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Interdisciplinary Faculty of Economic and Administrative Sciences

RESEARCH

Comprehensive Economics and Policies in childcare in contexts of socio-environmental threat

Contexto económico y politicas públicas integrales en atención a la niñez en condiciones socio-ambientales de riesgo

Date received: July 10th, 2020

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Date of approval: September 28th, 2020

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Abstract

A social group given priority in Mexico's political agenda is children; however, such attention tends to fade when it comes to those living in contexts of environmental threat and social vulnerability. The complex network of actors and institutions involved in processes such as nutrition, education, household income, and health demands the implementation of comprehensive policies that consider both structural and contextual factors that may shape these processes. To highlight the need for such comprehensive policies aimed at children, a non-experimental correlational study was conducted to show that living in conditions of social precariousness and environmental threat affects child neurodevelopment. The results revealed significant negative associations in working memory (r = -.396), verbal comprehension (r = -.406), processing speed (r = -.280), and perceptual reasoning (r = -.437). The findings confirm limited cognitive development among children living in environments of environmental threat and social precariousness, and therefore, underscore the need to promote comprehensive policies that directly address this issue.

Keywords: environmental threat, social vulnerability, cognitive performance.

JEL Codes: I-Health, Education, and Welfare; I14, Health and Inequality; I18, Government Policy; Regulation; Public Health.

Resumen

Un grupo social de prioritaria atención en la agenda política de México es la niñez, sin embargo, tal atención se disipa en el caso de aquella población que vive en contextos de amenaza ambiental y vulnerabilidad social. La compleja red de actores e instituciones involucrados en los procesos de alimentación, educación, ingreso familiar y salud, exige instrumentar políticas integrales que tomen en cuenta los factores estructurales y contextuales que pueden determinar tales procesos. Para evidenciar esa necesidad de instrumentar políticas integrales en atención a la niñez, se realizó un estudio de diseño no experimental de correlación con el fin de mostrar que el vivir en un contexto de precariedad social y amenaza ambiental afecta el neurodesarrollo infantil. Los resultados develaron asociaciones negativas significativas en memoria de trabajo (r= -.396), comprensión verbal (r= -.406) velocidad de procesamiento (r=-.280) y razonamiento perceptual (r= -.437). Se confirma un limitado desarrollo cognitivo en infantes residentes en contextos de amenaza ambiental y precariedad social y, por tanto, la necesidad de impulsar una política de carácter integral que atienda de manera puntual tal problemática.

Palabras claves: amenaza ambiental, vulnerabilidad social, desempeño cognitivo.

Codigos JEL: I, I14,I18.

Introduction

Vulnerability as a consequence of social imbalances has increased and become ingrained in the culture of Mexican society (Águila et al., 2015). The accumulation of disadvantages in this regard has multiple causes and manifests in various dimensions. Among structural causes, notable factors include the global economic recession and the consequent decline in trade flows, reflected in a widespread drop in exports (in value and volume); dependence on remittances received; and low levels of foreign direct investment. Undoubtedly, the global structural recession has affected economic development expectations, which is reflected in low GDP growth, decreased national consumption and investment, deterioration of the labor market, increased unemployment rates, reduced employment, and rising poverty at both national and intra-regional levels. Since the 1980s, the Mexican government's economic policy has adopted neoliberal measures and focused on global markets. However, four decades later, the expected economic and social benefits of this approach remain unfulfilled.

While the possibility of overcoming the stagnation of the national economy (reactivating employment and reducing poverty) remains contingent on the behavior of structural factors in the global economy, particularly the country's ability to implement counter-cyclical policies (CEPAL, 2014), the situation has become even more complicated due to the effects of the Covid-19 pandemic on the national economy and, consequently, social welfare. Government measures to limit the spread of the disease have caused an unprecedented economic slowdown. More than a year after the health emergency, the situation remains concerning. The health emergency justifies greater public sector intervention, clearly and transparently, to support households, businesses, and the financial sector by providing liquidity (through credit grants and postponement of financial obligations) and economic solvency.

