International
Labour
Organization

Child labour, education and health: A review of the literature

Peter Dorman

Geneva
November 2008

International
Programme on
the Elimination
of Child Labour
(IPEC)

Statistical Information and Monitoring Programme on Child Labour (SIMPOC)

First published 2008

IPEC, Dorman, P.
Child labour, education and health: A review of the literature / International Labour Office - Geneva: ILO, 2008

ISBN: 978-92-2-121849-4 (print); 978-92-2-121850-0 (Web PDF)

International Labour Office

Literature survey / child labour / child worker / schooling / occupational health / occupational safety / developing countries - 13.01.2

ILO Cataloguing in Publication Data

ACKNOWLEDGEMENTS

This report was prepared by Mr. Peter Dorman and coordinated by Mr. Frank Hagemann from IPEC Geneva Office.

Mr. Peter Dorman would like to express his appreciation for helpful comments provided by Deborah Levison, Sevinç Rende, Michael Bourdillon and two anonymous reviewers on a previous draft of this report.

Funding for this ILO publication was provided by the United States Department of Labor (Project INT/04/60/USA).
This publication does not necessarily reflect the views or policies of the United States Department of Labor, nor does mention of trade names, commercial products, or organizations imply endorsement by the United States Government.

Visit our website: www.ilo.org/ipec

Printed in Switzerland
Photocomposed by IPEC, Geneva

Contents

Tables

Figures

Introduction

This paper reviews the rapidly-expanding literature on the relationships between child labour, education and health. With the renewed interest in child labour as an economic and social problem during the 1990s, researchers have attempted to assess its linkages to the core elements of human capital, hoping to solve continuing riddles in development policy and improve the quality of life for the world's poorest and most disadvantaged inhabitants.

In many respects, however, the central questions are wrongly posed. First, "education" and "health", no less than "child labour", are not unitary phenomena. There are different levels of education and different cognitive skills to be acquired; there are many aspects of health that need not correlate with one another; and there are many specific types of child labour with diverse effects. Second, much depends on context, and the conditions in which children and their families find themselves vary enormously around the world. The economic causes of child labour are not everywhere the same, nor are the cultural factors governing the role of children. Educational and health systems, and the expectations ordinary people have of them, also vary. Finally, and perhaps most important of all, the work of children, their educational activities and their health conditions are not determined separately; they are the joint product of the entire set of mutually determining influences that constitute a place and time. In technical terms, none of them are exogenous. As we will see, this results in large technical difficulties in measurement and analysis, and in the end it may be that any unidirectional answer is illusory.

Notwithstanding these limitations, however, there is now much we can say about the channels by which child labour is linked to human capital outcomes. The two sections that follow review research on education and health respectively. Due to the size of the literature, I have generally restricted this review to works published during the past ten years in English.

1. Child labour and education

1.1 General remarks on definitions and measurement

Nearly every study on the relationship between child labour and education compares the educational outcomes of children who don't work, or who work less, and those who do work, or work more. The first hurdle that needs to be surmounted, then, is accurate measurement of both these variables. "Education" is difficult to define and measure because it is multi-faceted. It can take the form of school attendance, school performance or skill acquisition, and each of these can be approached in more than one way. We will take up specific problems in identifying education outcomes over the course of this section. But child labour is also far from simple to measure.

One problem is that the line between child labour and the more innocuous category of child work can be drawn in various ways. One approach is to differentiate on the basis of the type of work involved. Here the emphasis is often placed on the System of National Accounts (SNA), which defines "economic" work in terms of its content and productive role. Thus, gathering fuel for household use is classified as economic even though it often occurs outside a market context, while burning the fuel in the process of cooking a meal is classified as non-economic. Hence children who engage in tasks that adhere to this conception of economic production are usually designated as child labourers, while those whose tasks fall outside the SNA are said to be engaged in "chores". This delineation typically has gender consequences; as we will see, it excludes many girls from inclusion in the ranks of child labourers even though the extent of their activity and perhaps also its educational consequences may be comparable.

Other researchers use hours of work as the sorting variable. In such cases it is common to make a more-or-less arbitrary distinction between those who work more or less than a certain number of hours per week, perhaps specifically during the school year. This has intuitive appeal in an analysis focusing on education, since hours of work may compete most directly with hours of schooling or studying. It also has the advantage of appealing to the provision for light work by children, defined as "not such as to prejudice their attendance at school", embodied in ILO Convention 138. On the other hand, this Convention is commonly interpreted as pertaining only to economic activity as this is defined under the SNA. We will consider both approaches.

A crucial problem that impinges on nearly every attempt to distinguish between child labourers and other children has to do with the intermittent character of child labour itself. Children's employment is typically sporadic, involving repeated movements into and out of work. The most comprehensive study of this phenomenon is Levison et al. (2006), who tracked the work experience of a large sample of children in Brazil. They compared two approaches to measurement. In the first, a researcher might ask whether children had worked during the past week, where work status is self-reported and is restricted to market work. In the second, the same definition of work would be used, but the reference period would be the four months prior to the survey. With frequent spells of work and non-work, it would be expected that the number identifying themselves as workers under the second approach would be greater—but how much greater?

The four-month panels of Brazil's Pesquisa Mensal de Emprego (Monthly Employment Survey) permit an answer to this question. Levison et al. restricted their sample to six cities during the early 1980s and late 1990s, totalling just under 400,000 children with complete data. They found that the multiple of the second measure to the first varied from somewhat under 1.5 to over 2, depending on age and gender. A portion of their results are displayed in Table 1.

Table 1: Ratio of child labour count, within last four months to within last week

Brazil: Pesquisa Mensal de Emprego for São Paulo, Rio de Janeiro, Belo Horizonte, Salvador, Recife and Porto Alegre

Age	10-12		13-14		15-16	
Gender	Girls	Boys	Girls	Boys	Girls	Boys
1982-84	2.05	1.97	1.65	1.63	1.43	1.35
1996-98	2.37	2.20	1.96	1.85	1.58	1.49

Source: Levison et al. (2006), employing all four-month panels

These findings warrant several comments. First, the multiples for girls systematically exceed those for boys and fall with age. Second, the multiples are substantially larger during the more recent time period. Finally, and for our purposes the most important implication, any study that compares outcomes for children who did or did not engage in child labour, and which uses a relatively short reference period for identifying child labourers, will be hampered by measurement error. This will reduce the likelihood that an analysis will yield a statistically significant relationship between child labour and education. For this reason, it will be important to pay attention to the reference periods employed by the studies reviewed in the remainder of this paper.

1.2 General remarks on the child labour–education nexus

The purpose of this review is to identify the ways in which child labour influences education outcomes, but the relationship is hardly this simple. First, it is clear that educational opportunities are themselves a major influence on child labour. The decision of households to put their children to work should logically be affected by the opportunity cost of this work, which may be time spent in school. This can be expected to show up at the level of individual choices, since children who do poorly in school or appear to benefit little from it are likely candidates for early entry into the labour force. It has also been documented at a community level, where the expansion of the quality and availability of education has served to reduce rates of child labour, (Rosati and Rossi, 2007). Ironically, the opposite effect can also occur: education can make children more productive, raising their prospective earnings and providing an inducement to entering the labour force. This was observed by Phoumin and Fukui (2006) in their study of Cambodian children, where being enrolled in school is associated contemporaneously with a 14% higher wage. This could of course induce greater child labour among those who also attend school. The general lesson is that simple correlations between child labour and educational outcomes need to be analyzed carefully to separate out the different directions and types of causation. This has become the norm for the most recent studies in this field, although there are still those which rely on raw relationships, e.g. Abler et al. (1998)

A second issue concerns the dynamic character of educational decisions. Each choice students or their families make, and each level of performance achieved, has consequences for future choices and accomplishments. To fall behind in one's studies in one year can lead to a situation in which it appears more attractive to leave school in a later year. Thus a cross-sectional study that seeks to explain current school attendance or performance with respect to current labour force status may miss the true extent of causation. (Sawada and Lokshin, 2001). This is an argument for retrospective studies, those that relate accumulated school achievement and long-term work histories, although they may in turn be subject to recall bias.

1.3 Competition between school and work

The most general question one might ask is whether school and work compete for children's time and attention. This is not specifically a matter of causation—both school attendance and work status may themselves be determined by other factors—but it does have the potential to establish the relevance of child labour for human capital formation. A large number of studies have examined various aspects of this competition, in most (but not all) cases finding it present in the data.

One approach would be to examine situations in which educational opportunities were enhanced and to estimate the (presumably) negative effect on child labour rates, under the assumption that, just as work has the potential to take time away from school, school may also do this for work. A much-cited example is Ravallion and Wodon (1999), which analyzed a program under which subsidies for school attendance were introduced in Bangladesh. They classified children as either school attendees or child labourers based on whether school or work was claimed as their "normal activity", so competition between the two statuses exists by construction. Given this framework, they found that, among boys, about a fourth of the increase in school attendance was equally a transition out of work; the corresponding figure for girls was about one eighth.

An indirect approach to the same question was employed in a developed country context by Eckstein and Wolpin (1999). Rather than trying to simulate an experiment, they used data from the

1979 youth cohort of the US National Longitudinal Survey of Labour Market Experience to calibrate a choice-theoretic model of work and school attendance. They found that if all American high school students adhered to their model, and if their work opportunities were simply eliminated, their dropout rates would have fallen from 18% to 16%. It is difficult to compare this result to other work, however, because it is dependent on an elaborate model which may or may not actually characterize students' decision-making.

Rather than having its impact primarily on school attendance or non-attendance, child labour may impinge on the hours children allocate to study. This is largely a matter of the role of what has been called "idleness", time spent neither in work nor education. Of course, such free time may serve many positive functions, but it also mediates between more narrowly defined work and educational activities. To the extent that "idleness" is the alternative to work, the relationship between work and school will be attenuated. The evidence on this question is mixed. Heady (2003) found that working children in Ghana spent an average of one hour per week less in school, 22 rather than 21, although this difference was statistically significant. Somewhat larger effects were found by Binder and Scrogin (1999) in a small (N=327) sample of fifth grade students in three cities in Mexico during 1993. If children identified themselves has having engaged in market work during the previous day, they devoted an average of a half-hour less to school plus home study combined. This impact rose to 45 minutes for children who reported working in household production. These were simple correlations, however; in regressions controlling for child and household characteristics the relationship between work and education hours weakened. It is important to note, however, that this study examined only the most direct connection between work and study time, occurring within the same day. If, for instance, a commitment to market labour induces a withdrawal of commitment to education over a longer time period, this may not be captured in a study whose reference periods for both work and education are a single day.

An intriguing look at community-level variability in the role of "idleness" can be found in Chamarbagwala and Tchernis (2006). They used a variety of data sources to analyze the school attendance of Indian children during the 1999-2000 school year. Three nested types of activity were defined, school attendance, work (market work, non-market work, household tasks) and idleness. (Only one of these could be primary for a given child.) They estimated three binary probit models to determine the degree of competition among the three activities, allowing for differences at the village level. They found that in some communities children were nearly always engaged in either work or school primarily, while in others what we are calling idleness was primary for a substantial portion of them. They interpreted this as indicating that social norms regarding what is appropriate for child can differ across communities; where idleness is frowned on child labour competes more or less directly with schooling, whereas in other regions a reduction in child labour might lead to an increase in idleness, with little effect on school attendance rates.

The most common approaches to estimating the extent of substitution between work and school rest on strategies that attempt to control for confounding factors. Since child labour both causes and is caused by school attendance choices, for example, it would be helpful to try to isolate only the first of these. This might be done by using other variables, uncaused by education, to predict involvement in child labour and then using this prediction rather than child labour itself as an explanatory variable in a regression predicting school attendance—the instrumental variables approach. An example is Beegle et al. (2005), which employed a sample of 2133 Vietnamese children whose data were collected during the 1990s. They instrumented child labour with community-level economic factors unlikely to be related to education and found a negative relationship between predicted child labour and school attendance. Working the average number of hours in paid or unpaid economic work is associated with a 30% decline in the likelihood of attending school. This estimate, however, should be viewed with caution, since community-level instruments cannot capture household-level differences, and the relationship is contemporaneous. (Other results from this study will be described later.)

By contrast, Cardoso and Verner (2006), in a study conducted in Fortaleza, Northeast Brazil, found little relationship between school and work, with variation in idleness accounting for most of the differences in time use. They attribute this to the lack of work opportunities for children in this region, but it may also be due to their estimating strategy, since they instrumented for child labour by using the child wage, with the latter accounting for only 9% of the variation in the former. This weak relationship is not surprising, given that children's wages can be expected to affect their employment through both income and substitution effects, and also because much child Labour is unpaid. On the other hand, instrumenting child labour by rainfall variation increased the measured child labour/education trade-off in Ghana, according to Boozer and Suri (2001).

The first-stage regressions to instrument child labour and education can themselves be revealing. This can be seen in Sedlacek et al. (2005), which instrumented for income-generating child labour in separate equations for school attendance in Brazil, Ecuador, Nicaragua and Peru, based on surveys from 1995-98. They found that, of the 15 variables used to predict schooling and child labour, 14 were oppositely signed and significant in all four countries. Meanwhile, using instrumental variables, these authors found that a change in exogenous variables that would lead to a 10% reduction in child labour would also be expected to increase the rate of school attendance by 7%.

Another strategy is the use of simultaneous equations. The simplest version of this is bivariate: two equations, one each for schooling and work. This depends, of course, on the assumption that these are the only relevant choices available to children, since otherwise additional equations would be required. (We will see this shortly.) A trade-off between these two activities appears at the individual level if error terms are correlated. In other words, if it is generally the case that a child whose work exceeds its predicted level is also one whose schooling falls below its predicted level, this indicates that work and school are substitutes. This was exactly the result found in Alcázar et al. (2002), who pooled samples from six Latin American countries during the late 1990s, and Wahba (2006) who analyzed a 1988 sample of over 10,000 Egyptian children.

More generally, one can allow for a wider range of individual choices, so that children could either be in school, in work, in neither or both. A simultaneous equations approach would provide estimates for each of these conditions. It can either be "ordered" (where the conditions are ranked according to desirability) or unordered. In the unordered case, the trade-off between school and work appears in the tendency, if it exists, for at least some children to find themselves in either the school-only or work-only condition rather than in one of the other two. Maitra and Ray (2002), for example, found evidence of this for samples drawn from Ghana, Pakistan and Peru, and especially for girls. On the other hand, they defined work as full-time paid employment only, so the inability to combine work and school may be an artefact of their methodology.

A promising approach to the study of the work–school trade-off involves the role of economic shocks. When household income drops suddenly and unexpectedly, for instance due to the loss of employment by the household head, it is possible that children will work more and attend school or study less. If so, this would constitute strong evidence for the general competition between these two activities, and it would pertain particularly to the most vulnerable members of the community. Several recent studies have investigated this possibility in Latin America, particularly Brazil, where both economic shocks and high-quality data can be found.

Neri et al. (2005) drew on the Brazilian Pesquisa Mensal de Emprego for six cities over the period 1982-99. They were interested in what happened to children from households whose heads experienced a spell of unemployment; this means they followed transitions during the period subsequent to this initial loss of income. What they found was that these children were more likely to enter the labour force themselves and drop out of school. The average incremental effect on dropout rates was 24%, and it was higher for households that earned lower incomes prior to the onset of unemployment; in the lowest income quintile the increase was 46%. This is not just a matter of children working or not working. These researchers also found that, if a child both works and attends school at the time that parental unemployment begins, the likelihood of not advancing a grade also rises, by 30% for the bottom quintile.

A different estimation strategy employing the same data can be found in Duryea et al. (2007), who incorporated a wider range of household characteristics and distinguished between income shocks occurring during the school year and those arising over the summer. This latter distinction makes it possible to concentrate the analysis on those shocks that are potentially more relevant to schooling decisions. Thus, they find that, if a household head experiences unemployment during the summer, school outcomes are unaltered. On the other hand, shocks during the school year appear to have even larger consequences for child labour, school attendance and grade advancement. Table 2, taken from this study, is highly informative:

Table 2: Impact of unemployment shock to child labour and school outcomes, Brazil

	Predicted probability with no employment shock			Predicted probability with employment shock		
	enter labour force	drop out of school	fail to advance grade	enter labour force	drop out of school	fail to advance grade
baseline case	.242	.023	.311	.365	.050	.394
baseline, but with						
child male instead of female	.379	.022	.375	.517	.047	.427
parental schooling 8 years instead of 0	.110	.009	.208	.192	.022	.278
year 1998 instead of 1992	.157	.013	.224	.206	.056	.269
child age 12 instead of 16	.053	.011	.288	.071	.016	.342

Source: Duryea et al. (2007)

The baseline case is female, age 16, resident in São Paulo, father age 45, mother 40, neither parent with schooling, the father continuously employed prior to the onset of unemployment.

Several observations emerge. In the baseline case, the loss of employment by the household leads to a 50% increase in the likelihood of a child entering the labour force; this increase is as high as 75% for children of more educated parents (reflecting a lower base level) but falls to just over 30% for the most recent period. The risk of dropping out of school rises even more dramatically, more than doubling for the base case and tripling in the 1998 variant. Failure to advance a grade rises more modestly, but from a much higher base than the dropout rate. The overall picture of increased child labour and reduced school attendance and performance is unmistakable, although there is no tendency for greater increases in child labour to be associated with greater reductions in either school attendance or grade advancement. The implication is that a general trade-off between work and schooling is revealed by episodes of parental unemployment, but that other factors mediate between them in a more complicated fashion.

Quite different results were obtained by Skoufias and Parker (2006) in the context of the 1994-95 Mexican peso crisis. These authors followed a panel of families through this period in order to compare the work and school outcomes of children whose fathers (household heads in this case) experienced unemployment compared to those who didn't. No effect was observed for boys; the school attendance rate for girls fell by about a fourth. No impact was recorded on grade advancement. Similarly, Gubert and Robilliard (2008) found that weather-related agricultural shocks in Madagascar greatly reduced school attendance, but they did not investigate whether there was a corresponding increase in the time children devoted to work.

Mexican social policy permits a different sort of comparison. Over the course of the 1990s the Progresa (later renamed Oportunidades) program was introduced to progressively more communities on a random basis. By providing payments to poor families whose children attend school, Progresa should mute the financial impact of economic shocks, at least with respect to children's work and schooling outcomes de Janvry et al. (2006) used this context to compare the effects of shocks between populations covered and not covered under Progresa. Specifically, they constructed a sample of 52,719 children from poor families who were between the ages of 5 and 17 in 1997, with four observations for each over the following two years. The panel format permitted them to use a fixed effects approach in which the unit of observation was the change in outcomes for a given child, reducing the need to control for individual differences between children. Three types of shocks were considered, the onset of unemployment for the household head, illness of the household head, and illness of one of the study child's younger siblings. Child work was defined in SNA terms, both paid and unpaid, but excluded non-SNA household activities and was identified by a one-week reference period.

The effect of Progresa was noticeable in terms of schooling: children whose families were subject to shocks and who lived in Progresa communities did not reduce their school attendance, whereas those without access to Progresa did experience this reduction. At the same time, child labour, as defined and measured by the study, increased in the wake of shocks by about the same extent for both Progresa and non-Progresa families. The same pattern was found in Nicaragua, which has introduced the Red de Protección Social modelled on Progresa: shocks (in this case the "coffee crisis") increased child labour for both covered and uncovered populations, but only those without access to the benefits decreased their school enrolment. (Maluccio, 2005) In these two studies one can see mixed results for the hypothesis that schooling and child labour are competing activities. On the one hand, shocks do have opposite effects on these two outcomes. On the other, programs like Progresa and Red de Protección Social appear to be able to alter education outcomes without a corresponding impact on child labour, at least in the context of household shocks.

