a systematic methodology to identify hazardous industries and occupations for children using national survey data. The results from this study are intended to inform legislation on updating hazardous work orders for children, and initiate discussions on promoting safe work for children in agriculture through school-based initiatives or workplace interventions. Results for this study are applicable to the current situation of child labor in the Philippines, and the methodology may be useful for ILO Member States who are in the process of refining their hazardous work lists. This study also points to the need to conduct more research on hazardous work, and the importance of making the elimination of child labor in agriculture a priority.

Data from this study also provided a first glimpse of the national magnitude of work-related injuries to children, particularly in agriculture. In place of a formalized national surveillance system to track childhood injuries, the analysis of the SOC 2001 in this study has provided empirical evidence that Filipino children working in agriculture have a higher relative risk of injury than children working in other industries, and specific occupational hazards increase the odds of injury for these children. While epidemiologic research efforts continue to be improved in order to isolate the key risk factors for occupational injuries to children in specific industries, efforts to prevent and reduce the risk of occupational injuries to children should not be delayed.

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