The problem addressed in this study is linked to these structural factors, since labor and social policies depend on and are determined by fiscal, monetary, financial, exchange rate, and foreign trade policies. Social policies related to education, health, and work involve this diversity of factors, institutions, actors, and processes interacting in each program, guideline, and policy action. It is no coincidence that the United Nations International Children's Emergency Fund (UNICEF) designed a comprehensive platform to facilitate the articulation of sectoral programs (social development, health, education, participation, and nutrition, among others) in an effort to gradually create a protective environment for children's rights. Countries are urged to incorporate a comprehensive care scheme for children into their national policy agendas, especially policies targeting early childhood populations and vulnerable groups.

This context justifies the research framing this document. It aims to show the socio-environmental risk conditions experienced by groups of children living in rural areas of Mexico, highlighting the need to promote the design and development of public programs based on comprehensive care schemes for childhood.

Conceptual and Referential Development. Contexts of social vulnerability, environmental threat, and cognitive assessment tests for children.

Two basic concepts are generally used when addressing socio-environmental risk conditions in specific socio-historical and population contexts: social vulnerability and environmental threat. The first, vulnerability, denotes the lack or absence of essential elements for survival and personal development, as well as insufficient tools to avoid disadvantaged situations (Sólomon, Villa, and Núñez, 2011). The second, environmental threat, refers to damage associated with natural or anthropogenic phenomena affecting the population. Below are some clarifications on both concepts from previous studies.

According to Lampis (2012), social vulnerability refers to susceptibility to harm and is used to study phenomena such as poverty and development (Chambers, 1995), disaster risk management (Wisner et al., 2004), and climate change adaptation in community contexts (Adger, 2006; O'Brien et al., 2009). Valencia (2016) focuses on aspects of organization, social relations, and

social structure, which involves understanding prevailing social logics in risk situations. Brooks (2003), when conceptualizing vulnerability, states that it is usually related to risk, danger, exposure, sensitivity, adaptive capacity, and resilience. He distinguishes between biophysical and social approaches in conceptual and methodological terms. The biophysical approach stems from social vulnerability and disaster risk management studies and prioritizes natural hazards and their impacts, emphasizing exposure to a threat over the subject's response capacity (Brooks, 2003; Valencia, 2016). Biophysical vulnerability assessments are rooted in a positivist epistemology based on the nature of a physical-environmental hazard, as an extension of human system exposure and the studied system's sensitivity to impacts of such hazard (O'Brien et al.; Valencia, 2016).

The social vulnerability approach, on the other hand, comes from a more critical research tradition addressing disaster risk management from a political ecology perspective (Wisner et al., 2004) as well as poverty research (Barrientos, 2013). This perspective considers that social and political processes determine the impact of so-called natural threats (Fraser, 2014). Based on this idea, Cutter et al. (2003) argue that social vulnerability is partly the product of social inequalities, as these act as shaping factors of groups' sensitivity to harm and impact their ways of responding to environmental threats. In this sense, vulnerability includes social inequalities related to factors such as income, rural urbanity, occupation, infrastructure, education, family structure, among others. It is worth mentioning here the recognition of structural aspects as determinants, or at least conditions, of social vulnerability and, consequently, the need to implement comprehensive policies.

Regarding the term environmental threat, environmental studies use a wide range of terminology to address damage associated with natural phenomena or anthropogenic events, referring to different approaches to harm caused by environmental threats. Smith and Petley (2009:9) describe "...potential threats facing human society from events originating and transmitted through the environment," noting that human involvement tends to increase involuntary exposure to rare and uncontrollable natural events (asteroid impacts, earthquakes) toward more voluntary exposure to danger through common technological failures in the built environment (transport accidents, air, water, and soil pollution). In this logic, environmental threat constitutes the primary negative causal aspect of harm over short or long periods.