A somewhat different approach was taken by Rucci (2004) in her analysis of the effects of the Argentine crisis at the end of the 1990s. Nearly the entire population was affected by this income shock, and no social program mitigated it for a randomly selected subpopulation, so the viable comparison takes the form of a before-and-after study. Employing Permanent Household Survey samples for the period 1996-2002, covering the urban population, she found that average real household income was cut in half by the crisis. Logistic regression was used to predict self-reported availability for work among teenagers as well as school attendance. Work availability rose significantly for all portions of the youth population, increasing by as much as 8% for those in the 14-15 age group. Meanwhile, school attendance fell by approximately 4 to 11%, again depending on the age subgroup. In short, reduction in school attendance could not be explained solely by increases in work availability, much less actual work (which was in short supply during the crisis); nevertheless the trade-off is apparent in their reciprocal movements.

Taken as a whole, the studies reviewed thus far largely confirm the view that school and work make competing demands on children's time, although several qualifications must be entered. (1) This is not the case in all circumstances. (2) Variation in school outcomes is generally greater than variation in measured work status or hours. (c) The extent of the trade-off between school and work differs according to demographic group, time period, location and the presence of income support programs in the context of economic or other shocks.

1.4 Relationship of school and work to other variables

Another sense in which work and school can be thought of as competing activities has to do with their associations with other factors. This shows up particularly in studies employing a simultaneous equations strategy to disentangle the school/work nexus. This yields coefficients that show the effect of social and economic variables on work and also on schooling. If they have opposite signs, so that factors that promote schooling also discourage work and vice versa, there may be said to be a trade-off between these two activities.

The roster of studies that have yielded evidence of this sort is very long, and all that can be done here is to briefly list them and describe their key findings:

Admassie (2002), rural Pakistan: A wide range of variables predict school attendance; nearly all are inversely related to child labour in a model that permits joint choice of work, school, work and school or neither. An example is the adoption of more mechanized agricultural methods, controlling for household wealth.

Tzannatos (2003), Thailand: Greater parental education increases schooling, decreases child labour.

Ersado (2002), Nepal, Peru, Zimbabwe: Economic variables and parental education have opposite effects on school attendance and child labour.

Canagarajah and Nielsen (1999), review of studies in five African countries: Parental education significantly increases schooling and decreases child labour in four of the five. Most other variables that positively affect one negatively affect the other.

Emerson and Souza (2007), Brazil: The object of study was the differential effect of household factors on school and work outcomes for boys and girls. Bivariate probit models were estimated separately by gender; with nine explanatory variables there were 18 possible pairs of effects (on school and work). In 11 instances a variable's coefficients were statistically significant in both the school and work equation, and in 10 of these they were oppositely signed.

Kruger et al. (2007), Brazil: Parental wages and household wealth have opposite effects on school attendance and child labour.

Dammert (2007), rural Peru: Reduced coca production, by lowering parental incomes, induces greater child labour but has no effect on education.

Cockburn (2001), rural Ethiopia: Parental education and most household assets increase children's school attendance and reduce child labour.

Bando et al. (2005), Mexico: Parental education increases the probability of school attendance and reduces that of child labour.

Hsin (2005), rural Indonesia: Parental education positively affects school attendance, negative affects child labour.

Rosati and Rossi (2003), Nicaragua and Pakistan: In a model with four work/school options, comparing only the work-only and school-only outcomes yields opposite signs on most variables in both countries, including parental education.

Saucedo et al. (2004), Mexico: Parental education negatively predicts every outcome other than school-only, but there is no corresponding pattern to other explanatory variables.

Deb and Rosati (2004), Ghana and rural India: Most variables in both countries, including parental education, have opposite effects on the likelihood of school attendance and work, where idleness is a third possible outcome.

Ray (2000), Ghana: Most variables, including parental education, have opposite effects on the probability of school attendance and work.

Patrinos and Psacharopoulos (1997), Peru: Having younger siblings is associated with poorer school performance and increased child labour.

Wahba (2006), Egypt: The unskilled adult wage is positively associated with school attendance, negatively with child labour; parental experience as former child labourers positively predicts current child labour but is unrelated to school outcomes.

Duryea and Arends-Kuenning (2003), Brazil: In a model which controls for both adult and child income, parental income is positively associated with school and negatively associated with child labour.

Kruger and Berthelon (2007), Brazil: Having younger siblings leads to less education and more work (including household chores); having older siblings has the opposite effects.

Levison et al. (2001), Mexico: Most variables have opposite effects on whether a child specializes in school or work.

Summing up, the overall pattern is that factors that favour education disfavour child labour and vice versa. This is particularly the case with parental education. This is not an ironclad relationship, and there are important local exceptions, but to the extent that one can generalize, it seems safe to say that work and schooling are, to some extent, competing outcomes.

1.5 Work hours and education outcomes

One reason why measured child labour may not be strongly associated with schooling is that it is often defined in a binary fashion: either a child works or he or she doesn't. One would expect, however, that the intensity of work, particularly the number of hours it commands, would play a role. Fortunately, time use data is captured in various ways in some surveys, making possible a set of studies that consider the relationship between hours of work and education.

Before reviewing them, however, it is necessary to address a preliminary issue. It turns out that much depends on how work is defined, and in particular on whether its boundary is extended to include household tasks. As we have already seen, the System of National Accounts limits economic activity to a subset of productive household activities, but researchers are not bound by it, and many have tallied all hours children spend in tasks that materially benefit their households. This has an important gender dimension, since in most societies girls are far more likely than boys to bear the larger share of the burden of "non-economic" household chores.

Several studies have focused on the effects of including or excluding household tasks in the definition of work:

As previously noted, Ersado (2002) examined schooling and child labour in Nepal, Peru and Zimbabwe. She found that having younger siblings has no effect on the school outcomes for girls in rural areas, but does for urban girls. This can be interpreted as evidence for the role of childcare as a work activity competing with school for these latter girls.

Ilahi (2001), Peru: In a sample of 1961 children taken during the period 1994-97, she found that episodes of sickness among family members result in girls taking on more caring labour, with negative consequences for their education.

Assaad et al. (2003), Egypt: These researchers considered three definitions of child labour, market (the most restrictive), SNA (including all work encompassed under the System of National Accounts) and "Inclusive" (SNA work plus household chores). For each of these they used a cut-off of 14 hours per week to distinguish child labourers from non-labourers. They note, incidentally, that the measurement of household chores in the Egypt Labour Market Survey they employ is inexact: it is reported by adult respondents, and parents often underreport the number of hours due to their expectations of what girls should be doing. Instrumenting for their different measures of work, the authors find that work has no impact on schooling for boys, but does for girls only if the most inclusive measure is employed. Depending on the subgroup and model specification, working more than 14 hours per week in a combination of economic and household tasks reduces girls' probability of school attendance by 50-90%.

Ritchie et al. (2004), Guatemala, India, Kenya, Nicaragua, Pakistan, South Africa: They analyze time use data in one-hour increments gathered during these countries during the period 1996-2003, finding that girls, and particularly those not enrolled in school, worked far more hours when non-economic work (according to SNA) was taken into account.

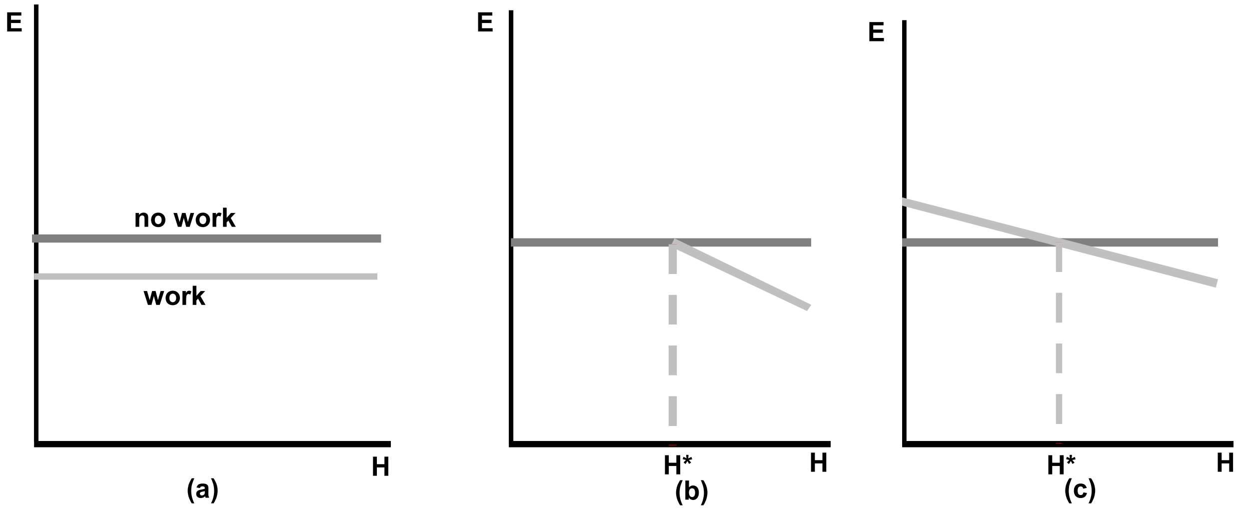
Levison and Moe (1998), Peru: This study estimates work and school equations, where the sample is restricted to girls, and work refers to hours allocated to household chores. As in the evidence reviewed in the previous section, it is possible to compare coefficients for the same variables in the two equations. Six were significant in both, and all of them were oppositely signed.

Levison et al. (2001), Mexico: They compare measures of work time that include or don't include household tasks and find that it makes a great difference for estimates of the tradeoff between work and study time for girls.

In addition to these studies, there are others that will be considered in the context of other issues. Overall, the evidence is considerable that the number of hours deemed to be occupied by child labour depends greatly on the definition of work, and that restriction of work to either its market form or to the SNA boundary yields a much smaller total for girls in particular. This should be borne in mind when we examine research on the work hours/schooling trade-off.

The question of how many hours a child can work before his or her education suffers has been central to child labour research for decades. Much of the evidence for developed countries, at least through the mid-1990s, is summed up in National Academy of Sciences (1998), where its inconclusive nature is demonstrated. In general terms, three possible relationships appear in the literature, where H represents hours of work and E educational outcomes:

Figure 1: Potential Relationships between Hours of Work (H) and Educational Attainment (E)



In the first possibility, (a), work is assessed to have a negative impact on education irrespective of hours. Several studies cited support this view, but since they do not control for hours, the composite effect probably corresponds to the effect of an average level of work intensity. While (a) is not generally plausible, it is included because it reflects the most common empirical approach to child labour/education studies. A second possibility is (b), where work has no effect on educational performance below a critical level of work intensity H* and a negative effect thereafter. Alternatively, in (c) the decision to work is associated with a positive effect but intensity works in the opposite direction; after a critical number of hours per week educational performance suffers. Both (b) and (c) are broadly consistent with ILO Convention. No. 138, with its concern that children's permissible (light) work be "not such as to prejudice their attendance at school." (c), however, has the property that it upholds the light work limitation even though a simple work/no work empirical assessment along the lines of (a) might find that child labour has no overall impact on education.

From a practical point of view, the most important question is the location of H*. If it is sufficiently close to zero, we may regard all work (of certain types) as inimical to education; if it is larger its location can be used to distinguish acceptable from unacceptable work intensities. The National Academy team was deeply divided on this matter. Most studies that locate a threshold put it at 20 hours per week, but this appears to be an artefact of researchers' choice of this number for hours categorization. In the end, the report found it prudent to endorse a 20 hour per week cut-off for work during the school year, even while recognizing that the evidence remains incomplete. One recent study by Marsh and Kleitman (2005), which draws on a panel drawn from the National Education Longitudinal Survey covering the years 1988-94, found little support for an hours threshold; on the contrary, in their data all work hours have negative impacts on a variety of educational outcomes. A different perspective is provided by Mortimer and Staff (2007), who analyzed longitudinal data collected in Minnesota for high school students during 1988-91, with annual follow-ups over 12 additional years. They segment their sample into low and high promise students, and differentiate students' work according to whether it is full or part-time and steady or sporadic, also keeping track of cumulative work through high school. They conclude that working fewer than 35 hours per week is desirable for most of their sample, a relatively high threshold, and that a few students even do well to work more than this. Their outcome measures include ultimate educational attainment (college) and post-graduation employment. It is clear from these two examples that recent research has not resolved the issue of work hours versus education in the United States.

In the remainder of this portion of the review, we will look at research in developing countries.

Phoumin and Fukui (2006), Cambodia: They instrumented for hours worked and estimated school attendance, finding that the relationship is an inverted-U, with school attendance increasing and then decreasing in hours worked per week. Using three different measures of school attendance, they locate the turning point, where additional work has a negative educational effect, from 15-16 hours. Unfortunately, they use only a dummy variable for gender, so the gendered impact of work time measurement cannot be ascertained.

Guarcello et al. (2004), Bangladesh, Brazil, Cambodia: In the course of examining three data sets for other purposes (discussed later in this report), the authors report cross-tabulations for weekly hours of work and school attendance:

Table 3: Weekly work hours and school attendance, children ages 7-14

Hours	1-10	11-20	21-30	31-40	41+
Bangladesh	36.7	68.2	27.3	6.6	9.4
Brazil	97.1	96.3	92.1	77.0	63.7
Cambodia	86.6	88.3	83.3	74.3	54.1

Source: Guarcello et al. (2004)

It appears that the negative effect of work time on school attendance appears only in excess of 20 hours per week. Care should be taken in interpreting these results, however: (1) they do not control for other factors that would influence work and schooling, in particular the precise age of the child, (2) the definition of work includes only SNA activity, not household chores, and (3) the reference period is just one week. In addition, the grouping of hours is arbitrary, and the difference in effects may take hold above or below 21 hours per week for these samples.

Ray and Lancaster (2003), seven countries: These authors began with the working assumption that the relationship between hours worked per week and educational outcomes would take the form of an inverted U, and their explicit purpose was to ascertain the switch point—the number of hours at which the relationship would switch from positive to negative. They examined three measures of educational performance and used three different estimation techniques. The dependent variables were school attendance/enrolment, number of years of education completed (“schooling”), and schooling for age (SAGE), defined as

$$\text{SAGE} = \left(\frac{\text{Years of schooling}}{\text{Age} - \text{E}}\right) \text{x } 100$$

where E is the age at which students typically begin school in the country in question. The techniques were a four-equation model simultaneously estimating the likelihood of working only, attending school only, doing neither or doing both, ordinary least squares (OLS) and instrumental (IV) regression relating hours of work to educational outcomes, and a two equation instrumented model (3SLS) simultaneously estimating work hours and educational outcomes. Table 4 displays the smoothed but otherwise unadjusted relationships between hours worked (on the x-axis) and educational outcomes (on the y-axis):

Table 4: Unadjusted relationships between hours of work (x) and education outcomes (y)

		Boys		Girls	
Country	Dep. Variable	Slope	after ? hrs	Slope	after ? hrs
Belize	attendance	negative	0	positive	6
Cambodia	attendance	negative	15	negative	10
Namibia	attendance	negative	10	negative	15
Panama	attendance	negative	0	negative	10
Philippines	attendance	negative	0	negative	5
Portugal	attendance	negative	10	negative	15
Sri Lanka	attendance	negative	5	negative	5
Belize	SAGE	flat		negative*	0
Cambodia	SAGE	negative	10	negative	0
Namibia	schooling	negative	5`	negative	10
Panama	SAGE	positive	30	positive	35
Philippines	schooling	negative	0	negative*	0
Portugal	schooling	positive	35	negative	0
Sri Lanka	SAGE	negative	10	negative	15

An asterisk signifies a small measured effect.
Source: Ray and Lancaster (2003)

To read this table, begin with the first row of data, for Belize. This indicates that, if the average school attendance rate is measured on the y-axis and the number of work hours appears on the x-axis, the relationship is negative for boys across all hours of work; for girls it begins positively but turns negative at approximately six hours per week. The expected case would be one in which the relationship begins somewhat positively, due to factors such as health that are similarly correlated with both education and work, and then becomes negative at a critical point, when work interferes with schooling. This is indeed seen in many, but not all, countries. At this simple level it is impossible to generalize.

The authors then conducted their various statistical analyses on these country data sets, as summarized in Table 5. Once again a quadratic form is used for work hours, making possible the identification of a turning point at which the squared term outweighs the first-order term, reversing the combined effect.

Table 5: Estimated relationships between work hours and education outcomes

Country	Method	Dependent Variable	Work hours	Work hours squared	Marginal switch point, hours
Belize	OLS	attendance	negative*	positive	
Belize	IV	attendance	negative*	positive*	4.6
Belize	OLS	years of school	negative	positive	
Belize	IV	years of school	negative*	positive*	4.4
Belize	OLS	SAGE	negative	positive	
Belize boys	IV	years of school	negative*	positive*	4.4
Belize girls	IV	years of school	negative*	positive*	4.5
Cambodia	IV	attendance	negative	negative	
Cambodia	IV	yrs school	negative	positive*	
Cambodia	IV	SAGE	negative*	positive*	28.6
Cambodia	IV	literacy	negative*	positive*	30.0
Cambodia boys	IV	SAGE	negative*	positive*	28.8
Cambodia girls	IV	SAGE	negative*	positive*	28.2
Namibia	IV	Attendance	positive	negative	
Namibia	IV	yrs school	negative	positive	
Namibia	IV	literacy	positive	negative	
Panama	OLS	attendance	negative*	positive*	150
Panama	IS	attendance	negative*	positive*	41
Panama	IS	yrs school	negative*	positive*	30
Panama	OLS	SAGE	negative*	positive*	46.8
Panama	IV	SAGE	negative*	positive*	29.0
Panama boys	IV	SAGE	negative*	positive*	30.9
Panama girls	IV	SAGE	negative*	positive	
Philippines	OLS	attendance	negative*	positive*	100
Philippines	IV	attendance	negative*	positive*	36.7
Philippines	OLS	years	negative*	positive*	55
Philippines	IV	years	negative*	positive*	34.4
Philippines boys	IV	years	negative*	positive*	33.4
Philippines girls	IV	yrs school	negative	positive	
Portugal	OLS	attendance	negative*	negative*	
Portugal	IV	attendance	negative*	positive	
Portugal boys	IV	yrs school	negative*	positive*	25.7
Portugal girls	IV	yrs school	positive*	negative*	29.6
Portugal	IV	no. of failures	positive*	negative*	27.8
Sri Lanka	OLS	attendance	negative*	negative*	
Sri Lanka	IV	attendance	positive*	negative*	11.8

Country	Method	Dependent Variable	Work hours	Work hours squared	Marginal switch point, hours
Sri Lanka	OLS	yrs school	positive*	negative*	8.5
Sri Lanka	IV	yrs school	positive*	negative*	18.7
Sri Lanka	OLS	SAGE	positive*	negative*	9.5
Sri Lanka	IV	SAGE	positive*	negative*	18.1
Sri Lanka boys	IV	attendance	positive*	negative*	18.7
Sri Lanka girls	IV	attendance	positive*	negative*	13.6
Belize	3SLS	SAGE	negative	positive	
Cambodia	3SLS	SAGE	negative*	positive*	42.7
Panama	3SLS	SAGE	negative*	positive*	38.9
Sri Lanka	3SLS	SAGE	positive*	negative*	13.2

* indicates significant at $p < .05$.
Source: Ray and Lancaster (2003)

The first data row can be read as follows: for an OLS regression of work hours and other variables on school attendance in Belize, the coefficient on work hours was negative and significant; the coefficient on the square of work hours was positive but not significant. This suggests that the relationship between work hours and school attendance in this country, as estimated with OLS, is negative at all hours levels. In the next row, however, an instrumental variables technique was used, with the result that the coefficient on the square of hours is now significantly positive. At 4.4 hours per week the total effect of additional working hours switches from negative to positive under this estimation. In general, switch points of this sort are given only when the coefficients on both terms (hours and hours squared) are statistically significant.

