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Agricultural child labor: An approach from the ecological model of human development

Abstract

Child labor is considered an activity that puts the development of children[1] and adolescents at risk because it involves physical effort not appropriate for their age, which distances them from activities such as school and playing with friends. In the case of the agricultural sector, the risks are greater due to contact with pesticides, risky journeys and even being part of a forced migration due to the lack of resources in the communities of origin. In this research, it was investigated if this activity reduces their integral development through a descriptive-comparative analysis in a sample of 558 children and adolescents from agricultural communities of three states of the Mexican Republic. Subsequently, a statistical prediction log it model was generated where risk patterns were identified according to age, sex and migratory status, finding that 10-year-old migrant children as well as 8-year-old children from local or settled communities are the ones who they were more likely to enter child labor. With these results, it is intended that decision makers can design strategies that promote their permanence in the classroom and with their friends and not collaborating from the illegality in the Mexican agriculture sector.

Keywords: children and agricultural laborers, child development, and socio ecological model

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Introduction

Child labor is one of the most difficult phenomena to study, given how it is characterized economically, socially, culturally, psychologically and politically. The International Labour Organization (ILO) estimates that 264 million children do activities that affect or jeopardize their development, and around 85.3 million of them are in hazardous work, including the agriculture sector (OIT, 2014). In Mexico, several studies have shown children's involvement in agricultural work[2–5] however, other studies suggest that their numbers are underestimated.[6,7] Data reported in the Child Labor Module (Módulo de Medición Trabajo Infantil) of the National Survey on Occupation and Employment[8] highlights that there are 3 million child laborers, approximately 30% in the agriculture sector. Mexican child laborers in agricultural fields work 8 hours a day; in the sun, they do adult work in unhealthy conditions and are constantly exposed to agrochemicals and pesticides.[9–12] Moreover, they use tools such as machetes or knives, or operate heavy machinery[11–13] which threaten their development and even their lives. In general, the studies show that consequences are associated to school dropout, respiratory or gastrointestinal diseases, work-related accidents, lack of recreational spaces, involvement in migration processes, family disintegration, and separation of family members, socio-emotional difficulties such as low self-esteem, teenage marriage, teenage pregnancy, among others.[14–16] Based on the foregoing, this holistic proposal is an attempt to understand child labor in agriculture in Mexico, as a part of the population characterization made by the International Programme on the Elimination of Child Labour (IPEC).

Background

One of the problems when addressing child labor in the agriculture sector is the lack of a universal definition. Therefore, in this study, a concept was defined to incorporate related actions, such as paid work, unpaid work, and factors associated with the agriculture sector. This resulted in the following definition: "Agricultural child labor refers to work done by children under 18 directly in agricultural fields, in order to help their day-labor families, and also non-educational chores done by children at home, and which makes them vulnerable".

Factors associated with child labor in agriculture

Different studies[3–5,17,18] have highlighted that children work because of family poverty, but some other cultural and idiosyncratic factors have been detected too. The underlying idea seems to be that every family member should provide for the family, and by taking up this responsibility, today's children are instructed towards becoming tomorrow's competent adults.[6,11] In this type of production system, family acts as a partnership in which active collaboration is expected from children.[19] Parents justify this with the claim that values, such as responsibility, autonomy, and single-mindedness, are instilled in children so they are able to overcome obstacles of everyday life.[20] In Mexico, this occurs within three possible contexts: native residence in agricultural areas; through a temporary or permanent process of migration to other areas in the country, or even an international migratory process.[21–25] Harvesting is the season that engages most child laborers because they are considered more efficient for thinning, disbudding, and stripping,[26] and also, they prove to be even more well-behaved, obedient, and productive than adults.[27] In the agricultural fields, activities are divided by gender, leaving the "hazardous and dangerous" to boys (i.e., cutting, carrying, and accumulating), and the "easy" to girls (i.e., doing the cooking and domestic chores.[28] Additionally, there is a high rate of non-educational domestic chores done by child laborers, including care for younger siblings, care for older adults, and chores that are not appropriate for their age.[14,29–31] According to the United Nations Children's Fund (UNICEF) and the Secretariat of Social Development(Secretaría de Desarrollo Social, SEDESOL), children are engaged in child labor as young as age 6,[32,33] tough the group ranging from 10 to 13 years has more incidence,[23] even though Mexican law requires children to be 16 or older to be engaged legally in work activities since 2014.