Whichever conceptual definition is adopted, this work recognizes that social conditions will amplify, limit, or mitigate the effects of a particular environmental threat. Both terms are useful and complementary to fine-tune the analytical lens for approaching the issues faced by a given population group. In this work, environmental threat is constituted by the presence of agrochemicals, and social vulnerability refers to social inequality caused mainly by income level, rurality-urbanity, occupation, infrastructure, education, housing, and access to services.

Regarding children's cognitive performance, various measurement methods (psychometric and neuropsychological tests) are used for vulnerable populations exposed to neurotoxins (Morales, 2016). Neurotoxicological studies focused on brain functioning use psychological measurement/evaluation methodologies (Anger, 2003) ranging from classical designs using standardized psychometric tools to assess global intellectual abilities/capacities, to cognitive psychology approaches employing neurobehavioral batteries to measure specific sensory and motor responses through computerized tasks. Other research in environmental neurotoxicology employs clinical compounds (concepts, knowledge, sequencing, and visuospatial organization) derived from the Wechsler scales, providing a spectrum of specific psychological/cognitive functions such as verbal comprehension, verbal fluency, number, space, speed perception, memory, and reasoning

For example, Calderón et al. (2001) used the WISC RM to assess the effects of arsenic and lead on neuropsychological functioning in school children living in a mining-metallurgical area in San Luis Potosí city through the Banatynne compound model. Their results reported high arsenic levels in children's urine and a significant correlation of these levels with low cognitive performance (in long-term memory and linguistic abstraction). Along these lines, Rocha (2008), using a clinical compound interpretation methodology, found associations between visuospatial organization and verbal reasoning tasks with high arsenic concentrations in urine, and low long-term verbal memory scores

with high fluoride concentrations in urine.

Sarsour et al. (2011) studied independent and interactive associations between family socioeconomic status (SES) and single-parent status to predict children's cognitive functions related to inhibitory control, cognitive flexibility, and working memory. They also examined expressive language skills and the family environment as possible mediators of these associations. The study involved sixty families from California from various social strata, each with a school-age child (mean age = 9.9 years). Children's executive functioning was measured using a brief battery including the Wechsler Intelligence Scale for Children, Fifth Edition (WISC-V), and the Trail Making Test. Home environment quality was assessed using the Home Observation for Measurement of the Environment inventory. The authors found that family SES predicted the three executive functions of the children. Single-parent and family SES were interactively associated with children's inhibitory control and cognitive flexibility; children from low-SES, single-parent families scored lower. Parental responsiveness, enrichment activities, and family companionship mediated the association between family SES and children's inhibitory control and working memory.

Hackman et al. (2015) measured the effect of SES on 1,009 children in California regarding their cognitive functioning and found that family income and maternal education predicted planning skills for first grade and working memory performance at 54 months. Early SES effects remained stable through middle childhood, indicating that the relationship between early SES indicators and cognitive functioning emerges in infancy (1-3 years) and persists without narrowing or widening in early and middle childhood (5-10 years).

Continuing with this line of research, Lawson and Farah (2017) conducted a study aimed at understanding the extent to which executive functioning (specifically in the dimension of working memory) mediated the associations between education, family income, and achievement in reading and mathematics in a sample of 336 children aged 6 to 15 years. They employed the Wechsler Intelligence Scale for Children, Third Edition (WISC-III), specifically the Digit Span subtest, and the *Cambridge Neuropsychological Test Battery* (CANTAB). For academic achievement in mathematics and Spanish, they used the Woodcock-Johnson III (WJ-III) battery. Using a structural equation model, they found that socioeconomic status (SES) predicted significant changes in reading and math achievements over a two-year period; moreover, executive functioning but not verbal memory partially mediated the relationship between SES variables and changes in math performance.

In Mexico, Morales (2015) examined the cognitive performance of 84 children living in socio-environmentally vulnerable conditions using the WISC-IV and the Woodcock-Muñoz battery. Participants were indigenous children residing in pesticide exposure risk contexts, considering parental education and occupation, as well as family income and nutrition. Results showed significant differences between children with low and very low SES in cognitive tests evaluating intellectual ability, crystallized intelligence, and visual intelligence. These findings align with those of Arán-Filippetti (2011), regarding the three socioeconomic indicators directly related to children's cognitive performance (parents' educational and occupational levels, and family income), with parental education marking the greatest differences (Noble et al., 2007).