The results for many of the estimations are counterintuitive. Unlike the unadjusted relationships given in Table 4, the adjusted ones often indicate that small amounts of work are harmful to education, while large amounts are beneficial. This is not so serious for the Philippines, where the switch point is at a high enough level of work hours to be of little practical importance; it matters for Belize, Cambodia and some versions of Panama. It is possible that this could be an artifact of forcing the relationship into a quadratic form, but further analysis would be required to determine the source of the difficulty. On the other hand, the results for Sri Lanka are entirely plausible as reported, as are those for Portugal (with one exception). It is reasonable to believe, for example, that the switch point for a developed country like Portugal would occur at a higher number of hours per week than in Sri Lanka. More work should be done to test and refine these estimations.

Guarcello et al. (2007), six countries: These authors estimated the correlation between hours of work and education outcomes for a set of countries for which time use data were available; they were also able to test for causation in one country, China, due to the combination of time use and panel format.

In the case of China, a Health and Nutrition Survey had been administered to 3800 households in 1989, 1991 and 1993. Since time use data were available for the first of these waves, it was possible to estimate the likelihood of subsequent school attendance conditional on earlier work. The problem is somewhat more complicated, since school attendance in a later period also depends on earlier attendance, raising the issue of joint causality between contemporaneous work and schooling. This was addressed by means of a model that separates contemporaneous and delayed effects and uses the panel property to control for unobserved differences among households and children. The variable coefficients, such as age, age squared and prior school attendance, all had the expected signs, and many were statistically significant. Few of the children were engaged in market work, but non-market work was common; the coefficient on hours of non-market work was negative and significant in both statistical and practical terms. According to this evidence, full-time non-market work would make school attendance unlikely overall.

The other countries' surveys were examined for signs of a negative association, not necessarily causal, between work hours and schooling. Cross-tabulation of the raw data demonstrate that, for most countries, market and non-market work have a negative association with school attendance beyond a certain threshold, as indicated by Table 6.

Table 6: Threshold weekly work hours for negative association with school attendance

Country	Work Type	Threshold
Cambodia	Market	30
	Nonmarket	40
	Both	—
Ghana	Market	—
	Nonmarket	50
	Both	40
Guatemala	Market	25
	Nonmarket	30
	Both	45

Source: Guarcello et al. (2007)
Note: Thresholds are approximate, based on grouping and non-monotonicity of the hours-attendance relationship.

In the case of Guatemala there were also data on grade advancement. Cross-tabulation indicates there were no hours thresholds for negative associations in this dimension of school performance.

One would expect that the effect on education of any number of market hours performed per week would depend on the number of non-market hours also performed, and vice versa. This suggests combining the two types of work, but simply adding them carries the implicit assumption that an hour of one is equivalent to an hour of the other. The authors reject this assumption and use regression analysis to estimate a weighting factor that reflects the relative impact of each type of work on school attendance. (Their estimation method allows this factor to vary with the number of hours of each type of work.) Using this weighting scheme they calculate a sum of "effective working hours" for all children, a total that will normally be less than the simple arithmetic sum of market and non-market work.

This weighting scheme is of interest in its own right, apart from the association it permits between school attendance and the weighted sum of work hours. It uses education effects to answer the question, how many hours of non-market work are equivalent to an hour of market work? It is difficult to convey these weights, however, since they depend on the weekly amount of each type of work. For instance, with a given weekly amount of market work, the weight for an hour of non-market work will rise as more non-market work is performed. This is reasonable in light of the economic expectation of rising marginal costs against the fixed amount of time available in the space of a week. Similarly, the relative weight of non-market work will fall as more market work is performed.

To get a sense of the weighting system developed in this research, consider the case of a child who engages in 7 hours of market work per week and 20 hours of non-market work. In Ghana an additional hour of non-market work would have the same effect on school attendance as an additional .84 hour of market work; in Senegal the weight is .78. A calculation was attempted for Cambodia, but the impact of non-market work was so slight that the weight was not meaningful.

Using this weighting system it is possible to compare the relationship between weekly work hours and school attendance using both market work alone and the constructed measure of effective work. Figures 2-4 demonstrate this for Guatemala, Cambodia and Senegal respectively.

Figure 2: Probability of school attendance conditional on working hours, Guatemala

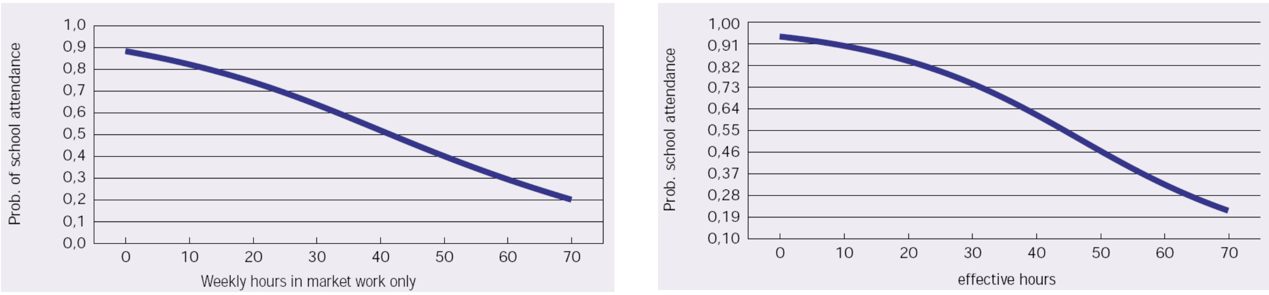


Figure 3: Probability of school attendance conditional on working hours, Cambodia

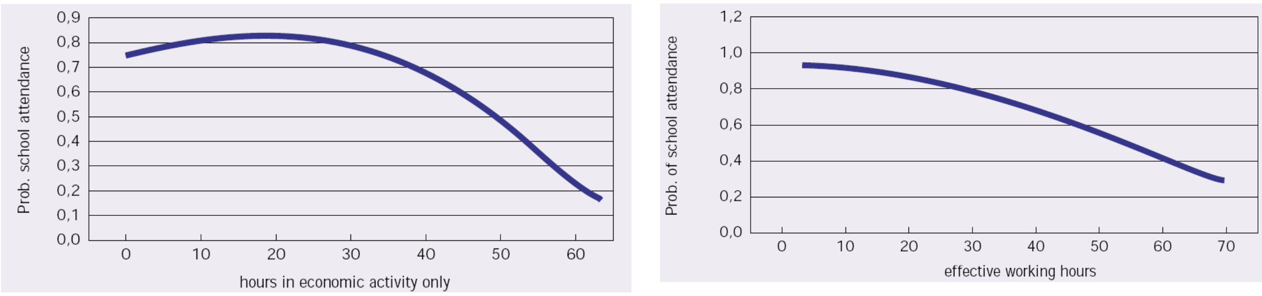
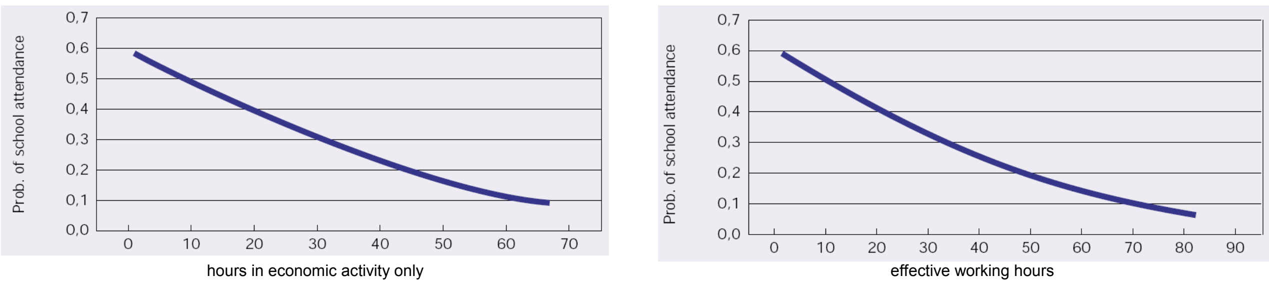


Figure 4: Probability of school attendance conditional on working hours, Senegal



Two general patterns can be discerned. In Cambodia the slope of the relationship between market work hours and the probability of school attendance is steeper than that involving effective work hours, at least beyond 30 hours per week. In Ghana and Senegal the slope is approximately the same, but the effective work curve is shifted to the right of the market work curve. Both patterns suggest that, at relevant levels of combined market and non-market work, the latter has an effect on school attendance, but not as great as the former.

Akabayashi and Psacharopoulos (1999), Tanzania: These authors provide the most direct evidence concerning the relationship between hours of work and hours of study, where the latter are understood to be in addition to regular school time. The sample was drawn from the Tanga region 200 km north of Dar es Salaam in 1993-94. 542 children maintained time use logs; their reading and math skills were also estimated by their parents, information that will be considered later in this review. The researchers estimated equations for hours of study and hours of work, taking into consideration that these are jointly determined. They found that nearly all explanatory variables with a positive effect on one had a negative effect on the other, confirming that studying and working compete for children's time allocation. Their work does not calibrate this trade-off, however, nor do the data permit a comparison of different types of work; all forms of work, market and non-market, economic and non-economic, were recorded without distinction.

Summing up this section, we are unable to avoid the conclusion that the evidence remains thin on the essential question of work hours and schooling. As generalizations, one can say that work hours compete with school hours beyond some threshold, but the threshold varies from one country to another. Work also competes with study at home, but little is known as yet about threshold effects. In addition, it appears that non-market work, including work outside the SNA boundary, ought to be considered in addition to market work, but these different types of work probably differ in their effect on schooling.

1.6 Child labour and school achievement

The most common indicator of human capital formation employed in child labour studies is school attendance. This is not because attendance is most closely tied to the acquisition of skills, but because surveys normally ask about children's school attendance or enrolment. From a theoretical perspective, of course, attendance and enrolment are both inputs into skill acquisition, not outputs. Several studies, however, have taken advantage of data on more direct performance indicators, the topic of this sub-section.

1.6.1 Grade attainment

Earlier we reviewed Beegle et al. (2005), which followed the progress of 2133 rural Vietnamese children surveyed in 1992-93 and again in 1997-98. Child labour was defined as income-generating work; the strategy was to identify the effect of child labour in the first period on education outcomes in the second. Using hours of child labour as an explanatory variable, the authors found that the mean level of child labour in the early 1990s was associated with a 6% decrease in the highest grade level attained five years later.

1.6.2 Schooling for age (SAGE)

The formula for this indicator was given above. It is an indirect but highly suggestive statistic. While it is possible that a student might trail "innocuously" due to a late start or a simple pause in schooling, in most cases lagging behind one's age level is a sign of substandard achievement; it also presages an earlier exit from schooling altogether.

The first study to feature this dependent variable prominently was Patrinos and Psacharapoulos (1997), where the relationship between work and education outcomes were analyzed for a sample of 2741 children in Peru. They found a significant relationship between child labour and SAGE only for the indigenous portion of their sample, but their technique was a simple logistic regression which did not take account of interactions between variables—in particular, for reverse causation from education to work. Subsequent studies, using more developed methods, have tended to find a stronger relationship.

For instance, SAGE was one of the dependent variables analyzed by Sedlacek et al. (2005), discussed earlier. The simple cross-tabulations are not without interest:

Table 7: Percent of children ages 10-14 lagging behind expect grade level in four countries

	Brazil	Ecuador	Nicaragua	Peru
School only	42	47	35	28
School plus work	54	55	45	36

Source: Sedlacek et al. (2005)

Only children currently attending school are included in this table to highlight the effect of work among those who would be recorded as having a positive educational status if school enrolment or attendance were the object of inquiry. In every case working children have a substantially greater tendency to fall behind. Recall that the definition of work employed in this study is restricted to income-generating activity only, so it will tend to understate the SAGE differential associated with more general measures of child labour. In an instrumental variable analysis the authors estimate that a change in exogenous variables that would result in a 10% decrease in the incidence of child labour would be expected to reduce the probability of lagging behind one's age group by 12%, a much greater effect than on school attendance alone (see above).

The tendency for child labour to affect SAGE to a greater extent than school enrolment was also highlighted in Duryea et al. (2007), which examined the effect of the household head's unemployment shock on his children, as discussed earlier. Refer again to Table 2. The likelihood of failing to advance in school exceeds that of dropping out of school altogether by approximately an order of magnitude in most cases; similarly, the absolute effect of an unemployment shock is far greater on the SAGE measure than on school enrolment.

Work was placed in the context of sequential education outcomes in Canals-Cerdá and Ridao-Cano (2003). They followed nearly 2500 young people in Matlab, a rural district in Bangladesh, as they proceeded through primary and secondary school. The purpose of the study was to trace the effect of early entry into the labour force on SAGE, where work status took the form of a binary variable. (No allowance was made for different hours of work.) Their technique was to estimate a series of sequential outcomes conditional on the age at which children began working. For instance, work during an initial period could be seen to have a contemporaneous effect on SAGE, and this in turn would influence outcomes in subsequent periods. They also used work history and differences in the transmission of school performance across time periods to infer individual proclivity for education—identifying children whose unobservable characteristics favour or hinder them in school achievement.

Earlier involvement in work, in this study, is associated with a tendency to lag behind age level. If child labour begins during primary school the probability of continuing into secondary school is reduced by over 10%. This effect is tripled if work begins prior to the start of primary school. Moreover, they find that working children who continue in school have greater unobserved affinity for schooling than nonworking children in the same grades. The presence of this selection effect means that simple comparisons of education outcomes between working and nonworking students understates the true impact of work. That is, if one were to hold student ability and motivation constant, the negative effect of work would be greater than that which is actually measured. If this result can be generalized to other samples, it has far-reaching implications for the types of studies summarized in this report.

The effect of child labour on SAGE was less pronounced than its effect on enrolment in Khanam (2004), but still noticeable. Their data were collected by the International Food Policy Research Institute in Bangladesh; selecting only for children ages 5-17 living in two-parent families, they had available a sample of 1628. They created four categories out of the studying/not studying and working/not working dichotomies and implemented a multinomial logistic regression. Their chief finding was that working reduced the likelihood of being in school by 93% for girls and 88% for boys, but they also found that girls who worked were 36% more likely to be behind their age group, while the corresponding figure for boys was 26%. The enlarged effect of work on school attendance may be due to the approach taken by the survey, which asked heads of households to categorize their children according to one primary and one secondary activity. It is possible that this filters out children whose more limited engagement with work might otherwise lead them to be classified as "working". The greater impact on girls, incidentally, is of interest in light of the survey's inclusion of household as well as market work in its definition of work as a principal activity.

Another study in which the impact on SAGE, while noticeable, was less than dropping out of school altogether was Neri et al. (2005), discussed earlier. In that case, the increase in the likelihood of falling behind, for the most economically vulnerable portion of the child population, was about two-thirds of the corresponding increase in the risk of leaving school.

To summarize this section, SAGE is regarded as a revealing indicator of educational performance for children who remain in school. There is a near-consensus among researchers that work lowers the likelihood of remaining with one's grade cohort, and in some instances the SAGE effect exceeds the impact on enrolment or attendance. This is one of the clearest indicators of the tendency for work to compete with study for a child's available time.

1.6.3 Grades

The effect of work hours on grades among high school students was one of the main topics discussed in National Academy of Sciences (1998). Since that time there has been less interest in the topic in the US literature and surprisingly little research in other locations. It may be difficult to pursue this question in developing countries due to lack of access to student academic records. In any case, the search conducted for this review found only one study of work and grades in a developing country context, Kandel and Post (2003). They delivered a survey to secondary school children in Zacatecas, Mexico, sampling 3903 children in urban, small town and rural environments. They found that working during the previous year has no effect on current grades, controlling for other factors, but they do not address the problem that work status may be endogenous.

The potential role of endogeneity is highlighted in Stinebrickner and Stinebrickner (2003). They examined the effects of work on grade point average for students at Berea College, a school in Kentucky that requires all students to contribute to college operations. With no controls for factors bearing on students' choice of work and the college's choice of students to perform particular tasks, working time and grades are positively correlated. Restricting the sample to first semester students only, however, eliminates the role of choice on both sides (the work assignments are random), and for these observations the relationship is negative. While the specific context is outside the domain of this review, the lesson is an important one and may go some way toward clarifying the difficulties encountered by the National Academy of Sciences.

1.6.4 Cognitive assessments

Presenting child labour and education as simple alternatives fails because a significant fraction of working children remain in school. Nevertheless, the devotion of scarce hours to work may show up as reduced academic achievement, and perhaps the truest measure of this cost is the reduction in actual learning as reflected in lower scores on standardized exams. Indeed, Glewwe (2002) found that test scores outperform other measures of educational attainment as predictors of adult earnings. Beginning in the 1990s standardized learning assessments became more common in much of the world, and the last decade has seen a wave of research into the linkages between work and cognitive outcomes. That literature will be reviewed in this section.

One of the pioneers in this wave was Akabayashi and Psacharopoulos (1999), described earlier. In this case, learning outcomes were estimated by parents rather than through formal assessments, separately for reading and math. The authors instrumented for hours of work and study and found a significantly negative effect of work time on both sets of skills, although somewhat weaker for girls than boys.

Another relatively early effort was undertaken by Fuller et al. (1999). They analyzed student performance on the Early Literacy Exam (ELE) administered in two sites, Bahia and Ceará, in north eastern Brazil; in all, 1916 children were sampled. Respondents were asked how many tasks they performed at home, and an index was constructed based on how many they identified. The average was 2.6 in Bahia and 2.2 in Ceará. A simple OLS regression was performed to estimate the impact of this variable on ELE scores, and it proved to be negative and significant in all instances, with girls experiencing approximately twice the effect of boys. It is possible that this finding may be affected by the endogeneity of work tasks, although it could be hypothesized that this effect will be less for younger children engaged in housework than older children engaged in economically productive work as defined by the SNA. Absence of controls for endogeneity also calls into question the results reported for Nigeria in Fetuga et al. (2007), although in this latter case the mean test scores of working and non-working children in a "raw" comparison were not significantly different.

Heady (2003) was the first published study to merge test scores with LSMS data, in his case for Ghana. The household survey, taken in 1988-89, contained a dichotomous variable for work status; at the same time, children also took five tests: easy reading, easy math, advanced reading, advanced math, and a Raven test intended to measure ability as opposed to the learning of content. This last measurement might serve to control for child characteristics that influence educational outcomes without being influenced by them. Two types of work were also identified, inside and outside the home. Beginning with simple cross-tabulations and controlling for age, Heady found that nonworking children do better than working children on every learning test, with the difference being significant in about a third of them.

Heady then performed regressions employing the LSMS data as explanatory variables. Here he found the following:

- Easy reading: Both types of work have a significantly negative effect. Working in the home lowers the average score by 23%, working outside by a third.
- Easy math: Neither type of work has a significant effect.
- Advanced reading: Hours of work (rather than status) has a significant effect, with each weekly hour lowering the predicted score by somewhat under 1%.

- Advanced math: Hours of work is again significant, again lowering the predicted score by somewhat less than 1% per hour.

These results, however, are subject to bias. As mentioned above, Heady hopes that the Raven test will capture the differences in ability and motivation that children bring to school and not be influenced by it, but both assumptions are questionable. In addition, many children did not take the exams, and this may introduce a measure of selection bias. Finally, only children who do relatively well on the easy exams are likely to be in a position to take the advanced ones; thus, as Heady points out, those working children who do take advanced reading or math are likely to possess unobserved advantages in ability, with the result that the impact of work on advanced test scores will be underestimated. Subsequent work in this area has taken greater steps to control for biases of this sort.