Ecological understanding of human development for child laborers in agriculture

Research on child labor in agriculture comes from different disciplines;[4,5,7,34–36] therefore, a multidisciplinary analysis was conducted with the purpose of establishing a baseline for understanding the viability of addressing the child labor in agriculture issue from the Ecological Model of Human Development Table 1.

Each discipline addresses partially one or more aspects related to child labor in agriculture. However, these are not integrated, which indicates a lack of a holistic understanding regarding this issue. Thus, a viable theoretical approach was sought to study child labor in agriculture, finding an alternative in Psychology through the Ecological Model of Human Development (EMHD), as proposed by Bronfenbrenner.[37] The basic postulation of the EMHD assumes a mutual, progressive accommodation between a developing human being and the changing properties of the immediate settings in which said person lives[37–41] formulated five levels or subsystems directly or indirectly operating in development. The most immediate level, called a micro system, includes activities, interpersonal relationships, and role patterns each child shows[43] Kostelnik For child laborers in agriculture, the micro system in which they participate not only includes school, family setting or peer group, but also the agricultural fields in which they work or help. The next level, referred to as Macro system, includes environmental interconnections between micro systems.[43] For instance, the relationships established in the school setting, among household members, or with the people for whom child laborers work in agricultural fields.

Table 1 Multidisciplinary Analysis

Discipline	Main objective
Economics	To study the income earned for the household, as well as income used for savings and money transfers.
Anthropology	To analyze how the tradition of working the land was transformed into an occupation, and the migratory family conditions.
Pedagogy	To study educational lag, implemented educational programs, and subsidies offered by several institutions.
Law	To analyze legal agreements related to child labor in agriculture, as well as the minimum age for employment.
Medicine	To assess the physical effects of exposure to agrochemicals and pesticides, as well as diseases directly related to work in agricultural fields.
Agronomy	To study the main areas, crops, and seasons in which most child laborers are engaged.
Clinical Psychology	To analyze the psychological impacts of agricultural child labor and the migratory process on children and their socio emotional development.
Social Psychology	To study child labor in agriculture as a social phenomenon from which community behavior may be described.
Educational Psychology	To analyze the learning and cognitive development processes of child laborers engaged in the agriculture sector.

Level three, called Exo system, refers to settings in which people are not involved directly, but that affect them directly or indirectly.[43] In this particular case, it includes agricultural fields where children's parents or primary caregivers work, institutional programs designed to benefit population, and migration, whether the whole family or just some members migrate to get a job. Level four, categorized as a Macro system, includes a cultural, ideological, political, and institutional framework of influences that affect or might transversely affect lower-order systems.[40,43] This macro system integrates laws in relation to child labor, and the cultural perception or treatment of the issue. Finally, there exists a subsystem transversely affecting childhood development, called Chrono system, which describes the historical time in which development occurs. Under this conceptualization, the following research questions arose: Is child labor the subsystem that poses more vulnerability to development in Mexican agricultural child laborers? And is there a way to predict which variables primarily result in children's involvement in agricultural child labor?

Methodology

Objectives were proposed as follows: To inquire into whether or not child labor is the subsystem that poses the greatest vulnerability to development in Mexican agricultural child laborers. And to develop a statistical model for identifying variables that are decisive for children's involvement in agricultural work in their communities of origin or destination, to be achieved through a field-based, non-experimental, transversal and descriptive study[44] of Mexican child labor in agriculture as represented in 19 municipalities of Sinaloa, Veracruz, and Oaxaca. In order to collect data, proportional, simple sampling was performed in Sinaloa and Veracruz, and maximum variance simple sampling was performed in Oaxaca, based on data provided by the National Agricultural Day Laborers Survey (Encuesta Nacional a Jornaleros Agrícolas, ENJO)[11] and the National Council for the Evaluation of Social Development Policy's (Consejo Nacional de la Política de Desarrollo Social, CONEVAL)[45] Poverty and Social Deprivation Maps (Mapas de Pobreza y Rezago Social).

