Cognitive development of children in vulnerable contexts: the role of psychosocial intervention

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ABSTRACT
Psychosocial intervention programs are carried out in Latin American communities with socioeconomic disadvantage to improve their quality of life; few evaluations are carried out to measure their effectiveness. The study aimed to determine if intervention processes in vulnerable communities might favor the children’s development. An analysis of variance was used to find the dependence between different intervention processes and the cognitive development of 97 children between 3 and 6 years old. No relationship was found between the type of intervention received by the communities and their infants’ global cognitive development. However, the children of the community intervened by multiple agents and services showed significant differences related to a better performance in dimensions such as language, rhythm, memory, and attention. It is necessary to ensure nutrition and guarantee quality education, early stimulation, spaces of relationship with peers, and a community aware of their co-responsibility in childcare to improve children’s cognitive development.

Introduction

The first years of life are essential for children’s development, not only for them to be in good physical health but also for their cognitive and socio-emotional progress. It will provide them with the ability to learn and adapt over time (Amar & Martínez-González, 2011; Berlinsky & Schady, 2015) and promote a good school performance critical to assess better opportunities in later years (Sabri, Gan, Law, Chin, & Mohd Shariﬀ, 2020).

Cognitive development refers to the permanent and differential transformation of cognitive structures and functions throughout life, based on preformed behaviors and interaction with the environment, where the mind emerges from a developing brain. Both individual action and social interaction are necessary for this to happen (Sastre, 2006).

Early sensory experiences, enriched with appropriate stimuli, improve performance in cognitive development (Mustard, 2010; Rosenzweig & Bennett, 1996; Van Praag, Kempermann, & Gage, 2000). The brain’s response in an enriched environment appears to be similar to the results of formal training. Enriched experience and training evoke the same cascade of neurochemical events on brain plasticity (Amar & Martínez-González, 2011). These plastic events may include changes in the structure, distribution, and synapses toward learning processes (Aguilar, 2003).
During the first years of life, the plasticity of the brain is at its best. For this reason, experiences, especially in this period, shape the structure of the infant’s brain (Vegas & Santibáñez, 2010). However, this extreme plasticity is a two-sided coin from adaptation to vulnerability. Poor nutrition from birth to the first two years of life, for example, can impair brain development (Black et al., 2008). When children’s basic needs are not solved, their development slows down.

All the circumstances that children experiment, are fundamental for how they build their world, learn to solve problems, and socialize with others (Amar, Abello, & Tirado, 2014). These skills favor the reduction of problems such as violence, poverty, and inequality. Neglecting various basic needs of children, such as nutrition, stimulation, and affection, should produce cognitive and physical developmental disorders (Amar & Martínez-González, 2011; Berlinsky & Schady, 2015; Pomati & Nandy, 2020). For this reason, multilateral organizations such as UNICEF (Junquera, 2020), OECD (2017), or the World Bank (Hansen, 2016) have pointed out the opportunity that investment in programs aimed at early childhood development constitutes (Vacher, Goujon, Romo, & Pouper, 2020).

Human development is an integral process of construction and change in which children actively participate. This process involves transformations in the cognitive, affective, and social spheres that affect each child as a whole and define them as persons in a given context (Amar et al., 2014; Amar & Martínez-González, 2011; Orozco-Hormaza, Sánchez-Ríos, & Cerchiaro-Ceballos, 2011). The environment is essential for children’s physical and cognitive development. Early interventions are important in the child’s physical, motor, and cognitive development, so community participation is essential as an agent for stimulating the child’s development (Amar et al., 2014; Li et al., 2021). We can also include the school as another context in which children must have the necessary stimuli and conditions to develop their abilities. There must be strong communication between communities and families with schools (Fiore, 2001; Yotyodying, Dettmers, & Jonkmann, 2020). Collaborative work between these entities is essential in the school success of children. Studies found that parents, teachers, and communities must encourage children’s engagement in school activities to ensure adequate cognitive and social development (Wang, Degol, & Henry, 2019). At the same time, studies found a great sensitivity of children towards the adversity of the environment in which they are. In this way, there is a relation between high levels of stress and lower cognitive development (Armstrong-Carter, Finch, Siyal, Yousafzai, & Obradović, 2020). There are large adverse effects on children’s cognitive and socio-emotional development raised by parents who experienced parenting stress (Barboza-Salerno, 2020).

Children with risk factors as preterm birth and poverty tend to have lower scores on cognitive assessments than preterm infants born in prosperous homes and children without risk factors (Beauregard, Drews-Botsch, Sales, Flanders, & Kramer, 2018).

The community is a fundamental agent in the child’s socialization process with the family and the school. They provide a safe space where the child will have the most significant development experiences. Children, in addition to interacting at school with their peers and teachers, also have contact with their neighbors, friends, among other people, thus being the community who often provides support for survival and protection of children in a settlement population (Amar, 1998; Amar et al., 2014, 2016; Amar & Martínez-González, 2011).