Two standardized testing programs, the Third International Mathematics and Science Study (TIMSS) and those administered by the Latin-American Laboratory of Quality of Education (LLECE), have provided an improved basis for exploring the effects of child labour on learning outcomes. TIMSS was organized by the International Study Center at Boston College and administered in more than 40 countries in 1995. LLECE oversaw the testing of children in the third and fourth grades in thirteen Latin American countries, assessing skills in language, math and other areas. The international scope of these programs permits cross-country and comparative analysis, an opportunity taken up by different teams of researchers.

TIMSS provided the starting point for Orazem and Gunnarsson (2004). They pooled seventh and eighth grade samples from Colombia, Czech Republic, Hungary, Iran, Latvia, Lithuania, Romania, Russia, the Slovak Republic and Thailand and employed measures of child labour performed outside the home. They employed both OLS and IV methods, with the latter seeking to correct for the endogeneity of work. The work variable was treated ordinally and as a set of independent categories based on hours performed per day; Table 8 reports their results for the latter:

Table 8: Percent change in TIMSS score relative to nonworking reference group

	OLS		Instrumental Variables	
	Math	Science	Math	Science
<1 paid hour	-0.8	-1.5	1.3	-1.2
1-2 paid hours	-1.9	-1.7	-11.7	-14.6
3-5 paid hours	-3.0	-2.4	-10.2	-11.5
1-2 hours in home	0.5	0.9	-1.7	-0.8

Source: Orazem and Gunnarsson (2004)

All of these results are significant at p = .05. In general, increased work takes its toll on student performance. This is much more apparent when the endogeneity of work time is taken into account through the use of instrumental variables, even when the work is undertaken within the home. It is mildly anomalous, on the other hand, that the doubling of paid working time does not appear to impose a performance cost in the IV specification.

LLECE was the basis for Sanchez et al. (2005), subsequently published, in part, as Gunnarsson et al. (2006). Child labour status is self-reported in response to the question of whether they worked outside the home always, occasionally or never when not in school. They begin with cross-tabulations and find:

> Across eleven countries and two achievement tests (twenty-two total cases), the pattern never varies. Those who work only some of the time outperform those who work all the time, and those who never work outperform both. The advantage for children who do not work is large, averaging 27.5% for languages and 25.0% for mathematics over those who always work. The advantage for occasional child labourers is much smaller, averaging 8.8% in languages and 8.1% in mathematics. (p. 8)

They then pooled their samples and regressed test scores on household and educational variables as well as country dummies, finding a highly significant negative impact of work on measured learning. Of course, the relationship between the explanatory variables and test performance is likely differ across countries, so of greater interest is Table 9, which summarizes separate regressions for each country. Average test scores are calculated for each work classification controlling for household and school-related influences. Note that the maximum possible scores are 19 for language and 32 for math.

Table 9: Predicted average test scores controlling for household and school variables

	Language	Math
Argentina	12.3 13.5** 14.1**	16.0 17.6** 18.0**
Bolivia	9.8 10.3* 11.6**	14.5 14.7* 15.6**
Brazil	11.4 11.8 13.3**	14.6 15.8** 17.8**
Chile	11.6 12.6** 13.6**	13.8 15.0** 16.5**
Colombia	10.3 11.7** 12.6**	14.2 15.8** 16.1**
Dominican Republic	9.5 9.5 10.6**	12.6 13.3* 13.1
Honduras	9.1 9.4 11.9**	11.8 11.0 13.2*
Mexico	9.6 10.7** 11.8	13.8 15.4** 17.1**
Paraguay	11.2 11.8 13.1**	13.9 15.4 18.0**
Peru	9.1 9.7** 10.7**	11.6 11.8 13.4**
Venezuela	10.0 10.5 11.3**	12.2 12.9 13.7
All	10.2 10.9** 12.1**	13.6 14.4** 15.7**

Asterisks refer to the estimated difference in mean scores being significantly different from the "always" working category at $p < .05$ (*) or $p < .01$ (**).
Source: Sanchez et al. (2005)

In all but one case, greater work is associated with lower test scores, and the majority of the relationships are statistically significant. In the pooled regression, employing country dummies, variation in the extent of child work explains approximately a fifth of the variation in test scores.

More recent evidence from Senegal is reported in Dumas (2007). Her data derive from the *Éducation et Bien-être des ménages au Sénégal*, a survey administered in 2003 to a sample of 1800 households. The extent of child work is calculated from a question that asks the age at which work outside the home began; the difference between the current age and this starting age constitutes the "work" variable. The children sampled are between the ages of 13 and 18, and the data also include test scores in French, math (oral and written) and life skills. Dumas finds that, in the French and math tests, earlier initiation into child labour is associated with higher scores. She controls for individual characteristics by including scores on exams taken shortly after beginning education as explanatory variables and using the score on a subsequent exam as the dependent variable. This anomalous result is only slightly weakened by including hours of work as an additional control, and then only in the case of one of the four tests (for written math skills). This may be due to the fact that there is a much higher degree of attrition from school among the child labourers, suggesting that those who remain in school are distinctive in unmeasured ways.

Work continues on refining the relationship between work and educational outcomes in developed countries; TIMSS in particular offers great promise. In an important review of TIMSS data, Post and Pong (2000) conducted regressions separately across 23 countries for which both test scores and child employment data are available in the 1995 iteration. Controlling for household characteristics, including those related to socioeconomic status, they come up with findings summarized in Table 10.

Table 10: Effects of work hours on TIMMS scores

Test:	Math				Science			
Hours:	1-4	5+	1-4	5+	1-4	5+	1-4	5+
	boys		girls		boys		girls	
Australia	-20.7**	-29.3**	-4.2	-1.9	-17.1**	-18.7*	-3.3	3.5
Belgium (fl)	-33.5**	-60.0**	-4.7	1.3	-17.7*	-35.8*	-6.3	-18.6
Belgium (fr)	-12.7*	-51.5*	-1.0	17.5	-7.1	-38.9**	-0.4	-11.8
Canada	-2.6	-23.9**	3.9	-5.9	-4.6	16.8*	-0.6	-12.8
Colombia	-5.9	-21.5**	-15.9	-6.2	-2.0	-9.6	-13.8	2.4
Cyprus	-15.9**	-29.2**	-28.2**	-53.7**	-11.9	-27.3*	-18.5*	-37.6**
Denmark	-0.7	5.7	12.2*	2.8	0.5	10.5	2.1	-3.2
Germany	-9.2	-11.3	13.6*	0.7	-7.2	6.8	10.2	0.2
Greece	-23.4**	-49.8**	-33.3**	-30.9**	-17.1*	-36.4**	-19.9*	-30.1**
Iceland	-1.9	-29.2*	7.9	1.9	4.3	-33.6*	2.5	-7.7
Iran	-8.6	-1.9	-15.9	9.4	-9.6	-14.1	-13.5	-24.3
Ireland	-20.1**	-40.2**	-11.6*	-18.1	-19.7**	-40.8**	-9.7	-22.3*
Israel	-15.0	-23.9	14.7	-18.0	-15.3	-17.3	10.2	30.3

Test:	Math				Science			
Hours:	1-4	5+	1-4	5+	1-4	5+	1-4	5+
	boys		girls		boys		girls	
Lithuania	-12.8*	-28.0**	-14.1*	-38.4**	-23.2**	-26.9*	-17.2	-31.8*
Netherlands	-16.8*	-26.2*	-4.4	-31.2*	-7.4	-23.9*	-2.2	-35.6*
New Zealand	-14.7**	-11.9	2.2	-10.1	-14.9*	-1.6	-4.7	-18.6
Norway	4.3	-0.6	21.9**	6.9	1.2	14.7	10.9*	-6.9
Philippines	-28.2**	-25.5**	-28.8**	-30.8**	-38.5**	-48.4**	-42.5**	-19.4**
South Africa	5.7	0.5	-7.1	-29.4**	4.6	5.6	-10.9	-17.3
Switzerland	-12.3*	-44.8**	-8.4	-40.7**	0.7	-32.9*	2.4	-16.3
Thailand	14.9**	-24.7**	-17.7**	-30.1**	-9.8*	-8.9	-9.6*	-14.8*
Scotland	4.6	2.5	-4.2	-10.8	-5.7	-10.1	-8.4	-37.2*
United States	-12.9**	-35.3**	3.2	-12.8	-12.1**	-32.6**	4.2	-12.4

Asterisks signify significance at the p = .01 (**) and p = .05 (*) levels.
Source: Post and Pong (2000)

Hours of work are per week during the school year; the mean scores on the math and science tests are 35.9 and 18.6 respectively. (Only the eighth grade exams are analyzed.)

Given the large size of many of the coefficients relative to mean test results, their precise value should not be taken too seriously. Nevertheless, the main patterns are suggestive: negative impacts far outnumber positive ones; few of the positive impacts are statistically significant; and the effect of work hours on test performance for girls is substantially more mixed relative to that for boys. The last of these in particular, along with the dimensions of the coefficients, points to the inability of the authors' regression model to sufficiently capture confounding influences; nevertheless, there remain strong grounds for concern.

The larger part of this study focuses on the United States, using the National Educational Longitudinal Study (NELS), a longitudinal data set tracking students who were in the eighth grade in 1988. Like TIMSS, NELS measures math and science skills; also like TIMSS, NELS asks students how many hours students worked in their current or most recent job, but unlike TIMSS it does not specify whether the hours counted are during the school year or the summer. Internal evidence suggests that student self-reporting contains substantial measurement error, so on both grounds the evidence should be approached with caution. Nevertheless the longitudinal character of NELS is a major virtue.

The authors regressed NELS performance in both the eighth and tenth grades on a set of household variables and self-reported work. Two models were estimated for the eighth grade, one with no control for student ability, the other employing self-reported grades for the two years prior to eighth grade. In the tenth grade regression the eighth grade scores were employed as a control. One of the explanatory variables was a constructed index representing socioeconomic status; this was highly significant in every instance, and its coefficient represented 14%, 8%, 3% and 4% of the mean scores on eighth grade math, eighth grade science, tenth grade math and tenth grade science respectively. Table 11 reports the coefficients on work hours expressed in relation to the effect of SES.

Table 11: The effect of work hours on NELS scores relative to socioeconomic status

	Math: boys	Math: girls	Science: boys	Science: girls
NELS grade eight without a control for unmeasured ability				
1-4 hours	-.22**	-.05	-.22**	-.08*
5+ hours	-.22**	-.03	-.26**	-.10**
NELS grade eight with self-reported prior grades employed as a control				
1-4 hours	-.24**	-.07*	-.18**	-.07*
5+ hours	-.25*	-.05*	-.21**	-.07*
NELS grade ten with grade eight scores employed as a control				
1-4 hours (8th grade)	-.30*	-.19*	-.29**	-.05
5+ hours (8th grade)	-.41**	-.14	-.20*	-.14
1-10 hours (10th grade)	.26**	.15*	.13*	.14*
11-20 hours (10th grade)	-.07	.14	-.07	-.04
20+ hours (10th grade)	-.29**	-.18*	-.26*	-.10

Asterisks indicate statistical significance at p < .05 (*) and p < .01 (**) levels.
Source: Author's calculation based on Post and Pong (2000)

In very general terms, the cross-national patterns apply to the US as well. Negative effects predominate over positive ones, particularly for boys. These can amount to a substantial fraction of the effect of socioeconomic status, unquestionably a major determinant of educational outcomes. The one exception appears to be ten or fewer hours of work for tenth-graders, which has a positive influence. This may reflect the benign (or selective) effect of light work as understood under Convention 138, or it may be an artefact of the ambiguity attached to the work question, which doesn't distinguish between summer and the school year. For this reason the results should not be taken as direct evidence on the appropriate cut-off between allowable and non-allowable work hours for teenagers during the school year.

While no single study in this field is conclusive, the pattern is unmistakable: the earlier children begin working, and the more hours they work, the more at risk they will be for falling behind in the development of their cognitive skills. Particularly for paid work outside the home, this applies with greater force to boys than girls. These patterns appear to apply equally to children in developed and developing countries. Nevertheless, more research is needed to delineate potential threshold effects or inflection points beyond which risk accelerates.

1.7 Subjective evidence

While careful analysis of the statistical relationship between children's work activities and their measured educational outcomes has taken the centre stage in this review, attention should also be given to the views expressed by children themselves. It is common for child labour and related surveys to include a question that asks children who are not attending school to provide the main reason. Some version of this is standard in surveys administered with the assistance of SIMPOC, and Table 12 summarizes the responses for many of them.

Table 12: Percent of children reporting work-related reasons for school non-attendance

	Household chores	Self-support	Generating income for family

	Household chores	Self-support	Generating income for family
Ethiopia	18.7	1.4	9.5
Ghana		1.0	0.4
Malawi			4.3
Bangladesh	6.9	4.6	27.0
Mongolia (all non-att)	9.0		5.0
Philippines	0.4		19.0
Sri Lanka	4.3		19.9
Turkey	7.6		
Costa Rica	0.6		21.6
El Salvador	6.1		8.1
Panama	9	11	26

In addition, the Philippines survey asked children who were both working and in school whether work made it more difficult for them to study, and whether it had a negative effect on their education. 44.8% answered yes to the first, while only 22.3% agreed with the second.

Several qualifications need to be offered regarding these data. First, each country has its menu of reasons which it offers to respondents; missing data mean that the corresponding question was not included. Second, the denominator is not always the same. In general, the percentages are for children recorded as working and not attending school, but in Mongolia, for example, the denominator includes all non-attending children, whether working or not. Also, the precise definition of child work and the reference period for work activity differ, and these too have an effect on the denominator. Nevertheless, for each of these countries the answers are mutually exclusive: respondents are allowed only one primary reason. While it would be unjustified to read very much into the variation exhibited in this table, a few general conclusions can be drawn. Household chores play a significant role in non-attendance in some countries but not in others. Self-support imperatives appear to be loosely correlated with family income needs. Overall, the last of these is the most important work-related factor and may be of great importance in some countries.

Surveys may also ask adult respondents for the reason that children in their households have left school. Here the evidence is somewhat mixed, perhaps reflecting larger differences in the denominator. Thus Nielsen and Nielsen (1997) find that only 2% of their sample of Zambian households give work as the primary reason for children leaving school, while 35% of Ethiopian respondents in Cockburn (2001) and more than half in Cockburn and Dostie (2007) said that work was the main reason for failure to attend school. The corresponding figure was 37.7% for a sample of Egyptian households in Graitcer and Lerer (2000).

A different view is offered in Kandel and Post (2003) in their analysis of Mexican survey data. Children currently in school were asked about their expectations for continuing to a higher educational level. Children working for pay had lower expectations, but regression transferred this effect to other variables that are associated with the likelihood of working. On the other hand, after controlling for confounding factors, the authors found that children who work without pay for more than 14 hours per week are 30% more likely to anticipate further educational progress—a result that may be subject to the same endogeneity bias discussed earlier in the context of this study.

Finally, 100 children engaged in the production of cottonseeds in Andhra Pradesh, India were surveyed by Mathews et al. (2003) in the summer of 2001. All of them reported that their work made it impossible for them to attend school during the growing season of May-February. No information was provided, however, concerning the construction of this sample, and no controls were provided.

Unfortunately, children's views seem to be collected as an afterthought in most surveys, with little attention given to the standardization of question framing, and reporting is variable with respect to denominators. This makes it difficult to come to general conclusions, even though there is reason to take the subjective views of children and other respondents seriously.

1.8 Summary

Much of the literature in this field asks the question of whether child labour "in general" has a negative effect on educational outcomes. This is probably the wrong way to pose the problem. Work at different ages, in different activities and of different intensities should not be regarded as homogeneous, and differences between and in some cases within nations have to be taken into account as well. Moreover, child labour is not an exogenous factor but one that is co-determined with education through the interaction of a wide range of social and economic variables. We should not be surprised to see a trade-off between education and child labour, but even the most conclusive evidence for it would be of limited practical relevance.

The critical questions have to do with what kind of labour, for which children, and for how long, as foreseen in ILO Convention No. 138. Here we have the benefit of a growing body of evidence using a variety of measures of educational performance and a range of statistical techniques. Perhaps the two most important dependent variables have proven to be SAGE and especially scores on standardized learning assessments. Broadly, one can say that increasing hours of work display harmful results on both counts. Household work should be included; here the results of Guarcello et al. (2007) are particularly persuasive. The child's age is also germane, as demonstrated in the sequential model developed in Canals-Cerdá and Ridao-Cano (2003).

Nevertheless, we are not yet at the point where we can use the existing research base to answer the practical questions surrounding ages, gender, hours, activities and education. Useful would be a greater availability of longitudinal data to capture delayed effects of child labour on education, with finer detail in hours and types of work. Indeed the last point has hardly been investigated at all. One may hypothesize that the effect of child labour on education can be decomposed into two components, the psychosocial impact of the work activity and the competition for the child's time and effort resulting from the number of hours worked during the school year. Failure to control for the first would bias the second. While it would be impractical to study each type of activity for these impacts, it would be possible to identify a small set that are currently of interest for statistical and regulatory policy. An example would be the question of whether the SNA boundary should be widened to incorporate more household work. When possible, the dependent variable should be scores on relevant cognitive tests; enough work has already been done in this area to demonstrate that the results could be reliable and illuminating.

2. Child labour and health

Child labour researchers are deeply interested in the health consequences of child work, and a large literature has emerged in this field. It is remarkable, however, that this concern has not carried over into the more general field of development studies. Due to initiatives by the World Health Organization and the World Bank, attention has been drawn in general terms to the relationship between health and macroeconomic outcomes, with research centred on particular diseases like malaria. Nevertheless, the influence of work on health, for adults and children alike, remains below the radar. For example, Mwabu (forthcoming), the health economics chapter in one of the highest profile surveys in the field of development, makes no mention of either child labour or adult occupational health. In the absence of relevant research, there is little we can say about the economic (as opposed to the human) significance of the work-related effects on health, but it is reasonable to assume that injuries and illnesses in childhood in particular can have a magnified impact on subsequent life opportunities. We are therefore fortunate to have a growing body of research on health and child labour that can provide a starting point for future work to place these impacts in a larger context.

There are several ways to measure the work–health relationship. One can compare the overall health status of child workers to an appropriate reference group, the inference being that the difference is attributable to work activity. This requires, of course, a reference group that is otherwise identical in all relevant respects, or a statistical procedure powerful enough to isolate the role of work. A second approach, perhaps the most common among researchers with a background in the health sciences, is to identify exposures associated with work activities and environments. Ideally, this would provided the first half of a comprehensive research program, with the other half taking the form of estimating exposure-response relationships—but this second step is far less common. Third, one can document the record of injuries and illnesses child workers have experienced at work or as a result of it; here too one ought to have a reference group, since any activity children might substitute for work would have at least some associated risk. Since exposure-response studies are infrequent, this review will be weighted toward the first and third of these alternatives.