An estimated total of 578 surveys were conducted municipality- and state-wide, under the following participation requirements:

1. The child must be in the age group 5 to 17 years;
2. The child must have an adult day-laborer family member; and
3. The child must be living temporarily or permanently in the selected communities.

The "Encuesta para niñas y niños, hijos de jornaleros agrícolas"[9] instrument was used, which assesses factors associated with full development in children aged 5 to 17 years, and consists of 62 items divided into 6 components:

1. Child Labor in Agriculture: It determines type of work (paid or unpaid), working conditions, wage earned, and money habits.
2. Household and Unpaid Activities: It examines household activities, time spent in these activities, and care for younger siblings.

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3. Education and Desired Career: It evaluates academic grade level, education lag, enjoyment of school, school attendance, and aspirations for adult life.
4. Family and Socio emotional Interactions: It investigates family relationships, communication, establishment of limits and rules, decision making, and expression of feelings.
5. Health: It explores eating habits, suffered diseases, and health care services.
6. Play: It examines recreational activities, and types and perceptions of play.

The results of this instrument indicate that the lower the score, the more risk factors. By contrast, the higher the score, the more protective factors. Cronbach's alpha reliability coefficient for this instrument was 0.83, and the total variance explained was 56.1%, calculated through principal components analysis.

Results

A total of 578 cases were sampled originally; however, only 558 cases were eventually selected, since 20 did not meet the criteria of participation. The number of selected cases by state was as follows: 209 (37.5%) in Sinaloa, 159 (28.5%) in Veracruz and 190 (34.1%) in Oaxaca. Studied cases were representative, given a 10% margin of error for every sampling.

Socio demographic data

Participants were 53.2% male and 46.8% female, with an age range of 5 to 17 years, and a mean age of 11.84and standard deviation of 3.54. However, for the total population, representative age (mode) was 14 (12.7%).

Regarding family typologies, most participants lived in a nuclear family(59.8%) or an extended family(34.8%). 14.5% of nuclear families faced separation for a period every year, with some members relocating to work as day laborers, while the rest of the family members remained together in their community of origin or migrated.

Analysis of component results

The following section includes an analysis of results obtained from the 6 components in the instrument.

Child labor in agriculture component

65.9% of participants were found to have risk factors. In fact, by performing a comparative analysis among states, Veracruz and Oaxaca were found to have more cases with risk factors, with 91.8% and66.8% respectively. By contrast, the state that provides more protection was Sinaloa, with just 53.1% of cases. Only 0.9% of child laborers work under fair and legal conditions, with more occurrences in Sinaloa. Thus, sampled participants' development is significantly damaged.

Household and unpaid activities component

67.9% of participants showed expected factors related to household activities. However, data by state showed the highest percentage of risk in Oaxaca (46.3%). This percentage is notably lower in Sinaloa (21.1%) and Veracruz (13.2%). Also, Veracruz showed the greatest proportion of protective factors, with 18.9%. Since Oaxaca showed disparity in data, this component was crossed with sex and age to check for interrelations. Oaxaca female adolescents showed more risk factors compared to female adolescents from the other states.

Health component

86.8% (expected and protective factors combined) of children reported that even if they have suffered from any disease, there was a health care center near where they could go for health care services. A comparison among states revealed that Veracruz and Oaxaca show more protective factors (59.1% and 44.7%, respectively). Nonetheless, Veracruz also showed more risk factors by 17.6%. Disparity in data for Veracruz was directly associated with specific crops; i.e., more protective factors were found in coffee crops, where agricultural work is a family-shared task, thus children are cared for by a parent or tutor. By contrast, adolescents that work sugarcane crops commute on their own and choose home remedies or self-medication when necessary, even if there are health care centers near. In general, this component did not pose a significant risk for the sample of participants.