Regarding social vulnerability and environmental threat in rural contexts, the literature reviewed indicates that in Mexico, the agricultural sector is one of the most affected by adverse economic situations; therefore, working in agriculture is synonymous with social vulnerability and marginalization. Mejía and Viveros (2016) state that precarious socioeconomic conditions bring harmful consequences for those who, due to low income, cannot meet basic needs such as food, housing, healthcare, education, or access to a decent pension system.

According to official sources (INEGI, 2016), most agricultural workers and their families live in poverty: by December 2015, the population aged 15 and over engaged in agricultural activities reached 5.5 million people, 56% of whom were farmers and 44% support agricultural workers (day laborers), with women representing 11 out of every 100 workers. In the state of Sonora, 14% of the population lives in rural areas, and 188,122 people work in agricultural jobs, accounting for 6.6% of the total state population (INEGI, 2016), a figure that rises during harvest seasons. For example, in 2015, over 60,000

workers were displaced in the central region alone due to grape production. Social and infrastructure researchers have reported in the local press the precarious living conditions of the population in the town of Miguel Alemán (López, 2018). Their reports recognize that the combination of environmental, economic, social, and poverty-related factors prevalent in the town are linked to an average mortality age of 51 years (twelve years less than the rest of Sonora's population). Regarding health infrastructure, between 1990 and 2014 there was one state health center and one IMSS clinic; in that same year, another care center opened but proved insufficient to serve a population that increased by more than 23,000 inhabitants during that period. Thirty-three percent of the population lacks access to public health services (INEGI, 2015). The lack of sanitary infrastructure worsens with large groups of migrants arriving, leading to higher poverty and marginalization rates. Tuberculosis prevalence in the town is three to four times higher than in the city of Hermosillo, a disease associated with poverty, especially among migrants, compounded by adolescent pregnancies, drug addiction, and sexually transmitted infections (López, 2018).

Studies in this region have found that workers do not use necessary protections when handling pesticides, chemical containers are often buried, children work in fields or play near them, there is no drainage system, and house floors are dirt, among other imminent risk conditions and practices (León, 1997; Leal, 2013; Ochoa, 2012; Gutiérrez et al., 2013; Silveira et al., 2016; Ochoa et al., 2018).

The presence of pesticides in agricultural localities within Rural Development District (DDR) 144 of Hermosillo is evident. Several studies have identified the use of pesticides banned by international agencies in this region (Gutiérrez et al., 2013; Leal et al., 2014; Silveira et al., 2018). Likewise, the presence of organochlorine pesticides has been detected in various soil samples (Cantú et al., 2011; Leal et al., 2014); and in human populations, exposure to agrochemicals has been detected in serum mixtures, breast milk, and semen of day laborers (Silveira et al., 2011; Gámez, 2007; Valenzuela et al., 2008; Limón et al.). All of this supports the conception of an environmental threat context in these DDR 144 localities.

Regarding family profiles, Ochoa et al. (2018) characterized the socioeconomic conditions of agricultural localities in central, southern, and northern Sonora, observing that most participating children came from vulnerable social sectors (parents with an average education level of primary school, main occupation as agricultural workers, and monthly incomes ranging from two to five thousand pesos). It is worth noting that this study considered rural localities in DDR 144 for the central region, which are also referenced in this work.

Analysis of the possible relationship between the physical-environmental context and child development: to date, the region of interest continues to face problems with aquifer contamination, air pollution due to smoke and dust, and inadequate drainage services (Implan, 2016–2018). Streets are often flooded with domestic and/or rainwater wastewater, leading to the proliferation of insect vectors of infectious diseases. With 75% of the town unpaved, these problems are associated with cases of salmonellosis and typhoid fever due to the pathway of open defecation (absence of toilets and latrines) from the street to food. Winds carry dust contaminated with various pollutants, including agrochemicals and fecal matter, to food exposed in the streets.