Before continuing, it will be useful to review the methodological problems that need to be overcome in order to produce sound evidence in this field. First, finding an appropriate reference group is virtually impossible. The main reason for this has to do with the so-called "healthy worker effect", the tendency for the healthiest, most robust individuals to be selected or self-select for work, particularly physically demanding work. This shows up empirically in studies that estimate work and health equations from the same data, when their residuals are negatively correlated, as in O'Donnell (2005) and Wolff and Maliki (2008). It would be desirable to have individual-level data that could correct for this reverse causation (from health to work), but such a hope is not realistic. In the end we are left with non-comparable comparison groups and insufficient statistical resources to correct the bias. One can only take this factor into consideration, recognizing also that a reverse effect could be caused by the potential for low socioeconomic status to result in greater resort to child labour *and* poorer health conditions. (Levison and Murray-Close, 2005). Second, "child labour", however defined, is not a homogeneous activity with identical expected health effects; each type of activity presents qualitatively and quantitatively different risks. In this sense, the entire enterprise of identifying "the" health impact of child labour is chimerical. Nevertheless, given the inability to conduct separate investigations into each type of work, we are left with the task of pursuing an overall relationship. Third, as Levison and Murray-Close (2005) also point out, some hazardous activities may exhibit threshold effects, such that health impacts are apparent only after a particular number of hours. Fourth, health assessments are subject to their own biases, such as the relationship between health status and nutrition, since the latter might be selected positively (where child labourers are favoured with greater intra-family allocations of food) or negatively (due again to low SES or age or gender bias). (Leinberger-Jabari et al., 2005; O'Donnell et al., 2002) Fifth, the delayed relationship between work and health, with causation running in both directions, can confound otherwise sensible research strategies. Many studies, as we will see, employ contemporaneous comparisons—today's work with today's health—but it is likely that this misses many important health impacts. By the same token, today's health, which may render a child non-working, may be the result of yesterday's work, an effect that will be noticed only if the reference period (the time duration prior to the survey date used to establish child labour status) is sufficiently large. In other words, the healthy worker effect may itself be the product of prior work. Sixth, it is difficult to attribute health outcomes precisely to work and non-work factors. This is clearly the case with diseases, such as muscular-skeletal or respiratory problems, that may be attributable to cumulative impacts from multiple sources, but it also applies to traumatic injuries, where the causal exposure does not lend itself to a distinction between working at a site or simply being present at it. This is the case for many risk factors associated with small-scale farming, one of the chief activities of working children around the world—and the home environment for their non-working siblings. Finally, statistical systems even in developed countries are believed to undercount injuries to children due to reporting disincentives. (Runyan and Zakocs, 2000)

With these caveats in mind, we can proceed to the empirical literature.

2.1 Exposures

Exposure studies, by their nature, are occupation-specific. There are many small literatures on specific types of activity which do not lend themselves to generalization and are therefore beyond the scope of this review, quite apart from the point, made above, that exposure-response relationships are normally not identified. For a recent survey of exposure studies in a wide range of potentially hazardous occupations, the reader can consult Fassa (2003).

Nevertheless, there are two questions of prime importance regarding exposures that call for coverage in this review: to what extent do children's most characteristic work activities, particularly in agriculture, encompass risk factors known to be significant in general studies of industrial hygiene, and to what extent do the same factors affect adults and children differently due to developmental or other considerations?

We will begin with a brief survey of exposures in agriculture in light of its centrality in the world of children's work. Fassa (2003) documents the use of hazardous equipment, exposure to pesticides, poor sanitation conditions, unsafe transportation to and from the field, excessive and ill-timed work hours, ergonomic issues, extreme temperatures, excessive noise and risks from contact with large animals. Pesticide and ergonomic risks were also identified by Mull and Kirkhorn (2005) in Ghana, Mathews (2003) in India, and pesticide exposure appears even among Egyptian children engaged in brick-making due to their proximity to farms. (Kishk et al., 2004) Medically identified pesticide poisoning also occurs among child agricultural workers in the United States, although it is relatively uncommon—.034% of such workers on a full-time equivalent basis. (Calvert et al., 2003) Overall, it can be said that the prominence of agriculture in children's work activities is due to their family economic context and not to any particular suitability of agricultural work itself.

The more encompassing question is whether children face distinctive risks due to their age or related developmental considerations. This was addressed in some detail in National Academy of Sciences (1998), which found several grounds for concern:

1. ***Activity matching.*** Children are drawn to work that is sporadic, requires minimal skill or training and poses few barriers of entry or exit. This fits their social situation, but it may lead to significant mismatching from a health and risk exposure perspective. For instance, such jobs tend to arise in small or micro-enterprises that have little access to safety equipment, where there is little formal training and where rapid turnover of the workforce can lead to insufficient supervision and accumulation of experience. The National Academy cited numerous studies indicating that "secondary" employment of this sort tends to present greater risks of illness and injury. Thus, social and economic circumstance may push children into precisely the sort of jobs they are least suited to. In developed countries this shows up especially in construction. (Dorman, 2000)

2. ***Experience.*** Some problems faced by children at work are the result of inexperience rather than youth per se. Accident rates are highest for workers who are new to the job, and of course a much higher percentage of children will qualify as "new". The effects of experience can compound those of judgment which may be more age-related.

3. ***Muscular-skeletal development.*** Children are not smaller adults; their bodies are distinctive in significant respects. This can lead to a different set of ergonomic risk exposures than would be faced by similarly-sized adults, yet equipment and work organization rarely make allowances for this effect. A second concern is that work-induced impairments to children may have long-lasting consequences due to their impact on further growth and development.

4. ***Sleep needs.*** Adolescents have different circadian patterns than adults, increasing their capacity for night activity but increasing the cost and physical difficulty of tasks scheduled in the morning. Nevertheless, agriculture in particular demands early morning work, and habitual loss of sleep may impair school performance.

5. ***Hormonal and neurological development.*** The sensitivity of children to chemical stressors can differ greatly from that of adults. While the literature on child and adolescent environmental health is enormous, one risk factor deserves special attention: lead. Relatively small lead exposures can have serious impacts on developmental outcomes, particularly generalized intelligence (IQ) and mood/personality. The toxicology of lead in children is well studied, due to the campaigns against leaded gasoline and paint that have been carried on in developed countries. For a comprehensive summary that focuses on occupational exposures, see Ide and Parker (2005), which reviews 41 prior studies.

Table 13 is taken from Ide and Parker, who summarize and interpret data from three earlier reports.

Table 13: Estimated impacts of lead exposure in child labourers

Activity	Source	Mean blood lead in µg/dl	Potential loss of IQ
Ceramic workers (Ecuador)	Harari and Cullen (1995)	70.2	17.6
Scavengers (Philippines)	Torres (1991)	28.4	7.1
Street vendors (Philippines)	Martins (1996)	17.8	4.5

Source: Ide and Parker (2005)

All three groups are at elevated risk of cognitive deficiency. This is most apparent with children who work directly with leaded compounds (ceramics), but it also appears in situations in which the exposure channels are not as directly evident.

Along similar lines, Nuwayhid et al. (2005) measured lead blood levels in 60 nonworking and 78 working boys ages 10-17 in Lebanon. The working sub sample, found in small urban workshops, had significantly higher lead accumulations. Taken together, the exposure evidence from these studies is slim but suggestive, particularly in light of the broader evidence from toxicology.

Lead is not the only potential neurotoxin, however. Saddik et al. (2005) examine children's exposure to solvents in a different sample drawn from Lebanon. They identified three groups of 100 boys: a subject group exposed to organic solvents at work and two control groups, non-exposed working children and nonworking school children. Exposures were attributable to metalworking and painting. The working control group was drawn from selected service industries, and the nonworking controls were drawn from the same neighbourhoods that supplied the working children.

All children were given a series of clinical, intelligence, emotional and dexterity tests, and the results were adjusted after controlling for a set of household and behavioural variables. The most salient results are given in Table 14.

Table 14: Test scores for exposed working, unexposed working and unexposed non-working Lebanese children

Test	Working exposed	Unexposed working	School children	p-value
Number of neurotoxic symptoms	6.8	1.3	1.2	<.001
Total Digit Span (IQ)	10.08	12.36	12.9	<.001
Time to insert 25 pegs (dominant hand)	85.76	70.58	71.31	<.001
Time to insert 25 pegs (non-dominant hand)	93.61	76.01	78.60	<.001
Mood state: not angry	74.55	84.42	88.58	.002
Mood state: not confused	76.93	88.18	91.29	.001
Draw-a-person test (total, extent of detail)	82.60	92.54	93.33	.189

Source: Saddik et al. (2005)

Draw-a-person is an intelligence test, as is Total Digit Span. The exposed children show elevated response in all four dimensions, generally at high statistical significance. The authors note that the children's sensitivity exceeds that found for adults in comparable studies, presumably because of their developmental status.

A more specialized, but highly consequential, risk is that of mercury exposure in the context of gold mining, since mercury is used to separate gold from the surrounding matrix. Bose-O'Reilly et al. (2008) performed clinical evaluations of three samples in Indonesia and Zimbabwe, children working in gold mines, nonworking children who live in gold mining districts, and controls who neither work nor live in contact with this industry. Table 15 reports their key findings. Physical measures show highly elevated exposures among children connected to gold mining, but the evidence of differential expression is less pronounced.

Table 15: Ratio of mean mercury exposures/expressions relative to controls, gold mining

Test	Nonworking children in vicinity	Child workers
Urine	17.6	81.6
Urine (creatinine)	26.2	104.3
Blood	1.9	4.2
Hair	1.8	3.3
Symptoms of Intoxication (Indonesia)	0	8%
Symptoms of Intoxication (Zimbabwe)	29%	55%

Source: Bose-O'Reilly et al. (2008)

The greater susceptibility of children to risk exposures is recognized in country labour codes adhering to ILO Convention No. 138; children beneath the age of 18 are prohibited from performing activities permitted to adults. Nevertheless, there are two broad problems. First, do these distinctions adequately address the differences in susceptibility and subsequent developmental impact? Much of the research discussed in the following pages is implicitly addressed to this question. Second, are hazardous work prohibitions adequately enforced? The latter is to a large extent a matter of monitoring, since much child labour occurs under the social and statistical radar. Runyan et al. (2007) show that this problem is endemic even in developed countries: 43.2% of girls and 51.9% of boys contacted in a telephone survey who had worked at least two months during the previous year had performed at least one task prohibited under the US Department of Labour's hazardous work orders.

In general, it can be said that there is widespread awareness that children differ from adults in many respects that bear upon the identification and assessment of risk exposures, but that research remains spotty and most exposures are undocumented.

2.2 Injuries

As Fassa (2003) reports, the most comprehensive data on child occupational injury rates, fatal and nonfatal, are collected in the United States. Her study offers a thorough review of this literature for the purpose of extrapolating incidence rates on a global level by industry and severity. We will return to her results shortly. Another major review of the US data was assembled by the National Academy of Sciences (1998); they examined 17 studies on nonfatal and 7 studies on fatal injuries in the course of proposing reforms to US child labour regulations. In this section we will briefly summarize the findings of these two overviews, extend coverage to the present by incorporating more recent research and identify sources for non-US data.

2.2.1 General incidence

The National Academy noted data from the US National Institute for Occupational Safety and Health covering the years 1990-92, which found that 16-17 year-olds faced a risk of fatal injury of 3.51 per 100,000 full-time worker equivalents (FTE's), compared to adult rates that range from 3.87 to 4.56 depending on age bracket. They point out that, given the restrictions on youth employment, these numbers suggest that young workers are likely to be at substantially greater risk controlling for differences in industrial and occupational composition. Indeed, as we will see in the case of agriculture, the failure to adhere to such restrictions, due to a regulatory loophole in the US, does substantially increase the risk faced by young workers. Even so, the picture for nonfatal injuries is even less favourable. The most recent evidence cited by the National Academy finds that 15-17 year olds face a general occupational injury rate of 4.9 per 100 FTE's, compared to an all-ages rate of 2.8.

More recent evidence, reported by NIOSH (2002), confirms the ratio of adolescent to adult fatal injuries, while NIOSH (2003) confirms the ratio for nonfatal injuries. The most recent data, presented in Windau and Meyer (2005) are for 1999-2003; they find a fatality rate of 3.1 per 100,000 FTE's for workers ages 15-17, compared to 4.2 for the entire working population. For nonfatal injuries treated in hospital emergency departments, NIOSH (2004) estimates an incidence rate of 5.2 per 100 FTE's for the age 15-17 bracket, compared to 3.0 overall.

Cumulative incidence is not reported by public sources in the US, but it appeared in a state-level study conducted by Dunn et al. (1998). They surveyed a representative sample of 562 teenagers, ages 14-17, in North Carolina, all of whom had worked either in paid employment or unpaid farm employment. 54% reported at least one injury on the job, of which 12% required a missed day of either work or school. Finally, White and O'Donnell (2000) surveyed 2725 students between the ages of 10 and 16 in Norfolk and North Tyneside, England in 1996 and 1998, finding that 10% of those working in the former town and 7% of those working in the latter had had an accident at work in the previous year that was serious enough to require medical treatment.

Unfortunately, quantitative evidence for developing countries is less comprehensive than it should be. Nuwayhid (2005), described previously, found that boys working in small industrial shops in Lebanon were far more likely to have been injured during the previous year than those in a control group. Graitcer and Lerer (2000) constructed a subject group of 78 Egyptian children 10-14 years old working full-time for pay outside the home and paired it with a control group of 103 nonworking children drawn from similar Cairo neighbourhoods. They found that 38.2% of the subject group had experienced at least one injury on the job during the previous year and assessed 40% of these episodes as "serious". Fentiman et al. (2001) describe injuries to bonded Ghanaian children in lake fishing as frequent and note the high rate of parasitism they endure.

By far the most extensive data on injury rates among young workers around the world can be found in the SIMPOC surveys administered with the assistance of IPEC. These vary greatly in the questions they ask, and for this reason it is not possible to cross-tabulate them. Table 16 provides brief summaries; note that the age range of children sampled in these surveys is generally lower than that used by statistical agencies in the US. Since the youngest children are generally given less risky activities to perform, a comparison between Table 16 and the NIOSH data cited above will understate the comparative disadvantage faced by children in developing countries.

Table 16: Incidence and severity of occupational injuries to child workers in selected SIMPOC surveys

Country	Survey	Injury/illness incidence for child workers	Severity (denominated by injured/ill children)
Bangladesh	2002/03 National Child Labour Survey	7.6%	Approximately 1% hospitalized
Belize	2001 Child Activity Survey	boys 17.6%, girls 11.2%, total 15.5	
Cambodia	1999 Socio-Economic Survey	47.1%	
Dominican Republic	2000 National Child Labour Survey	boys 13%, girls 10%, total 12%	
Ethiopia	2001 Stand Alone Child Labour Survey	6.6%	1.9% boys, 3.2% of girls, 2.4% total have ceased working permanently

Country	Survey	Injury/illness incidence for child workers	Severity (denominated by injured/ill children)
Ghana	1992/1993 Methodological Sample Survey on Child Labour	parents report: boys 32.7%, girls 25.7%, total 29.4% children report: boys 30.2%, girls 23.1%, total 27.2%	boys 4.9%, girls 4.1%, total 4.6% hospitalized; 0.3% ceased working permanently
Kenya	1998/99 Child Labour Module of the Integrated Labour Force Survey	10.3%	
Mongolia	2002/03 National Child Labour Survey	negligible	
Nicaragua	2000 Household Survey	Parents report: 10.2% Children report: 13.9%	
Panama	2000 Child Labour Survey	1.9% frequent injuries 4.4% occasional injuries 93.7% rare injuries	
Philippines	2001 Survey on Children	parents report: 11.5% children report: 23.4%	11.2% stopped working for 30 days or more
Sri Lanka	1999 Child Activity Survey	10.6%	8.6 % required hospitalization, negligible fraction permanently prevented from working
South Africa	1999 Survey of Activities of Young People	4.4% injury, 2.2% illness	
Ukraine	1999 Child Labour Survey	3%	

The variation in these reported numbers probably exceeds the actual differences in cross-country experiences and may be accounted for by differences in the wording of questions, sampling, or the selection of denominators in published reports. Further research to control for these factors and circumscribe the actual range of variation is called for.

2.2.2 Severity

NIOSH in the US reports data on the total number of injuries to teenagers and the number involving particular impairments, economic outcomes or treatments, but it is doubtful that reliable incidence ratios can be constructed for different severities of injury. The reason is that, the more severe an injury, the more likely it is to be counted. Thus, severity ratios calculated from published data are likely to be overstated. With this in mind, we note that NIOSH (2002) estimates that a third of all occupational injuries, including those to teenagers, are treated in hospital emergency rooms, and that somewhat less than 10% resulted in lost days of work or schooling. For those young workers who missed work, the mean number of days missed was four, but NIOSH cautions that this statistic may have different implications for part-time than full-time workers, since part-time workers can recover during the gaps in their schedule—and in the US most young workers are employed on a part-time basis.

State-level data add to this picture. Ehrlich et al. (2004) reviewed West Virginia Workers Compensation claims from 1996-2000 to determine the percentage of claims requiring surgery. Using an age cut-off of 19 and under to designate youth, they found that 2.4% of young male claimants and 1.1% of young females required surgery, compared to 6.1% of older males and 6.4% of older females. These numbers are not controlled for industrial or occupational composition of work, however. Cooper et al. (1999) examined Texas Workers Compensation claims for workers ages 14-17 over the period 1991-96 and found that 21.7% were able to demonstrate they had been out of work for more than seven calendar days. An alarming 3.4% were judged by a physician to have suffered a permanent impairment.

Severity data for developing countries, drawn from SIMPOC surveys, can be found in the fourth column of Table 15.

2.2.3 Industrial and occupational factors

Fassa (2003) provides the best-available analysis of US data for the purpose of estimating the distribution of injuries across major industries. Table 17 reproduces her Table 41, fatal injury rates by industry, compiled from three studies published during the 1990s.

Table 17: Fatal injury rates per 100,000 FTE's by Major Industry, US

Major industry division	Age	Fatality Rate
Agriculture	5-14	13.7
Agriculture	15-17	16.8
Mining	5-17	32
Construction	5-17	15
Manufacturing	5-17	4
Services	5-17	3
Retail	5-17	3

Source: Fassa (2003)

Mining is by far the most hazardous sector for children with respect to fatal injuries, but agriculture, which accounts for most employment worldwide, equals construction as the second most-deadly. Manufacturing is hardly more dangerous than services and retail in this respect.

Fassa also reviewed 21 studies on nonfatal injuries, five from outside the US. From these she constructed summary indices of frequency and severity across major industries. Her metric for severity is the Disability Adjusted Life Year (DALY), as documented in World Health Organization (2001). The DALY combines two measures of the burden of injury and disease, Years of Life Lost (YLL) and Years of Life with Disability (YLD). YLL is the expected number of life years lost due to premature death. YLD is the expected number of years lived with a particular disability, times the proportion of functionality lost due to the disability, where complete loss of functionality would be equivalent to death. Functionality ratios are determined through clinical studies, unlike the subjective data employed by a different measure, the World Bank's Quality Adjusted Life Year (QALY). Fassa constructed estimates of mean YLD per injury for each industry based on studies of the relative frequency of various impairments and the average YLD's associated with each impairment. Table 18 reproduces Fassa's Table 58, giving estimated nonfatal injury rates, average YLD per injury and YLD incidence rates by major industry.

Table 18: Nonfatal injury rates, YLD per injury, and YLD rates per 100 FTE's

Major industry and age	Nonfatal injury rate	YLD per injury	YLD rate
Agriculture			
5 to 14 years-old	4.3	0.18	0.77
15 to 17 years-old	4.3	0.18	0.76
Mining			
5 to 14 years-old	8.2	0.18	1.47
15 to 17 years-old	8.2	0.18	1.45
Construction			
5 to 14 years-old	4.8	0.17	0.83
15 to 17 years-old	4.8	0.17	0.81
Manufacturing			

Major industry and age	Nonfatal injury rate	YLD per injury	YLD rate
5 to 14 years-old	5.1	0.05	0.27
15 to 17 years-old	5.1	0.05	0.28
Service			
5 to 14 years-old	4.1	0.04	0.15
15 to 17 years-old	4.1	0.04	0.16
Retail			
5 to 14 years-old	6.3	0.06	0.36
15 to 17 years-old	6.3	0.06	0.38

Source: Fassa (2003)

Mining remains the most hazardous major industry according to the risk of nonfatal injury. From the standpoint of incidence alone, leaving aside severity, the retail sector is second, and agriculture has an even lower frequency. On the other hand, average severity is about the same for agriculture, mining and construction, far greater than for the other sectors. The composite index, YLD per 100 FTE's, still puts mining in first place, followed by construction and agriculture. Meanwhile, no clear pattern establishes itself with respect to age: average severity, as measured by YLD per injury, cannot be distinguished at two significant digits. Care should be taken in interpreting this evidence, since the categories are extremely broad and undoubtedly conceal many important hotspots within major industries. Also, they do not distinguish by gender, and boys and girls may differ greatly in the tasks they perform and the risks they are subject to.