Popular support groups, foundations, and professionals that help a vulnerable community often intervene in children’s cognitive development by promoting healthy socialization spaces. Trust between people helps to ensure the survival and care of children living in poverty contexts, who depend heavily on social reciprocity (Amar, 1998; Villanueva et al., 2016).

However, in extreme vulnerability contexts, the social network is often fragmented, deteriorating the sense of community necessary for collective action that satisfies needs and promotes resilience. Psychosocial intervention refers to professionals’ performance to observe and intervene in psychosocial problems (Blanco & Valera, 2007; García-Poole, Byrne, & Rodrigo, 2019); it means problems from the intersubjective construction by people who live them daily. Psychosocial intervention is a comprehensive and permanent process aimed to increase the human being, the family, and the community’s capacities to improve their lives. It is the action that allows subjects to exercise
control and power over their individual and social environment in order to face and solve problems and achieve changes in their environment (Blanco & Valera, 2007). These psychosocial interventions are usually implemented from government policies or civil society organizations oriented to promote social change. Multiple background studies show how these processes can transform power structures when they generate the empowerment and reconstruction processes of populations’ life projects (Razeto Pavez, 2013).

It has been identified how these intervention processes can generate favorable transformations in the communities. The studies focus on community dynamics and empowerment, but child development benefits are vague or less explored.

This research aimed to establish whether having psychosocial intervention processes in vulnerable communities can affect the cognitive development of a Latino children sample.

Materials and methods

The Analysis of Variance - ANOVA - was used using the JASP software to study the effects of sources of variation simultaneously, in this case, the different psychosocial intervention processes on children’s cognitive development in these communities. It was possible to establish the percentage of the variance in the dependent variable (cognitive development) that is explained by each of the two independent variables, namely, nutritional support and multiple psychosocial and community interventions. The level of relevance for all comparisons was set at $p < .05$.

Participants

Ninety-seven Colombian boys and girls between the ages of 3 and 6 from the following communities participated, distributed as shown in Table 1.

The number of children evaluated varies because it was a sample of volunteer families from the participating communities, each of which has different population sizes of beneficiaries. The parents of each child signed informed consent and authorized their participation in the study. Only children who agreed to participate participated.

Below is a description of the communities:

Community 1 is over-intervened by different organizations (civil and governmental). This neighborhood counts with several development spaces such as a community radio station, a library, a health center, and a center that offers psychological counseling services and develops various psychosocial intervention projects.

Communities 2, 3, and 4 have community centers where children receive nutritional support thanks to a foundation’s intervention.

Community 5 has no presence of civil or governmental organizations beyond an educational institution. This community is located in a neighborhood recently created by a free housing policy program for people in high vulnerability, victims of forced displacement or natural disasters, and demobilized from illegal armed groups. The five communities are located in neighborhoods with security problems such as gangs, psychoactive substance abuse, and general crime.

| Group          | Number of children evaluated | Psychosocial intervention received                  |
|----------------|------------------------------|----------------------------------------------------|
| Community 1    | 23                           | Intervened by multiple agents                      |
| Community 2    | 20                           | Nutritional aid                                    |
| Community 3    | 10                           | Nutritional aid                                    |
| Community 4    | 17                           | Nutritional aid                                    |
| Community 5    | 27                           | No intervention                                   |
The dependent variable was studied using the CUMANIN battery (Portellano, Mateos, Martínez, Granados, & Tapia, 2000). The battery gives an overall cognitive development score and comprises several subscales: psychomotricity, articulatory language, expressive language, comprehensive language, visuospatial structure, visual perception, iconic memory, rhythm, verbal fluency, and attention. The following scales were used for the interpretation of the data:

- Results between 1 and 29: inferior poor
- Results between 30 and 45: lower
- Results between 46 and 54: normal
- Results between 55 and 75: average normal
- Results between 76 and 99: normal superior

Results

The children’s cognitive performance in the CUMANIN test was analyzed according to the community of belonging (with multiple interventions, with intervention focused on nutrition and without intervention). The comparison between the participants’ average scores concerning their global cognitive development and their dimensions is presented in Table 2.

The results indicate that the participants’ overall cognitive development did not show significant differences related to the community to which they belong. Each group’s average scores indicate that the children showed cognitive development between normal and average normal, except for community 2 (operated only with nutritional support), whose average score is at the limit for lower cognitive development.

However, each cognitive development dimension analysis showed significant differences in the children’s average scores, particularly regarding articulatory language, expressive language, iconic memory, rhythm, verbal fluency, and attention.

The children of community 1 (multiple interventions and community services) achieved an average normal score for each of these dimensions.

Although children in community 2 (nutritional support only) showed a score that placed them in the normal superior score for the articulatory language dimension and the lower score in the other dimensions.

Children in community 3 (nutritional support only) obtained an average normal score in the visuospatial dimension, normal in the dimensions of articulatory language and iconic memory, lower for expressive language and rhythm, and very deficient in verbal fluency.

Children in community 4 (nutritional support only) achieved scores that place them in the average normal score for the articulatory language dimension; normal for the expressive language dimension; lower for iconic memory and rhythm; and inferior poor for verbal fluency and attention.