Diseases arise from this harmful interaction between social problems (insecurity, poverty, insufficient and poor-quality health and education services) and environmental problems (contamination by agrochemicals, dust, water scarcity, and saline intrusion, among others). Children are a population sector especially vulnerable to such adverse environmental conditions. Undoubtedly, this stage of life is crucial for human development, constantly evolving and sensitive to multiple impacting factors (Luria, 1978). An adequate environmental configuration can enhance individual abilities and, possibly, social progress (Lipina, 2016). However, in the DDR 144 localities, environmental and social conditions become limiting and even threatening to child development.

Childhood refers to a fundamental period in human life, during which psychological functions develop through a dynamic process of interaction between the child and the surrounding environment; this results in nervous system maturation with the consequent development of brain functions and, simultaneously, personality formation (Vygotsky, 1978). This development is a complex and precise process that begins very early in life and continues

for several years after birth. Critical periods for normal development include the intrauterine phase and the first year of life (Lezak et al., 2004).

Given the study's variables of interest, the Historical-Cultural Model of Vygotsky was adopted due to its fundamental premise: the brain is an organ that configures its functional structures according to the complex interplay of biological and social factors. The brain's morphological structure alone does not guarantee the presence of all psychic aptitudes but provides the potential to forge them through sociocultural experience. Furthermore, for this functionality to manifest, it is necessary that, mediated by learning processes, the child internalizes the world of human objects and phenomena (Luria, 1995; Vygotsky, 1982). Higher psychological functions are the product of learning (Azcoaga, 1985) and are established during ontogeny (Vygotsky, 1978). According to Vygotsky (1982), each function in child development appears twice and at two different levels: first on the social plane and then on the psychological plane. That is, initially it is an interpsychological category and later an intrapsychological category. In agreement with this, Luria (1978) states that functional processes in the child begin as extrinsic by origin and social by nature, and over time become intrinsic. Therefore, the acquisition of cognitive functions depends on both genetic inheritance and the subject's historical experiences.

Based on Vygotsky's contributions, it can be said that the roots of any psychological function should be sought in the social interactions in which they are generated; it is also important to understand that these interactions and the resulting psychological functions are based on a reality mediated by cultural semiotic tools. Hence, the interest in studying psychological functions from a developmental perspective (Cervigni, Stelzer, Mazzoni, Gómez, and Martino, 2012).

Methdological deisgn of the research

The adoption of policies for comprehensive childcare begins by recognizing the diversity of factors, institutions, actors, and processes that can either support or limit child development, particularly in populations considered vulnerable due to living in contexts of social precariousness and environmental threat. Acting or failing to act in this regard marks the difference in the future of such children. The possibility of establishing comprehensive policy actions begins with demonstrating the presence of the problem and the need for attention in a specific population and context. These considerations justify the research purpose underlying this work: to show that children living in conditions of social vulnerability (social conditions) and environmental threat (physical context) exhibit more limited cognitive development compared to their peers. The hypothetical assumption is that social vulnerability, framed within a context of environmental threat, relates to cognitive performance. The general objective is to associate social vulnerability with the cognitive performance of children residing in contexts of environmental threat in Hermosillo, Sonora, Mexico, from which three specific objectives arise: a) to characterize the sample through the social vulnerability index; b) to describe the cognitive perfomance of participating children; c) to associate cognitive perfomance with the variables that make up the social vulnerability index. This is a correlational, non-experimental study involving populations from agricultural localities in the city of Hermosillo, representing 80% of the surface area of Rural Development District (DDR) 144 and 93% of its population. The agricultural area of DDR 144 is predominantly irrigated, mostly oriented towards commercial agriculture (about 94,000 hectares). Cultivated surface varies yearly, depending on water availability and crops planted (INEGI, 2014). According to official figures, this district has 310 localities with more than 100 inhabitants each, 90% of which are located near agricultural fields. Most of the population are agricultural laborers and their families. According to a study by Silveira et al. (2018), residents of these communities are exposed to contamination due to limited infrastructure and housing conditions, a precariousness also confirmed by the Ministry of Social Development (SEDESOL, 2015): 14% of homes lack piped water, 33% lack drainage, and 15% have dirt floors (SEDESOL, 2015). Most of these localities and their houses are surrounded by agricultural fields where various agrochemicals are commonly applied, including some used domestically, which facilitates the population's exposure to toxic chemicals that can spread through air, soil, or workers' clothing (Quandt et al., 2006; Fenske, Lu, Negrete, and Galvin, 2013; Remoundou et al., 2014; Leal et al., 2014; Ochoa et al.; Silveira et al., 2016).