Finally, Fassa combined YLL and YLD into a full measure of DALY's per 100 FTE. Table 19 is taken from her Table 62.

Table 19: DALY's per 100 FTE by Major Industry for children ages 5-17

Agriculture	1.5
Mining	2.6
Construction	1.4
Manufacturing	0.4
Services	0.3
Retail	0.5
Total	1.0

Source: Fassa (2003)

To put this into perspective, Fassa estimates that the unconditionally worst forms of child labour for which hazard data are available—trafficked and bonded labour, child soldiering and prostitution—average 2.7 DALY's per 100 FTE each. This is about equivalent to mining and less than twice as hazardous as agriculture. Given that the major industry averages group together less- and more-hazardous activities within each broadly-defined sector, it is evident that "ordinary" dangerous work and unconditionally worst forms overlap in their measurable health impacts. As for the industry averages themselves, three tiers present themselves: mining as the most hazardous, agriculture and construction at a lesser level of risk, and manufacturing, services and retail at the lowest level. Once again, however, it is important to emphasize that these are very broad averages and should not be used to assess the riskiness of industries at a more detailed level.

Table 18 is based on a composite of studies, evaluated for their methodology. It is important to note that studies based solely on data from workers compensation systems will produce lower incidence estimates, since only a fraction of injuries are claimed under WC, and the corresponding rate for adolescents may be even lower. (Brooks and Davis, 1996; Fingar et al., 1992) For instance, Table 20 is taken from Simoyi et al. (1998), compiled from 1995 WC records for 16-19 year olds in West Virginia.

Table 20: Incidence of non-fatal injuries per 100 FTE's by Major Industry for 16-19 year olds, W. Virginia

	Males	Females
Construction	2.0	0.8
Manufacturing	2.2	0.5
Transportation and public utilities	0.8	0.9
Wholesale and retail	0.9	0.4
Service	4.6	3.9

Source: Simoyi et al. (1998)

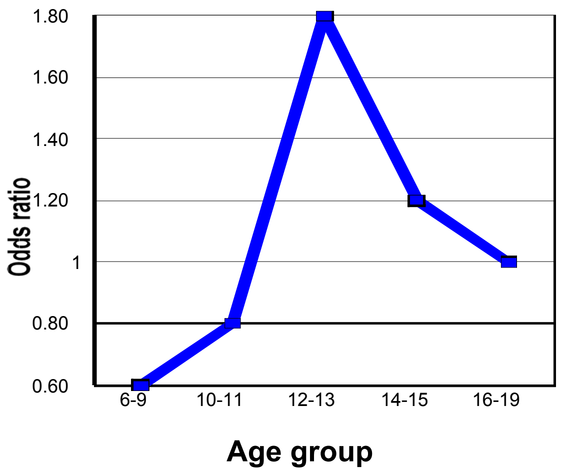
Despite the overall differences between these incidence rates and those reported in Table 18, certain useful patterns emerge. In this sample, young women face less risk than young men, even holding constant major industry. This is particularly striking in construction and manufacturing, and it suggests that a gendered division of labour may be responsible. As for the prominence of services, the authors note that cleaning and restaurant work appear to be major sources of risk. The nonfatal injury rate in services is loosely corroborated by Mardis and Pratt (2003), although they find a substantially higher rate in retail, using data from a network of hospital emergency departments across the US. (They also employed a 15-17 year old age bracket.)

It should be noted that the principle data sources in the US for fatal and nonfatal injuries, NIOSH's CFOI (Census on Fatal Occupational Injuries) and SOII (Survey of Occupational Injuries and Illnesses) and OSHA's Injury, Illness and Fatality (IIF) database, continue to be updated, but calculating incidence rates is not transparent, since denominators are not published.

Extrapolating from US data to the rest of the world is problematic in general, but may be particularly questionable in the case of agriculture. This topic is of great importance in light of the preponderant role of agriculture in global child labour. The main reason for doubt is that agriculture is far more mechanized in the US and other industrialized countries than it is generally. How important are equipment-related risks to children in the US and similar countries, and what quantitative evidence is available for the developing world?

First, the fatal risk in agriculture for young works, ages 15-19, is about 60% of the adult risk in that industry and almost eight times the fatal risk for non-agricultural work among youth. (Castillo et al., 1999; Lee et al., 2007) The available evidence indicates that the greatest risk factor for serious injury is mechanized equipment, particularly tractors. For instance, after reviewing the literature, the National Academy of Sciences (1998) concludes: "Studies show that the most common agents of minor injury to children are animals and falls, while the most common agents of serious injury are tractors and moving machinery." (p. 153) In more recent studies, Mason and Earle-Richardson (2002) find that tractors accounted for most of child agricultural fatalities in New York State during the period 1992-98, and Maiers and Baerg (2003) find similar results for Saskatchewan. Both studies, however, find that animal contact was responsible for a large share of nonfatal injuries, and the New York data show that children suffer disproportionately from this risk factor. Further evidence on the risks child workers face from larger animals is provided by Hendricks and Adekoya (2001), who drew on a survey of 26,000 US family farms in 1998. It is worth bearing in mind that, even using a rather inclusive definition of accident, these authors found that the incidence rate among workers under the age of 20 was .32%; on the other hand, eight years of such labour would generate a cumulative risk of just over 2.5%. Pesticide poisoning is another problem in US agriculture. Calvert et al. (2003) analyzed national and state-level databases representing all but four states and found, for workers under 18 years of age, that the rate of acute pesticide poisoning is .034% on an FTE (2000 hours) basis. To minimize hazards from machines, animals and chemicals, the US Department of Agriculture promulgates a list of age-appropriate activities, although these are not mandatory for family farms. Based on a sample of 425 children who had experienced injuries while working in agriculture, as well as 1886 who had done similar work without injury, Larson-Bright et al. (2007) found that adherence to these guidelines substantially reduces risk, demonstrating that the task content of child agricultural work plays an important role. Overall, task content interacts with age to determine the total risk. This explains the inverted-V shape age-risk relationship reported by these authors and depicted in Figure 5: the youngest children are presumably engaged in the safest tasks, but the tendency to assign riskier tasks to children as they mature appears to outstrip their age-related ability to avoid injury.

Figure 5: Odds ratio for injury in US agricultural work



Ages 16-19 is the reference group. Source: Larson-Bright et al. (2007)

The best available general survey of child injury rates in agriculture in a developing country is the Philippine Survey of Children, administered in 1995 and 2001 with the assistance of SIMPOC and summarized in Castro et al. (2005). Data are based on a nationally representative sample that includes 6351 working children between the ages of 5 and 17. While the self-reported character of this survey excludes fatal injuries, nonfatal risk is well documented. Based on child labour headcount and hours information, the authors found that the nonfatal injury incidence rates per 100 FTE for 2001 were 160 for agriculture and 34 for all non-agricultural activities taken together. As large as these figures are, the authors caution that they may be biased downward, since the measure of work hours in the survey is biased upward due to category averaging. While the severity of these incidents is not reported, their sheer frequency is cause for concern.

2.3 Child work and health status

2.3.1 Simple correlation between work and health

It would be interesting if a general relationship between health and child labour could be established. O'Donnell et al. (2002) are correct to point out, however, that there is no pattern across countries in the raw correlation between whether a child works and whether he/she reports health problems. In some there is a positive relationship, in others it is negative. This can be attributed in the first instance to the healthy worker effect, discussed above, but it also stems from the wide variety of tasks children perform, as well as the differences in environment and socioeconomic context. Only more targeted studies would be expected to find consistently positive results.

2.3.2 Biometrics

Two general measures have been of interest to researchers, height and body mass index (BMI), with both positively associated with health. The precise parameters—urban/rural environment, work activities, ages—vary from one study to the next, so it is not possible to tabulate them. Here are brief summaries, focusing on the biometric aspects:

Ambadekar et al. (1999), India: Data were collected in two low income neighbourhoods in Nagpur, generating two groups of 223 children each, a subject group working for pay outside the home and a control group not engaged in this sort of labour. All children were under 15; subject and control groups were matched according to age distribution and gender. There were no significant differences in height or weight across the two groups among girls, but working boys were both shorter and of lower weight. These differences became statistically significant (at a $p < .05$ level) at ages 14 and 12 respectively. Over the entire range of ages represented in the study there was no consistent difference in the caloric intake between subjects and controls.

Graitcer and Lerer (2000), Egypt: As described previously, this study examined 78 children working in small enterprises in Cairo, along with a control group of 100 school children from the same neighbourhoods. All children were in the 10-14 age range. They found no significant difference in either height or weight measures, nor in a range of other health indicators (including back and joint pain).

Yamanaka and Ashworth (2002), Nepal: 237 boys and girls were observed continuously between 7 am and 7 pm in highland and lowland agricultural villages in March 1998. On average girls engaged in 1.5 hours per day of heavy work, boys 40 min. Although low weight and height are commonplace in these populations, no correlation was observed between the amount of time spent in heavy work and these indicators. Diet was assessed not to be a confounding factor.

Hawamdeh and Spencer (2002), Jordan: 103 working boys were compared with their nonworking male siblings. Simple comparisons between sample means showed a significantly negative effect of work on both height and weight, but no controls for other factors were introduced.

Hawamdeh and Spencer (2003), Jordan: This second study, also of Jordanian boys, utilized a subject group of 135 and a control group of 405. The subjects were working (in an SNA sense) in either urban (81%) or rural (19%) environments. Statistical controls were employed for various household and parental characteristics, and also for whether or not the children were smokers, but there was no control for the healthy worker effect. Work was found to have a significantly negative effect on height, but the adjusted R^2 of the regression was only .098.

Izzet and Őzener (2005), Turkey: Teenagers in an apprenticeship program were compared with school-attending controls having the same socioeconomic status. The working teens had lower weight- and height-to-age ratios, although nutritional differences were apparently the explanatory factor. The study did not control for the selection of children into the apprenticeship program.

Kishk et al. (2004), Egypt: 72 children working primarily in brick-making in a single village were given clinical examinations. Stunting was common, but there was no control group.

O'Donnell et al. (2005), Vietnam: These authors analyzed the 1992/3 and 1997/8 Vietnam Living Standards Surveys, which included work, health and biometric data. They controlled for household and community-level factors and utilized the two waves of the survey to control, at least partially, for the healthy worker effect. They found no contemporaneous or delayed relationship between work and either weight or height.

Nuwayhid et al. (2005), Lebanon: This study, previously described, paired 78 working and 60 nonworking boys. Using a small set of statistical controls, they did not find a significant difference in height and weight measures.

Beegle et al. (2005), Vietnam: This was a re-analysis of the data employed in O'Donnell et al (2005). A shorter reference period for determining child work was utilized, which also permitted measurement of work hours, and the sample was restricted to children who were in school during the first wave of the survey. As before, however, biometric indicators did not register a significant difference between working and nonworking children.

Cortez et al. (2007), Brazil: 2063 adults between the ages of 23-25 living in Ribeirao Preto were surveyed. They were divided into three groups depending on the age at which they had begun working, with the youngest bracket being less than 14. There was a raw negative correlation between sorting into this group and height, but this relationship did not survive a regression controlling for demographic, household and behavioural variables. The sample size had sufficient power to test for a height difference of 2 cm at .05 alpha and .20 beta. Drawbacks include no control for parental height and the predominance of service work (90%) in employment.

The general conclusion to be drawn in that child labour seldom registers in biometric measures, which are better suited to capturing the effects of nutritional disparities.

2.3.3 Child labour and general health status

There are two general strategies that can be employed to ascertain whether there is an overall relationship between child labour and health, self-report and clinical evaluation. The following studies use both methods, and all attempt in some fashion to control for confounding variables.

Graitcer and Lerer (2000), Lebanon: Once again, this is a study of a paired subject and control group. Based on clinical evaluation, self report and school records, no significant difference was found for any health-related outcome.

Kassouf et al. (2001), Brazil: A sample of 4840 adults was drawn from the 1996/1997 Pesquisa de Padrões de Vida covering two regions. The mutual effects of early entry into the labour force, education and health were controlled sequentially; limited household controls were also employed. Income plays a mediating role between child labour and subsequent health, but the direct effect of early work is stronger in this study. There is no control for the endogeneity of child labour, however.

Francavilla and Lyon (2003), six countries: Household surveys for Brazil, Guatemala, Guinea, Kazakhstan, Peru, and Gambia were reviewed for potential relationships between the extent of household work and two measures of health status, body mass index and the incidence of illness in the week prior to the survey. No such relationships were found, but only descriptive statistics were employed.

Guarcello et al. (2004), three countries: These authors examine household survey data from Bangladesh, Brazil and Cambodia to determine the role played by work hours in conjunction with gender, industry and other factors. A particularly useful cross tabulation is presented in Table 21, which is Table 4 of their report. Work in this context is defined as falling within the SNA boundary; the reference period was one week prior to the survey date.

Table 21: Reported work-related ill-health by average weekly work hours, age, sex, sector and modality

		Bangladesh					Brazil					Cambodia				
		Average weekly hours					Average weekly hours					Average weekly hours				
		1-10	11-20	21-30	31-40	40+	1-10	11-20	21-30	31-40	40+	1-10	11-20	21-30	31-40	40+
Sex	M	10.6	4.2	7	11.6	15.5	3.1	7.3	8.5	7.5	7.7	42.0	43.4	51.9	63.7	54.4
	F	4.6	1.2	3.2	3.4	10.6	2.3	6.7	3.7	4.8	4.2	38.1	38.7	54.2	52.3	52.8
Age	5-9	10.4	14.8	9.5	13.2	15.1	3.3	8.1	4.9	6.2	9.0	39.5	34.5	58.4	74.8	53.2
	10-14	7.6	2.3	5.5	8.7	15	3.2	8.6	7.4	5.6	4.8	41.9	41.5	49.3	56.4	48.2
	15-17	7.5	5.9	6.2	11.3	15.1	2.0	5.2	6.8	6.9	6.6	36.0	45.4	55.9	56.8	56.0
	5-14	8.7	2.7	5.7	8.9	15	3.2	8.5	7.2	5.6	5.1	40.8	39.5	51.4	59.9	49.0
	5-17	8.4	3.1	5.9	10.3	15.1	2.8	7.1	6.9	6.6	6.2	40.2	41.0	53.0	58.4	53.6
Sector	Agriculture	8.4	3.2	6.2	13.5	13.2	3.3	9.1	10.2	10.3	11.2	42.9	42.5	56.9	62.9	57.5
	Commerce	6.6	1.5	3.6	3.7	11.3	0.4	3.4	3.0	4.0	3.8	30.8	33.0	38.9	49.3	38.1
	Services	9.2	5.0	2.2	7.6	12.8	3.9	3.6	4.5	4.7	5.5	20.4	42.4	54.3	37.3	41.4
	Manufacturing	10.5	2.3	5.0	8.4	16.5	2.1	8.6	5.0	5.9	10.1	43.4	47.1	28.4	40.5	53.6
	Other	8.7	7.8	10.6	9.3	20.1	2.7	4.0	4.5	4.4	5.6	39.0	38.5	45.2	51.9	60.4
Modality	Family	8.0	1.4	4.8	10.2	8.1	2.5	8.3	8.0	9.1	11.9	39.2	41.1	53.2	60.9	52.1
	Non-family	9.8	11.6	7.4	10.3	16.6	3.5	4.2	5.5	5.6	6.3	47.5	39.4	50.1	46.8	56.1
Total		8.4	3.1	5.9	10.3	15.1	2.8	7.1	6.9	6.6	6.2	40.2	41.0	53.0	58.4	53.6

Source: Guarcello et al. (2004)

National differences, particularly between Cambodia and the other two countries, are pronounced. A linear relationship between hours per week and ill-health does not appear for any segment in this table, much less an observable threshold effect. Boys generally report greater health difficulties than girls, and lower age brackets more than upper ones. The gender effect also survives controls for industry of employment and rural/urban location (not shown). Agriculture, in keeping with the evidence presented earlier regarding its objective health risk, tends to overshadow other sectors in its apparent contribution to ill-health. Finally, while there is evidence that working unpaid within the family poses a smaller health risk in Bangladesh, this relationship does not hold in the other two countries. The authors went on to estimate functional relationships from the data underlying Table 20, finding that the general patterns seen above still hold.

Fassa et al. (2005), Brazil: These authors queried a sample of over 3000 children from a low-income region for muscular-skeletal pain in general and back pain in particular. These children, whose average age was 13 and who were approximately half male and half female, reported substantially higher pain incidence if they were working in manufacturing and domestic service. Even after controlling for other risk factors, such as participation in sports and the nature of household chores, children in manufacturing had a 31% increased prevalence ratio compared to nonworking children; the corresponding figure for those in domestic service was 17%. Both differences were statistically significant. Construction was not significant, and the authors attribute this to a paucity of observations.

Nuwayhid et al. (2005), Lebanon: Nine self-reported health complaints were compared across subject and control groups, of which three proved statistically significant, indicating poorer health for the working children.

O'Donnell et al. (2005), Vietnam: Greater incidence of illness at the time of the second wave of the survey is associated with having worked during the first wave; this result survives a wide variety of econometric specifications.

Beegle et al. (2005), Vietnam: No relationship is found between earlier child labour and subsequent health. This difference from O'Donnell et al. is attributed by the authors to their decision to restrict their sample to school-attending children, since it is possible that differences in health outcomes could be due to school attendance rather than work.

Carusi-Machado et al. (2005), Brazil: This study uses the same survey employed in Kassouf et al. (2001), but it looks at the contemporaneous rather than lagged effect of child labour. A sample of 3087 children ages 7-14 was drawn and a binary variable for health status was constructed from a survey question asking respondents to identify their health as excellent, very good, good, average, poor, no opinion, don't know, or no answer, with excellent assigned a value of 1 and all other answers 0. Similarly, school attendance and work (seven-day reference period) were also binary assignments. A three-equation model was estimated; the authors found that errors were correlated between the work and school and work and health equations, but not between health and education. Controlling for the positive joint determination of work and health status, working has a negatively significant impact on health, equal to the effect of reporting the presence of a chronic disease.

Guiffrida et al. (2005), Brazil: The 1998 national household survey (PNAD), with a sample of 82,504 women and 77,789 men, was employed to test the two-way relationship between income and health. Four measures of health were utilized: a general self-report, the number of chronic diseases, the presence of functional disabilities, and whether the respondent was unable to perform her or his habitual activity during previous two weeks due to health reasons. Child labour was entered as a binary variable, depending on whether the respondent had entered the labour force at age nine or earlier. Simultaneous equations were used to control for interaction between health and income but not child labour. Under these conditions, the child labour dummy had a negative and significant impact on health in for both male and female samples estimated separately; its effect exceeded that of current unemployment, for instance.

Rosati and Straub (2006), Guatemala: Subject and control groups were siblings drawn from the National Survey on Living Conditions (2000), yielding 3409 observations in 1396 households. Health and child labour were both entered as binary variables, with health being bad/not bad and individuals having entered the labour force prior/not prior to age 15. The dependent variable was differences in within-household health status, so household factors could be assumed to be held constant. The result was that siblings who had started work earlier faced a 40% greater likelihood of subsequent health problems. The authors point out that this can be considered a lower bound, since it doesn't control for the healthy worker effect.