Education and desired career component

46.8% showed protective factors, meaning they attended school and had a career plan. However, 24.9% faced risk factors since they have dropped out of school or are illiterate and do not have an appropriate career plan. An analysis of results by states revealed that Sinaloa was the state with most cases with protective factors (60.8%), while Veracruzhad the highest number of cases with risk factors (39.6%). Although 75.1% of participants attend school, 44.4% of them combine it with field work. Veracruz was found to be the state with highest risk, while participants from Sinaloa attend school regularly and do not show education lag. Based on these results, this component is clearly the parents' and tutors' responsibility, so it should not be considered as posing vulnerability.

Socio emotional and family interactions component

In relation to the data drawn from this component, a high percentage of child participants (96.6%) were found to have both expected and protective strong family ties, a fact that allows us to understand how they assume a certain role within their families and what activities they do, whether educational or not. Veracruz was the state with the most cases with both risk factors (4.4%) and protective factors (64.2%). Particular features of the population with more risk factors were solitary commute, having children of their own, and working in sugarcane crops. By contrast, features of the population with more protective factors were school attendance, living with their families, thus remaining united. In general, this component or variable is characterized by greater protection in the sample of participants.

Play component

This research found that 64.9% did age and developmentally appropriate recreational activities. This was especially true for children that do not migrate and live in the state of Oaxaca. Conversely, Sinaloa showed more protective factors (26.8%), given children were more likely to play and have fun. Veracruz was the state with greater risk or vulnerability factors with 15.1%, especially among children who combined work with school and thus were hardly likely to have fun or play during the day. This component or variable proved to be free of vulnerability to participant children's development. Based on the results obtained from the instrument, the Child labor, and Household and Unpaid Activities components were found to pose greater risk to development; expected components included Education and Desired

Career, and Play; finally, Family Interactions and Socio emotional, and Health were considered as protective components.

Child labor in agriculture probabilistic model

Since the Child Labor in Agriculture component, variable or micro system posed greater risk to children's development, a probabilistic model was developed to identify relevant risk factors and variables. In order to achieve this, a log it model was applied to analyze paid work as the explained variable (Y) that takes the values 1 or 0: (1) if child is at risk of child labor, and (0) if child is not at risk of child labor. Moreover, explanatory variables were determined as follows: age (years of age), sex (0 male, 1 female), type of family (0 local or settled, 1 migrant), ethnic condition (0 does not speak any indigenous language, 1 speaks an indigenous language), education (0 does not attend school, 1 attends school). To make this prediction, the function of the data distribution was evaluated using the following formula:

$$\Pr ob(Y_I - 1) = \frac{1}{1 + e^{-(\alpha + \beta_k X_{ki})}} = \frac{e^{\alpha + \beta_k X_{ki}}}{1 + e^{\alpha + \beta_k X_{ki}}}$$

Where

Pr(y =1 | X) represents the probability that y takes the value 1 (occurrence of studied feature), in the presence of covariates X;

X is a group of n covariates { x0, x1, … ,xn } composing the model;

b0 is the constant of the model or independent term; and

bi represents covariate coefficients

During the first statistical calculation, determinations were taken regarding cases selected for the study (N), cases excluded or ineligible due to a missing value. This resulted in 535 selected cases for study.

Expected and observed values were subsequently compared, and by using a cut-point method in the probability Y, individuals with 0.5 were classified. This means that a probability of <0.5 was classified as works =0 (does not work), and if the resulting probability is >0.5, it was classified as works=1 (does work). During this first step, 95.9% of cases were classified correctly by the model.