Participants were residents of five localities in DDR-144 located on the Hermosillo coast: La Peaña, El Fundador, Ejido Salvador Alvarado, Los Pocitos, and El Ejido Ávila Camacho. A total of 115 children were selected via non-random convenience sampling, considering three inclusion criteria: 1) residing in a locality evaluated as socially vulnerable (Ochoa, 2018); 2) attending a primary school located very close to cultivation field; y 3) having parents employed in the agricultural sector. The average age of participants was 9.8 years, and 57.7% were girls.

To describe participants' social situation, variables from the Social Vulnerability Index in Hazardous Environments (Cutter et al., 2003) were used: parents' occupation, mother's education level, family income, marginalization, and number of family members. Most data were obtained via a self-designed socioeconomic questionnaire. The only data sourced from official figures was marginalization, using an index ranging from 0 to 100 provided by the National Population Council (INEGI, 2010). The medical history section of the WISC-IV was used to exclude children who had experienced prenatal, perinatal, or postnatal complications that could act as confounding variables. The instrument used to assess cognitive development was the *Wechsler Intelligence Scale for Children IV* (2003), in its short form of 7 subtests. These generate a global score and four indices: 1) verbal comprehension (skills in verbal concepts formation, expression of relationships between concepts, richness and precision in vocabulary definition, acquired knowledge, verbal agility, and intuition); 2) perceptual reasoning (praxis-constructive skills, formation and classification of non-verbal concepts, visual analysis, and simultaneous processing); 3) working memory (capacity to retain and store information, mentally operate with it, transform it, and generate new information); y 4) processing speed (ability to quickly and efficiently explore, organize, or discriminate simple visual information). It is important to note that this work continues from prior research (Ochoa, 2018), which facilitated the identification of communities with precarious infrastructure and services as well as contact with the population of interest through primary school staff. Both teachers and mothers signed informed consent forms. Data collection logistics were arranged with specialized research center personnel. The WISC-IV subtests and socioeconomic questionnaire were administered individually, with an estimated time of 55 minutes per child. The Modern Manual's administration guidelines were followed to ensure reliable data collection. After evaluating children at each school, a briefing process was conducted to build a database using SPSS version 22. Statistical analyses to meet the objectives included frequency analyses to describe children's characteristics and Spearman's non-parametric correlation test for group contrasts.

Results and discussion.

To test the general objective associating social vulnerability with cognitive performance of children residing in environmental threat contexts in Hermosillo the first specific objective was addressed: characterizing the sample through the social vulnerability index. Table 1 describes the variables taken from the vulnerability index and the data for the study population. It can be observed that parental education was incomplete secondary school for both mothers and fathers. Notably, 15 fathers had no formal schooling. The average income was 5,171.20 pesos. The localities scored from medium to high marginalization on average.

Table 1. Description of the variables in the social vulnerability index

Variables	Mean	Standard deviation
Mother's education	7.5	3.35
Father's education	7.3	2.91
Monthly family income	5,171.20	477.42
Number of family members	5.08	1.46
Marginalization	10.54	3.6
Total	115	

Subsequently, the second specific objective was addressed: to describe the cognitive performance of the participating children. Table 2 shows the cognitive performance of the participating children. The lowest score was in verbal comprehension, placing most of the evaluated sample in the borderline category; in the other scales, they were in the low average range.