Lee and Orazem (2007), Brazil: This study provides a more elaborate re-analysis of the data used in Guiffrida et al. (2005). Due to the use of more controls, more observations had to be eliminated due to missing observations, resulting in samples of 39,884 men and 28,043 women. The coefficients on child labour in simple probit regressions treating education and age of entry into paid work as exogenous are reported in Table 22.

Table 22: Probit estimates of the effect of early entry in the labour force on subsequent health outcomes, Brazil

Dependent variable	back problems	arthritis	hyper-tension	problem raising object	problem to climb stairs	problem walking 1 km
coefficient on entry to work	-.0067***	-.0040***	-.0019***	-.0030***	-.0014***	-.0011***
dependent variable	cancer	diabetes	asthma	problem to push/carry	heart disease	kidney disease
coefficient on entry to work	<-.0001	-.0001	-.0003*	-.0005***	-.0008***	-.0018***
dependent variable	depression	problem to bend down	tuberculosis	tendonitis	cirrhosis	problem walking 100m
coefficient on entry to work	-.0022***	-.0017***	<.0001	-.0003**	<.0001	-.0001***

Asterisks denote significance levels of $p < .01$ (***), $p < .05$ (**), $p < .10$ (*)
Source: Lee and Orazem (2007)

The coefficients in this table can be interpreted as marginal probabilities; thus entering the labour force a year earlier would be associated with approximately .7% greater likelihood of developing back problems later in life. These results are suggestive and roughly consistent with expectations. Thus, diseases that have long latency (cancer) or no plausible connection to early work (diabetes, cirrhosis) show no relationship, while physical impairments and diseases of stress exhibit a role for child labour.

The authors then instrumented for school attendance and age of entry into the labour force. Re-estimating these equations with the instruments eliminated statistical significance in every health equation. This damping effect might be viewed as exaggerated, however, for two reasons. First, the explanatory power of the first-stage equations was relatively low: .080 for age of beginning work and .134 for schooling. Second, the instrument for early entry into the labour force was the relative wage of unskilled labour in the respondent's state at the time of the work decision, but this combines both income and substitution effects. In general terms, it would be reasonable to suppose that the best estimates of the child labour/health relationships would be weaker than those reported in Table 20 but stronger than the results obtained with the authors' instrumented variables.

Wolff and Maliki (2008), Indonesia: Data from two surveys, one on households, the other on school facilities, were combined for the years 1993, 1996 and 2000, producing a total of 289,554 observations on children ages 10-15. The health portion of the household survey contained questions on child work, defined as paid or unpaid market activity for at least one hour per week, and several measures of general health status, including problems of coughing, fever, other diseases and the disruption of normal activity. The likelihood of reporting one of these health concerns increases for child labourers in a simple regression that controls for other child and family characteristics. The authors proceed to instrument for participation in child labour, finding that the effect on health rises substantially, with most of the impact on boys rather than girls. The authors admit they harbour doubts about whether their instruments, the adult unemployment rate and the adequacy of local school facilities, are truly unrelated to children's health, however.

2.4 Psychosocial outcomes

One of the longstanding concerns about child labour is that it could interfere with the process of psychological and social development, but it is only in recent years that researchers have attempted to put this hypothesis to an empirical test (Woodhead, 2004). The evidence remains sparse, but enough is known at this point to indicate that such concerns are justified.

In a recent study of child labourers in Ethiopia, Fekadu et al. (2006) administered the Diagnostic Interview for Children and Adolescents to a randomly constructed sample of 528 children between the ages of 5 and 15 employed as domestics, street-workers or in other paid tasks, along with 472 controls—children of similar ages and social condition but not economically active. The condition of the working children was relatively dire: over half work for more than eight hours per day, while a third are ten years old or younger. The interview tool scores respondents with respect to a large number of potential symptoms, such as disruptive behaviour disorder, mood disorders, anxiety disorders, separation anxiety disorder, elimination disorders, substance abuse, and psychosocial stressors. The authors performed logistic regressions on each of these outcomes, using as control variables a set of demographic and family health characteristics and found that in most instances being a child labourer was the only significant predictor. The odds ratio of child labourers to controls for a composite adverse diagnosis was 5.9, significant at $p <.002$. It would be helpful to have replications of this study in different countries and with different intensities of child labour, especially if they also incorporate more controls for factors that could cause mental health problems and are potentially correlated with selection into work, such as family income.

Among the many psychological risks faced by working children, one of the most troubling is their potential susceptibility to abuse, from both employers and older co-workers. This abuse can take many forms, but sexual and physical abuses are paramount concerns. Hadi (2000) randomly selected 4643 children ages 5-15 in 150 Bangladeshi villages for interviews, just over a fifth of whom were working, where work was defined as being engaged in SNA activity for at least four hours per day. It was discovered that approximately 12% of all the working children had reported being beaten at work, with “beating” taking the form of at least a slap. Even more disturbing is the evidence presented in Gharaibeh and Hoeman (2003). 41 boys ages 11-16 and working as mechanics in Irbid, Jordan were selected non-randomly and asked about their treatment at work. 25 (61%) reported physical abuse and 8 (27%) reported sexual abuse; in nearly every instance the culprits were older boys from the same or neighbouring workshops.

Finally, Doocy et al. (2007) conducted a comprehensive study of Nepalese child porters, using a sample of 249 such children and 262 controls. Portering is demanding work; the child porters described carrying loads averaging 47.5 kg, and their body mass index was significantly lower and presence of anaemia significantly higher than the controls. The authors point out that the sample selection strategy would not pick cases of death, serious disability or injury leading to a cessation of employment among the child porters, so the risks faced by this population may be underestimated. Table 23 reports the odds ratios faced by the porters relative to the controls for a variety of outcomes after adjusting for age and gender.

Table 23: Odds ratios, child porters to controls, adjusted for age and gender (Nepal)

	Adjusted odds ratio	*p*-value
Smoking	1.95	.15
Drug use (uncommon)	7.08	.11
Alcohol consumption	2.42	<.01
Felt alone in past year	1.89	<.01
Mentally stressed or tormented in last year	2.29	<.01
Physically assaulted in the past year	1.39	.21
Sexually assaulted in the past year	3.07	.05

Source: Doocy et al. (2007)

Again sexual assault appears as a significant risk of child labour, along with general emotional distress and early consumption of alcohol. It should be noted, however, that, despite sampling intentions, porters and controls differed greatly according to age, gender, caste, nutrition and education, and that it is unlikely that statistical methods would fully control for these differences. In addition, the study did not collect data on the financial conditions of porter and control households. Nevertheless, the composite picture is suggestive of the sort of psychosocial impairments that critics of child labour have long suspected.

2.5 Summary

A large proportion of the studies reviewed pursue a generalized relationship between "child labour" and "health", but not much can be asserted at this level. Child injury rates appear to be as high or higher than adults', but their severity, as measured by fatalities or the need for surgery, is lower on average. Biometric evidence, as well as evidence from studies of concurrent or subsequent general health, is mixed.

Fortunately, many researchers are assembling more targeted data on specific child work activities and health outcomes. If there is any methodological conclusion to be drawn, it is that research should focus on symptoms linked to particular stressors, such as those identified in Fassa (2005) or Lee and Orazem (2007). This can be expected to yield results that will, over time, yield child labour boundaries consistent with Convention 182.

Valuable research is being to accumulate in some of the more visible domains of child labour, like street work and small workshops, but perhaps the highest priority should be given to agriculture, which accounts for about 70% of all child labour worldwide. The broad evidence suggests that children are steered into this work by family circumstance, not its suitability for health and subsequent development. Moreover, the literature, while sparse, does not at this time point to any particular health advantage associated with unpaid agricultural work or agricultural work within the household. It appears that the main risk factors for serious injury in developed countries, tractors and similar equipment, are not operative in most developing country contexts, but other risk factors, such as work with large animals, are more likely to be shared. It is also possible that pesticide exposure might be higher in the developing world, for which the long-term health outcomes would be severe, albeit more resistant to measurement.

Much progress could be made by linking child labour health research to a broader agenda in adult occupational safety and health. As noted above, while adult occupations have been studied in great detail in developed countries, corresponding data are limited for the rest of the world. This is probably due to the tendency of development economists and other specialists to overlook the contribution of health to economic outcomes except in a few prominent areas. With a broader outlook on human capital factors, research into work and health should be intensified, and our understanding of the health consequences of children's work should benefit correspondingly.

A related initiative would be more focused research into the differences between child and adult exposure-response relationships, particularly in work activities of greatest importance in developing country households and labour markets. With this information we could arrive at more appropriate child labour boundaries by adjusting from the knowledge base established for adults. At present we can make only rough estimates: hazardous work for children encompasses hazardous work for adults, plus those activities where psychosocial, neurotoxicological and ergonomic differences are most salient.

Conclusion

Child labour is increasingly being viewed as, above all, a human capital problem, measurable by its impacts on education and health. The most recent decade of evidence corroborates this perspective and provides ample basis for taking action to reduce harmful impacts. Nevertheless, much work remains to be done to link specific outcomes to particular types of work, at particular intensities, for children of particular ages, gender and socioeconomic circumstances. This review has attempted to locate the current research envelope and to suggest, on this basis, directions for further empirical work that can be expected to have the greatest impact.

References

Abler, David, José Rodríguez and Héctor Robles. 1998. *The Allocation of Children's Time in Mexico and Peru*. Presentation Paper CIES 98 Conference, Buffalo.

Admassie, Assefa. 2002. *Allocation of Children's Time Endowment between Schooling and Work in Rural Ethiopia.* Center for Development Research Discussion Paper on Development Policy No. 44. Addis Ababa: Ethiopian Economic Policy Research Institute.

Akabayashi, H. and G. Psacharopoulos. 1999. The Trade-Off Between Child Labour and Human Capital Formation: a Tanzanian Case Study. *Journal of Development Studies.* 35(5): 120-140.

Alcázar, Lorena, Silvio Rendón and Erik Wachtenheim. 2002. *Working and Studying in Rural Latin America: Critical Decisions of Adolescence*. Inter-American Development Bank Latin American Research Network Working Paper #R-469.

Ambadekar, NN, SN Wahab, SP Zodpey and DW Khandait. 1999. Effect of Child Labour on Growth of Children. *Public Health*. 113(6): 303-06.

Assaad, Ragui, Deborah Levison and Nadia Zibani. 2003. *The Effect of Child Work on Schooling in Egypt*. Manuscript, University of Minnesota.

Bando G., Rosangela, Luis F. Lopez-Calva and Harry Anthony Patrinos. 2005. *Child Labor, School Attendance, and Indigenous Households: Evidence from Mexico*. World Bank Policy Research Working Paper 3487.

Beegle, Kathleen, Rajeev Dehejia and Roberta Gatti. 2005. *Why Should We Care about Child Labor? The Education, Labor Market, and Health Consequences of Child Labor*. World Bank Policy Research Working Paper No. 3479.

Bezerra, Márcio Eduardo G., Ana Lúcia Kassouf and Mary Arends-Kuenning. 2007. *The Impact of Child Labor and School Quality on Academic Achievement in Brazil*. Presentation Paper Universidad Iberoamericana, Mexico City.

Binder, Melissa and David Scrogin. 1999. Labor Force Participation and Household Work of Urban Schoolchildren in Mexico: Characteristics and Consequences. *Economic Development and Cultural Change.* 48(1): 123-154.

Boozer, Michael A. and Tavneet K. Suri. 2001. *Child Labor and Schooling Decisions in Ghana*. Unpublished manuscript.

Bose-O'Reilly, Stephan, Beate Lettmeier, Raffaella Matteucci Gothe, Christian Beinhoff, Uwe Siebert and Gustav Drasch. 2008. Mercury as a Serious Health Hazard for Children in Gold Mining Areas. *Environmental Research.* 107: 89–97.

Brooks, D. R. and L. K. Davis. 1996. Work-Related Injuries to Massachusetts Teens, 1987-90. *American Journal of Industrial Medicine.* 29: 153-60.

Calvert, Geoffrey M., Louise N. Mehler, Rachel Rosales, Lynden Baum, Catherine Thomsen, Dorilee Male, Omar Shafey, Rupali Das, Michelle Lackovic and Ernest Arvizu. 2003. Acute

Pesticide-Related Illnesses Among Working Youths, 1988–1999. *American Journal of Public Health.* 93(4): 605-10.

Canagarajah, Sudharshan and Helena Skyt Nielsen. 1999. *Child Labor and Schooling in Africa: A Comparative Study*. World Bank Social Protection Discussion Paper No. 9916.

Canals-Cerdá, José and Cristóbal Ridao-Cano. 2003. *The Dynamics of School and Work in Rural Bangladesh*. Unpublished manuscript.

Cardoso, Ana Rute and Dorte Verner. 2006. *School Drop-Out and Push-Out Factors in Brazil: The Role of Early Parenthood, Child Labor, and Poverty*. Institute for the Study of Labor Discussion Paper No. 2515.

Carusi-Machado, Danielle, Jack Huguenin and Carine Milcent. 2005. *Children in Brazil: Health, Education and Work*. Proceedings of the 33rd Brazilian Economics Meeting.

Castillo, Dawn, Nelson Adekoya and John R. Myers. 1999. Fatal Work-Related Injuries in the Agricultural Production and Services Sectors Among Youth in the United States, 1992-96. *Journal of Agromedicine*. 6(3): 27-41.

Castro, Charita L., Sarah Gormly and Amy R. Ritualo. 2005. The SIMPOC Philippine Survey of Children 2001: A Data Source for Analyzing Occupational Injuries to Children. *Public Health Reports*. 120: 631-40

Centers for Disease Control and Prevention. 2003. *NIOSH Alert: Preventing Deaths, Injuries, and Illnesses of Young Workers*. Atlanta: National Institute for Occupational Safety and Health.

Centers for Disease Control and Prevention. 2002. *National Institute for Occupational Safety and Health (NIOSH) Recommendations to the U. S. Department of Labor for Changes to Hazardous Orders*. Atlanta: National Institute for Occupational Safety and Health.

Chamarbagwala, Rubiana and Rusty Tchernis. 2006. *The Role of Social Norms in Child Labor and Schooling in India: A Hierarchical Model.* Northeast Universities Development Consortium Conference.

Cockburn, John. 2001. *Child Labour Versus Education: Poverty Constraints or Income Opportunities?* Unpublished manuscript.

Cockburn, John and Benoit Dostie. 2007. Child Work and Schooling: The Role of Household Asset Profiles and Poverty in Rural Ethiopia. *Journal of African Economies.* 16(4): 519-63.

Cooper, Sharon P., Keith D. Burau, Tracy B. Robison, Scott Richardson, Patricia G. Schnitzer and John J. Fraser, Jr. 1999. Adolescent Occupational Injuries: Texas, 1990–1996. *American Journal of Industrial Medicine* 35:43–50.

Cortez, Solange Aparecida Estevão, Marco Antonio Barbieri, Maria da Conceição Pereira Saraiva, Heloisa Bettiol, Antônio Augusto Moura da Silva and Viviane Cunha Cardoso. 2007. Does Child Labor Affect Final Height? *Occupational Medicine.* 57(2): 118-25.

Dammert, Ana. 2007. *Child Labor and Schooling Response to Changes in Coca Production in Rural Peru.* Institute for the Study of Labor Discussion Paper No. 2869.

De Janvry, Alain, Frederico Finan, Elisabeth Sadoulet and Renos Vakis. 2006. Can Conditional Cash Transfer Programs Serve as Safety Nets in Keeping Children at School and from Working When Exposed to Shocks? *Journal of Development Economics.* 79(2): 349– 373.

Deb, Partha and Furio Rosati. 2004. *Determinants of Child Labor and School Attendance: The Role of Household Unobservables*. Unpublished manuscript.

Doocy, Shannon, Brian Crawford, Chantelle Boudreaux and Earl Wall. 2007. The Risks and Impacts of Portering on the Well-Being of Children in Nepal. *Journal of Tropical Pediatrics.* 53(3): 165-170.

Dorman, Peter. *Child Labor in the Developed Countries*. IPEC Working Paper. Geneva: ILO.

Dubois, Pierre, Alain de Janvry and Elisabeth Sadoulet. 2003. *Effects on School Enrollment and Performance of a Conditional Transfers Program in Mexico*. Unpublished manuscript.

Dumas, Christelle. 2007. *Does work impede child's learning? The case of Senegal*. Unpublished manuscript.

Dunn, Kathleen A., Carol W. Runyan, Lisa R. Cohen and Michael D. Schulman. 1998. Teens at Work: A Statewide Study of Jobs, Hazards, and Injuries. *Journal of Adolescent Health*. 22(1): 19- 25.

Duryea, Suzanne and Mary Arends-Kuenning. 2003. School Attendance, Child Labor and Local Labor Market Fluctuations in Urban Brazil. *World Development.* 31(7): 1165-1178.

Duryea, Suzanne, David Lam and Deborah Levison. 2007. Effects of Economic Shocks on Children's Employment and Schooling in Brazil. *Journal of Development Economics.* 84: 188–214.

Duyar, Izzet and Bariş Őzener. 2005. Growth and Nutritional Status of Male Adolescent Laborers in Ankara, Turkey. *American Journal of Physical Anthropology.* 128: 693-8.

Eckstein, Z., and K.I.Wolpin, 1999. Why Youths Drop out of High School: The Impact of Preferences, Opportunities, and Abilities. *Econometrica* 67, 1295-1339.

Edmonds, Eric and Nina Pavcnik. 2002. *Does Globalization Increase Child Labor? Evidence from Vietnam*. NBER Working Paper No. 8760.

Edmonds, Eric. 2006. Child Labor and Schooling Responses to Anticipated Income in South Africa. *Journal of Development Economics.* 81(2): 386-414.

Ehrlich, P. F., McClellan, W. T., Hemkamp, J. C., Islam, S. S. and A. M. Ducatman. 2004. Understanding Work-Related Injuries in Children: A Perspective in West Virginia Using the State-Managed Workers' Compensation System. *Journal of Pediatric Surgery*. 39(5): 768-772.

Emerson, Patrick M. and André Souza. 2002. *Bargaining over Sons and Daughters: Child Labor, School Attendance, and Intra-Household Gender Bias in Brazil*. Nashville: Department of Economics, Vanderbilt University.

Emerson, Patrick. M. and André Portela Souza. 2007. *Is Child Labor Harmful? The Impact of Working Earlier in Life on Adult Earnings.* Institute for the Study of Labor (IZA) Discussion Paper No. 3027.

Emerson, Patrick M. and Shawn D. Knabb. 2006. Opportunity, Inequality, and the Intergenerational Transmission of Child Labor. *Economica*. 73(291): 413-434.

Emerson, Patrick M. and André Portela Souza. 2007. Child Labor, School Attendance, and Intrahousehold Gender Bias in Brazil. *The World Bank Economic Review.* 21(2): 301–316.

Ersado, Lire. 2002. *Child Labor and School Decisions in Urban and Rural Areas: Cross Country Evidence.* International Food Policy Research Institute Food Consumption and Nutrition Division Discussion Paper No. 145.

Esin, Melek Nihal, Serap Bulduk and Haluk Ince. 2005. Workrelated Risks and Health Problems of Working Children in Urban Istanbul, Turkey. *Journal of Occupational Health.* 47: 431–436.

Fassa, Anaclaudia Gastal, Luiz Augusto Facchini, Marinel Mór Dall'Agnol and David C. Christiani. 2005. Child Labor and Musculoskeletal Disorders: The Pelotas (Brazil) Epidemiological Survey. *Public Health Reports.* 120(6): 665-674.

Fassa, Anaclaudia Gastal, 2003. Health Benefits of Eliminating Child Labour. IPEC Working Paper. Geneva: ILO.