The cases were grouped into deciles of risk, and observed probability was compared with expected probability in each case. A high value in contrast revealed differences between expected and actual values. Chi square values were calculated relative to a P>=0.05 level of statistical significance. No statistical significant differences between expected and observed events were identified, indicating a good fit of the model Table 2.

Table 2 Hosmer–Lemeshow test

Step	Chi square	Degrees of freedom	Significance
1	12.947	8	0.114
2	11.085	8	0.197
3	14.686	8	0.066

Under these goodness-of-fit conditions and having verified its utility to calculate estimates, variables to be included were determined, as well as the degree of significance for each. So the SPSS generated an output with the variable, the value of the parameter, and the sampling error incurred in when the population and degree of significance parameters were estimated.

The model correctly classified children that did not work. The variables used in the equation, their regression coefficients and corresponding standard errors, the value of a Wald test of the null-hypothesis (Pi=0), the associated statistical significance, and the value of the OR (exp(B))with confidence intervals are presented in the following table Table 3:

These coefficients of the model allowed for the prediction of the probability of risk of child labor. Child labor in agriculture is directly predicted by the age and migration condition variables in the model. Results obtained showed that the group at greater risk and thus more vulnerable was children of 10 years or more that come from families of migrant farm workers, and that risk age was 8 for children from local or settled families.

Table 3 Model of Prediction of Child Labor

	Variables						I.C. 95% for	
		B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Step 1	Work	0.293	0.031	89.884	1	0	1.34	1.262	1.424
	Age	-2.925	0.363	64.822	1	0	0.054		
Step 2	Work	0.297	0.032	87.872	1	0	1.346	1.265	1.432
	Sex	-0.767	0.202	14.356	1	0	0.464	0.312	0.691
	Age	-2.594	0.375	47.853	1	0	0.075		
Step 3	Work	0.298	0.032	87.425	1	0	1.348	1.266	1.435
	Sex	-0.778	0.204	14.603	1	0	0.459	0.308	0.685
	Migration	0.43	0.207	4.314	1	0.038	1.537	1.025	2.305
	Age	-2.778	0.39	50.747	1	0	0.062		

Conclusion

Based on the background and results obtained, the conclusion can be drawn that this study contributed to a more comprehensive understanding of child laborers in agricultural or rural areas regarding two aspects: the conceptual framework and findings, which helped answer the research questions. In the conceptual framework, the EMHD proposed by Bronfenbrenner[37,41] undoubtedly contributed to grasp a comprehensive, holistic view of development in child laborers in the Mexican agriculture sector. However, given its extension, it

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was impossible to include all the subsystems and environments, or the people involved in each. Due to the foregoing, the scope of this study was focused on relevant subsystems according to the literature reviewed (i.e., child labor in agriculture, unpaid household activities, school attendance, family and interpersonal relationships, play, and health of participants).

In the literature review, there could be found that previous research indicates that environmental conditions significantly affect the development of most children who work in the Mexican agriculture sector. However, these studies were partial or had delimitations where socio emotional aspects or family settings were not taken into account, and these two systems significantly and effectively promote development in children. In relation to the foregoing, it was observed that children that migrated with their parents maintained a stronger emotional tie since they knew and recognized the conditions under which they live, migrate, or work. Therefore, these children were more caring and empathetic towards their parents and kin, even if this means engaging in paid agricultural labor, dropout, or even migration.

This study was able to identify child labor in agriculture as the component that poses more vulnerability, including long workdays and workload similar to an adult's. It revealed 8 as the age of first involvement in child labor for children in communities of origin, which is due to the lack of opportunities for parents, for whom it then becomes vital that children engage in paid work to achieve economic household stability. For migrant families, age of involvement climbed to 10 years, since agricultural work requires more physical effort, and family members believe that children's physical development at this age is appropriate for starting as agricultural workers. It is noteworthy that these finding sallow for the development of prevention programs against child labor, and have contributed to the planning of prevention and remedial community programs by the IPEC project, the primary objective of which is to help eradicating agricultural child labor in Mexico.

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Conflicts of interest

The authors declare no conflicts of interest.

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