Finally, the third specific objective was to associate cognitive performance with the variables that make up the social vulnerability index. Table 3 presents the Spearman non-parametric correlations between cognitive performance and the variables from

Table 2. Cognitive performance of participating children

Variables	Mean	Standard deviation
Verbal comprehension	75.85	10.24
Perceptual reasoning	84.01	9.11
Working memory	85.35	9.40
Processing speed	87.45	12.70

Table 3. Non-parametric correlations of the variables studied

WISC IV Indices				
Variables	**VCI**	**PRI**	**WMI**	**PSI**
Mother's education	.208*	.243*	.104	.270**
Father's education	.157	.175	.097	.241**
Monthly family income	.101	.095	.206*	.157
Marginalization	-.077	-.088	.106	-.045

p. 05*; p.000**.
VCI: Verbal comprehension index; PRI: Perceptual reasoning index; WMI: Working memory index; PSI: Processing speed index.

the vulnerability index. Significant correlations were found between mothers' education and verbal comprehension, perceptual reasoning, and processing speed.

Fathers' education was only correlated with processing speed. Among the purely economic variables, only working memory showed a correlation.

The results showed verbal comprehension to be one of the lowest-scoring cognitive functions among children living in rural contexts. Studies that examine the relationship between environment and language date back to Vygotsky (1978), who proposed that the environment acts as either a facilitator or an obstacle to such development. A correlation was also found between mothers' education and children's verbal comprehension, which aligns with the findings of Maggiolo et al. (2014), who identified a strong association between this factor and language development in both children with delays and those with typical development. It is worth noting that the mothers' average level of education was incomplete secondary school. Mazzoni et al. (2014) point out that even when giving punishment or praise, mothers in rural contexts tend to use fewer words. Similarly, working memory has been associated with social vulnerability. Studies like those by Lawson and Farah (2017) suggest that the greater the deprivation, the lower the performance of this function. It is important to reiterate that, while this study did not directly examine the relationship between pesticide exposure and cognitive function, it did consider residence in environments threatened by such chemicals. In that sense, the results were consistent with studies using dose-exposure designs (Martos et al., 2013; Rivero, 2012; Rowe et al., 2016; Vester & Claude, 2016). These findings are in agreement with Lipina (2016), who states that empirical evidence collected over the years across multiple investigations has indicated that during the early years of life, individuals in precarious socioeconomic conditions are at a disadvantage in maximizing their cognitive functioning.

Conclusions

The study confirms an association between socio-environmental factors and the development of executive tasks in children. These findings reaffirm the need to implement targeted support programs for this population group within the framework of comprehensive health, nutrition, and education policies. In this regard, the proposal recently made by UNICEF-Mexico in the 2019-2024 Agenda for Children and Adolescents is notable. This document explicitly aims to consolidate the National System for the Comprehensive Protection of the Rights of Children and Adolescents through five key areas of action: a) ensuring comprehensive development for children in early childhood; b) developing and implementing a national strategy to eradicate all forms of child malnutrition; c) ensuring that all children and adolescents attend school and learn; d) ending all forms of violence against children and adolescents and ensuring full care and restiitution of the rights of victims; y e) guaranteeing protection and access to rights for all migrant children and adolescents.

It remains to be seen, however, how the goals of such an agenda will materialize in the daily lives of children in Mexico, particularly those living in socially and environmentally precarious conditions who tend to show impairments in cognitive development, thus facing a future with limited opportunities to improve their quality of life. Undoubtedly, policies in health, nutrition, and education must consider not only the children but also their parents, rural families, teachers, and other social actors and institutions involved. A key issue is employment, the type of work, and corporate responsibility in the activities and processes that lead to environmental threats, hence the complexity of intervention efforts if the aim is to

truly address the problem. It is urgent to implement policies for the comprehensive care of Mexican children, in order to break the so-called vicious cycle of environmental illness (Mergler D., 2012, 2014), which unfortunately tends to be normalized in the reality of populations living in conditions of social vulnerability and environmental threat.

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