Fekadu, Daniel, Atalay Alem and Bruno Hägglöf. 2006. The Prevalence of Mental Health Problems in Ethiopian Child Laborers. *Journal of Child Psychology and Psychiatry.* 47(9): 954–959.

Fentiman A, Hall A, Bundy D (2001) *Health and cultural factors associated with enrolment in basic education: A study in rural Ghana*. Social Science and Medicine 52:429–439.

Fetuga, M. B., O. F. Njokanma and T. A. Ogunlesi. 2007. Do Working Children Have Worse Academic Performance? *Indian Journal of Pediatrics.* 74: 993-96.

Fingar, A. R., R. S. Hopkins and M. Nelson. 1992. Work-Related Injuries in Athens County, 1982-86: A Comparison of Emergency Department and Workers' Compensation Data. *Journal of Occupational Medicine.* 34: 779-787.

Fischman, Gustavo E. 2003. Children's Work, Schooling, and Welfare in Latin America. *Contemporary Sociology*. 32(1): 110-11.

Francavilla, F. and S. Lyon. 2003. *Household Chores and Child Health: Preliminary Evidence from Six Countries*. Understanding Children's Work Working Paper. Rome: UCW.

Fuller, Bruce, Lucia Dellagnelo, Annelie Strath, Eni Santana Barretto Bastos, Maurício Holanda Maia, Kelma Socorro Lopes de Matos, Adélia Luiza Portela and Sofia Lerche Vieira. 1999. How to Raise Children's Early Literacy? The Influence of Family, Teacher, and Classroom in Northeast Brazil. *Comparative Education Review.* 43(1): 1-35.

Fuwa, Nobuhiko, Seiro Ito, Kensuke Kubo, Takashi Kurosaki and Yasuyuki Sawada. 2006. *Intrahousehold Resource Allocation, Child Labor, and School Enrollment: Evidence from Rural India.* Presentation Paper Northeast Universities Development Consortium Conference.

Gharaibeh, Muntaha and Shirley Hoeman. 2003. Health Hazards and Risks For Abuse Among Child Labor in Jordan. *Journal of Pediatric Nursing.* 18(2): 140-7.

Giuffrida, Antonio, Roberto F. Iunes and William D. Savedoff. 2005. *Health and Poverty in Brazil: Estimation by Structural Equation Model with Latent Variables*. Inter-American Development Bank Technical Note on Health No. 1/2005.

Glewwe, Paul. 2002. Schools and Skills in Developing Countries: Education Policies and Socioeconomic Outcomes. *Journal of Economic Literature.* 40:436-482.

Graitcer P. and L. Lerer. 1999. *Child Labor and Health: Quantifying the global health impacts of child labor.* World Bank Early Child Development Paper No. 32.

Graitcer, Philip L. and Leonard B. Lerer. 2000. *The Impact of Child Labor on Health: Report of a Field Investigation in Egypt.* Early Child Development Series, World Bank.

Guarcello, Lorenzo, Scott Lyon and Furio Rosati. 2004. *Impact of Working Time on Children's Health.* Understanding Children's Work Working Paper.

Guarcello, Lorenzo, Scott Lyon, Furio Rosati and Cristina Valdivia. 2007. *Children's Non-Market Activities and Child Labour Measurement: A Discussion Based on Household Survey Data*. Geneva: International Labor Office. (Rome: UCW, 2004).

Gubert, Flore and Anne-Sophie Robilliard. 2008. Risk and Schooling Decisions in Rural Madagascar: A Panel Data Analysis. *Journal of African Economies.* 17(2): 207-38.

Guiffrida, Antonio, Iunes, Roberto F. and William D. Savedoff. 2005. *Health and Poverty in Brazil: Estimation by Structural Equation Model with Latent Variables*. Inter-American Development Bank Technical Note on Health No. 1.

Gunnarsson, Victoria, Peter F. Orazem, and Mario A. Sánchez. 2006. Child Labor and School Achievement in Latin America. *World Bank Economic Review*. 20(1): 31-54.

Hadi, A. 2000. Child Abuse among Working Children in Rural Bangladesh: Prevalence and Determinants. *Public Health.* 114: 380-84.

Harari, Raoul and Mark R. Cullen. 1995. Childhood Lead Intoxication Associated with Manufacture of Roof Tiles and Ceramics in the Ecuadorian Andes. *Archives of Industrial Medicine*. 50(5):393.

Hawamdeh, H. and N. Spencer. 2002. Growth of Working Boys in Jordan: a Cross-Sectional Survey Using Non-working Male Siblings as Comparisons. *Child: Care, Health and Development.* 28(1): 47-49.

Hawamdeh, H. and N. Spencer. 2003. The Effects of Work on the Growth of Jordanian Boys. *Child: Care, Health and Development.* 28(3): 167-72.

Heady, Christopher. 2003. The Effect of Child Labour on Learning Achievement. *World Development*. 31(2): 385–98.

Hendricks, K. J. and N. Adekoya. 2001. Nonfatal Animal Injuries to Youth Occurring on Farms in the United States, 1998. *Injury Prevention.* 7(7): 307-11.

Hsin, Amy. 2005. *Children's Time Use: Labor Divisions and Schooling in Indonesia*. California Center for Population Research Working Paper.

Ide, Lisa S.R. and David L. Parker. 2005. Hazardous Child Labor: Lead and Neurocognitive Development. *Public Health Reports.* 120(6): 607-612.

Ilahi, Nadeem. 2001. *Children's Work and Schooling: Does Gender Matter? Evidence from the Peru LSMS Panel Data*. Unpublished manuscript.

Jensen, Peter and Helena Skyt Nielsen. 1997. Child Labour or School Attendance? Evidence from Zambia. *Journal of Population Economics.* 10(4): 407-24.

Kandel, W. and David Post. 2003. After School Work in Mexico: Competing for Children's Time Success. *International Journal of Educational Development.* 23: 299–314.

Kassouf, A., McKee, M. and Mossialos, E. (2001*): Early Entrance to the Job Market and Its Effects on Adult Health.* Journal of Health Policy and Planning 16: 2-20.

Khanam, Rasheda. 2004. *Impact of Child Labour on School Attendance and School Attainment: Evidence from Bangladesh*. MPRA Paper, Munich.

Kishk, Fawzy M., Abdel-Ghany M. El-Masry, Salwa M. Abd-Allah and Hesham M. Gaber. 2004. *Vulnerability of Working Children to Environmental Health Risks: A Case Study in a Village in Rural Egypt.* Global Forum No. 8 for Health Research, Mexico City.

Kruger, Diana and Matias Berthelon. 2007. *Work and Schooling: The Role of Household Activities among Girls in Brazil*. Pontificia Universidad Católica de Valparaíso.

Kruger, Diana, Rodrigo R. Soares and Matias Berthelon. 2007. *Household Choices of Child Labor and Schooling: A Simple Model with Application to Brazil.* Institute for the Study of Labor Discussion Paper No. 2776.

Larson-Bright, Muree, Susan Goodwin Gerberich, Bruce H. Alexander, James G. Gurney, Ann S. Masten, Timothy R. Church, Andrew D. Ryan and Colleen M. Renier. 2007. Work Practices and Childhood Agricultural Injury. *Injury Prevention.* 13: 409-15.

Lee, B. C., J. D. Westaby, P. H. Chyou and M. A. Purschwitz. 2007. Agricultural Employers' Hiring and Safety Practices for Adolescent Workers. *Journal of Agricultural Safety and Health.* 13(1): 25-32.

Lee, Chanyoung and Peter F. Orazem. 2007. *Lifetime Health Consequences of Child Labor in Brazil*. 4th Minnesota International Economic Development Conference, University of Minnesota.

Leinberger-Jabari, Andrea, David L. Parker and Charles Oberg. 2005. *Child Labor, Gender, and Health.* Public Health Reports. 120: 642-7.

Levison, Deborah, Jasper Hoek, David Lam and Suzanne Duryea. 2006. *Intermittent Child Employment and Its Implications for Estimates of Child Labor*. Unpublished manuscript.

Levison, Deborah and Karen Moe. 1998. Household Work as a Deterrent to Schooling: An Analysis of Adolescent Girls in Peru. *The Journal of Developing Areas.* 32(2): 339-56.

Levison, Deborah, Karine Moe and Felicia Knaul. 2001. *Youth Education and Work in Mexico*. World Development. 29:1, pp. 167–88.

Levison, Deborah and Marta Murray-Close. 2005. Challenges in Determining How Child Work Affects Child Health. *Public Health Reports*. 120: 614-20.

Maitra, P. and Ray, R. (2002), *The Joint Estimation of Child Participation in Schooling and Employment: Comparative Evidence from Three Countries.* Oxford Development Studies, vol. 30.

Maluccio, John A. 2005. *Coping with the "Coffee Crisis" in Central America: The Role of the Nicaraguan Red de Protección Social*. International Food Policy Research Institute Food Consumption and Nutrition Division Discussion Paper No. 188.

Mardis, Anne L. and Stephanie G. Pratt. 2003. Nonfatal Injuries to Young Workers in the Retail Trades and Services Industries in 1998. *Journal of Occupational and Environmental Medicine.* 45(3): 316-23.

Marsh, Herbert W. and Sabina Kleitman. 2005. Consequences of Employment During High School: Character Building, Subversion of Academic Goals or a Threshold? *American Educational Research Journal.* 42(2): 331-69.

Martins, Joseph M. 1996. *Philippines Environmental Health Assessment*. Unpublished manuscript.

Mason, Christine and Giulia Earle-Richardson. 2002. *New York State Child Agricultural Injuries: How Often is Maturity a Potential Contributing Factor?* American Journal of Industrial Medicine Supplement 2:36–42.

Mathews, Rahel, Chen Reis and Vincent lacopino. 2003. Child Labor: A Matter of Health and Human Rights. *Journal of Ambulatory Care Management.* 26(2): 181-2.

Meiers, Suzanne and Joanne Baerg. 2003. Farm Accidents in Children: Eleven Years Experience. *Journal of Pediatric Surgery.* 36(5): 726-729.

Mortimer, Jeylan T. and Jeremy Staff. 2007. Educational and Work Strategies from Adolescence to Early Adulthood: Consequences for Educational Attainment. *Social Forces.* 85(3): 1169-94.

Mull, L. Diane and Steven R. Kirkhorn. 2005. Child Labor in Ghana Cocoa Production: Forces upon Agricultural Tasks, Ergonomic Exposures, and Associated Injuries and Illnesses. *Public Health Reports.* 120(6): 649-655.

Mwabu, Germano. Forthcoming. Health Economics for Low-Income Countries. In T. Paul Schultz and John Strauss (eds), *Handbook of Development Economics, Volume 4.* Amsterdam: Elsevier, North-Holland.

Nath, Samir R. and Abdullahel Hadi. 2000. Role of Education in Reducing Child Labour: Evidence from Rural Bangladesh. *Journal of Biosocial Science.* 32(3): 301-313.

National Institute for Occupational Safety and Health. 2004. *Worker Health Chartbook 2004.* Atlanta: NIOSH Publication No. 2004-146. Atlanta: National Institute for Occupational Safety and Health.

National Academy of Sciences. 1998. *Protecting Youth at Work: Health, Safety, and Development of Working Children and Adolescents in the United States.* Washington: National Academy Press.

Neri, Marcelo Côrtes, Emily Gustafsson-Wright, Guilherme Sedlacek and Peter F. Orazem. 2005. *The Responses of Child Labor, School Enrollment, and Grade Repetition to the Loss of Parental Earnings in Brazil, 1982-1999*. World Bank Social Protection Discussion Paper No. 0512.

Nuwayhid, I. A., J. Usta, M. Makarem, A. Khudr and A. El-Zein. 2005. Health of Children Working in Small Urban Industrial Shops. *Occupational and Environmental Medicine.* 62: 86-94.

O'Donnell, Owen, Van Doorslaer, Eddy and Furio C. Rosati. 2002. *Child Labour and Health: Evidence and Research Issues*. Understanding Children's Work Working Paper. Rome: UCW.

O'Donnell, Owen, Furio C. Rosati and Eddy Van Doorslaer. 2005. Health Effects of Child Work: Evidence from Rural Vietnam. *Journal of Population Economics.* 18(3): 437-67.

Orazem, Peter and L. Victoria Gunnarsson. 2004. *Child Labour, School Attendance and Performance: A Review*. Staff General Research Papers 11177, Iowa State University Department of Economics.

Pal, Sarmistha. 2004. Child schooling in Peru: Evidence from a Sequential Analysis of School Progression. *Journal of Population Economics.* 17(4): 657-80.

Patrinos, Harry A. and George Psacharopoulos. 1997. Family Size, Schooling and Child Labor in Peru: An Empirical Analysis. *Journal of Population Economics.* 10 (October): 387-405.

Phoumin, Han and Seiichi Fukui. 2006. *Cambodian Child's Wage Rate, Human Capital and Hours Worked Trade-Off: Simple Theoretical and Empirical Evidence for Policy Implications.* Kobe University Graduate School of International Cooperation Studies Working Paper.

Post, David and Suet-ling Pong. 2000. Employment during Middle School: The Effects on Academic Achievement in the U. S. and Abroad. *Educational Evaluation and Policy Analysis*. 22(3): 273-298.

Ravallion, Martin and Quentin Wodon. 1999. *Does Child Labor Displace Schooling? Evidence on Behavioral Responses to an Enrollment Subsidy*. World Bank Policy Research Working Paper No. 2116.

Ray, Ranjan. 2000. *The Determinants of Child Labour and Child Schooling in Ghana*. Unpublished manuscript.

Ray, Ranjan and Geoffrey Lancaster. 2003. *Does Child Labour Affect School Attendance and School Performance?* Multi Country Evidence on SIMPOC Data. Geneva: ILO.

Redmount ,Esther. 2002. Cyclical Patterns in School Attrition and Attendance: A Study in the Labor-Market Behavior of Children. *Economic Development and Cultural Change.* 51(1): 135-60.

Ridao-Cano, Cristobal. 2001. *Evaluating the Impact of Working While in School on School Progress: The Case of Rural Bangladesh.* University of Colorado Population Aging Center Working Paper No. 2.

Ritchie, Amanda, Cynthia B. Lloyd, and Monica Grant. 2004. *Gender Differences in Time Use among Adolescents in Developing Countries: Implications of Rising School Enrollment Rate*. Population Council Policy Research Division Working Paper No. 193.

Rosati, Furio C. and Mariacristina Rossi. 2007. *Impact of School Quality on Child Labor and School Attendance: The Case of Conafe Compensatory Education Program in Mexico*. Understanding Children's Work Working Paper. Rome: UCW.

Rosati, Furio C. and Mariacristina Rossi. 2003. *Children's Working Hours and School Enrollment: Evidence from Pakistan and Nicaragua.* Center for International Studies on Economic Growth Tor Vergata Research Paper Series No. 25.

Rosati, Furio C. and R. Straub. 2006. *Does Work During Childhood Affect Adult's Health? An Analysis for Guatemala.* Understanding Children's Work Working Paper.

Rucci, Graciana, 2004. *Macro Shocks and Schooling Decisions: The Case of Argentina*. University of California at Los Angeles. Unpublished manuscript.

Runyan, Carol W. and Ronda C. Zakocs. 2000. Epidemiology and Prevention of Injuries among Adolescent Workers in the United States. *Annual Review of Public Health.* 21: 247-269.

Runyan, Carol W., Michael Schulman, Janet del Santo, J. Michael Bowling, Robert Agans and Myduc Ta. 2007. Work-Related Hazards and Workplace Safety of US Adolescents Employed in the Retail and Service Sectors. *Pediatrics.* 119(3): 626-34.

Saddik, Basema, Ann Williamson, Iman Nuwayhid and Deborah Black. 2005. The Effects of Solvent Exposure on Memory and Motor Dexterity in Working Children. *Public Health Reports.* 120(6): 657-663.

Sanchez, Mario A., Peter F. Orazem and Victoria Gunnarsson. 2005. *The Effect of Child Labor on Mathematics and Language Achievement in Latin America*. World Bank Social Protection Discussion Paper No. 0516.

Saucedo, Silvia E. Giorguli and Carlos J. Echarri Cánovas. 2004. *The Combination of School and Work among Adolescent Children as a Household Strategy of Lone Mothers in Mexico*. El Colegio de México. Unpublished manuscript.

Sawada, Y., and M. Lokshin, 2001. *Household Schooling Decisions in Rural Pakistan*. World Bank Working Paper No. 2541.

Sedlacek, Guilherme, Suzanne Duryea, Nadeem Ilahi and Masaru Sasaki. 2005. *Child Labor, Schooling, and Poverty in Latin America*. World Bank Social Protection Discussion Paper No. 0511.

Simoyi, P., S. Islam, A. Haque, J. Meyer, E. Doyle and A. Ducatman. 1998. Evaluation of Occupational Injuries among Young Workers in West Virginia. *Human and Ecological Risk Assessment.* 4(6): 1405-15.

Skoufias, Emmanuel and Susan W. Parker. 2006. Job Loss and Family Adjustments in Work and Schooling During the Mexican Peso Crisis. *Journal of Labor Economics*. 19(1): 163-81.

Stinebrickner, Ralph, and Todd R. Stinebrickner. 2003. Working During School and Academic Performance. *Journal of Labor Economics*. 21(2): 449–72.

Torres, E. B., R. D. Subida and L. B. Rabuco. 1991. *The Profile of Child Scavengers in Smokey Mountain, Balut, Tondo, Manila*. University of Philippines College of Public Health Working Paper.

Tzannatos, Zafiris. 2003. Child labor and school enrollment in Thailand in the 1990s. *Economics of Education Review* . 22: 523–536.

US National Institute for Occupational Safety and Health. 2002. *National Institute for Occupational Safety and Health (NIOSH) Recommendations to the U.S. Department of Labor for Changes to Hazardous Orders*. Atlanta: National Institute for Occupational Safety and Health.

US National Institute for Occupational Safety and Health. 2003. *Preventing Deaths, Injuries, and Illnesses of Young Workers.* Department of Health and Human Services/NIOSH Publication No. 2003–128.

Wahba, Jackline. 2006. The Influence of Market Wages and Parental History on Child Labour and Schooling in Egypt. *Journal of Population Economics.* 19(4): 823-52.

White, L. and C. O'Donnell. 2000. Working Children and Accidents: Understanding the Risks. *Child: Care, Health and Development.* 27(1): 23-34.

Windau, Janice and Samuel Meyer. 2005. Occupational Injuries among Young Workers. *Monthly Labor Review.* 128(10): 11-23.

Wolff, François-Charles and Maliki. 2008. Evidence on the Impact of Child Labor on Child Health in Indonesia, 1993–2000. *Economics and Human Biology.* 6: 143–169.

Woodhead, M. 2004. *Psychosocial Impacts of Child Work: A Framework for Research, Monitoring and Intervention*. Understanding Children's Work Working Paper. Rome: UCW.

Woolf, Alan, Hillel R. Alpert, Anjali Garg and Samuel Lesko. 2001. Adolescent Occupational Toxic Exposures: A National Study. *Archives of Pediatrics and Adolescent Medicine.* 155: 704-10.

Woolfson, Charles A. and Matthias Beck. 2000. Child Labor. *International Journal of Occupational and Environmental Health*. 6(1): 63-7.

World Health Organization. 2001. *National Burden of Disease Studies: A Practical Guide*. Geneva: World Health Organization.

World Health Organization. 2007. *Work Injuries in Children and Young People*. European Environment and Health Information System Fact Sheet No. 4.7.

Yamanaka, Miki and Ann Ashworth. 2002. Differential Workloads of Boys and Girls in Rural Nepal and Their Association with Growth. *American Journal of Human Biology.* 14(3): 356-63.