Table 2. ANOVA for the average in each subscale of the CUMANIN test according to each community

| Subscale                  | C1   | C2   | C3   | C4   | C5   | f    | p    |
|---------------------------|------|------|------|------|------|------|------|
| Global Cognitive Development| 46.95| 45.30| 55.80| 49.94| 55.74| 1.869| 0.123|
| Psychomotricity           | 69.30| 73.85| 50.60| 65.47| 62.56| 1.423| 0.233|
| Articulatory Language     | 65.48| 81.55| 49.50| 61.47| 64.04| 2.185| 0.077|
| Expressive Language       | 69.35| 45.15| 41.80| 54.00| 47.96| 2.463| 0.051|
| Comprehensive Language    | 38.83| 27.45| 29.50| 33.29| 29.07| 0.643| 0.633|
| Visuospatial Structure    | 71.26| 54.80| 63.70| 64.66| 62.81| 0.712| 0.586|
| Vision Perception         | 58.39| 56.80| 37.40| 66.65| 49.41| 1.706| 0.155|
| Iconic Memory             | 72.65| 48.05| 50.50| 45.18| 53.74| 3.035| 0.021|
| Rhythm                    | 70.35| 43.40| 38.70| 37.59| 42.07| 4.109| 0.004|
| Verbal Fluency            | 56.13| 31.70| 14.00| 28.47| 21.30| 6.847| <.001|
| Attention                 | 54.91| 34.25| 66.00| 15.47| 40.89| 4.949| 0.001|

* Significance level <0.05
Finally, the children of community 5 (without intervention) showed an average normal score in the articulatory language dimension, normal for expressive language and iconic memory, lower for rhythm and attention, and inferior poor verbal fluency.

In general terms, the research results show that children in communities 2, 3, 4, and 5 showed severe difficulties related to verbal fluency, rhythm, and attention, while children in community one did not show lags in any cognitive dimensions development. This difference occurs because communities 2, 3, 4 and 5 did not receive interventions that strengthened the social and psychological area of the child, in addition they did not have spaces such as parks or libraries that promotes community development.

Discussion

This study’s findings allow us to conclude that there is a dependency between the possibility of having multiple options for psychosocial intervention, a diversity of community services, and the possibilities of childhood cognitive development in its different dimensions. It is necessary to ensure that children have spaces where they can share with their peers, their parents and caregivers share experiences about how to stimulate the cognitive development of their children (Mustard, 2010; Rosenzweig & Bennett, 1996; Van Praag et al., 2000), and also that the community has an educational institution that provides the necessary tools to promote critical reading and writing in children (Amar, 1998; Amar & Martínez-González, 2011; Sastre, 2006).

Our findings show that the frequent intervention of different foundations and state entities in community one has promoted community processes of social cohesion, solidarity, and participation, which have generated greater awareness of co-responsibility in childcare, and positively impacted the cognitive development of their children. This community has a wide range of social services such as educational institutions, kindergartens, a comprehensive care center that offers legal and psychological counseling, a community library where multiple cultural activities are carried out, a community radio station where information on parenting guidelines is provided.

It has been found that intervention programs that involve families and communities have better effects supporting and stimulating child development (Fiore, 2001; Hernández, 2005; Villanueva et al., 2016; Wang et al., 2019; Yotyodying et al., 2020), even have better results to prevent psychosocial risk (García-Poole et al., 2019). Furthermore, interdisciplinary approaches have better effects when applied in nutritional programs (Brito-Timauri, 2010).

On the other hand, the study reflects on the effectiveness of interventions focused on a need, such as nutrition, to promote cognitive development. It is clear that enjoying a good diet is essential for physical growth and brain development (Black et al., 2008) but does not ensure the acquisition of different skills to adapt the human being in their context (Campo, 2010).

It is also necessary to mention that situations such as low birth weight have been directly and significantly associated with the subsequent cognitive development of the child and even in adulthood; therefore, full cognitive development in children cannot be guaranteed, considering their current nutritional status without knowing its neonatal history (Brito-Timauri, 2010).

Regarding community 5 (without intervention), the children achieved a slightly higher performance in some dimensions compared to the communities that are intervened from the nutritional point of view. This neighborhood was created in the last two years from a government program of housing and, although the criterion for obtaining this benefit was to be in high vulnerability (victims of conflict, reinserted or affected by natural disasters), the particular antecedent conditions that could affect the development of infants were not controlled.

Considering that human development is a complex process of construction and change, in which children actively participate in transformations in their cognitive, affective, and social sphere (Amar et al., 2014; Amar & Martínez-González, 2011; Berlinsky & Schady, 2015), this research provides new evidence on the importance of early stimulation, preschool education for quality, and contact with
other peers and adults for the development of the different areas that make up cognitive development. Lo que

**Study limitations**

The main limitation of the study was the size of the working groups and their lack of balance. Variables related to the people doing the intervention and their professional training level, and others that may influence the interventions were not controlled.

**Conclusions**

The joint responsibility of community actors is vitally important to provide favorable conditions that allow them to enjoy better development opportunities and improve their living conditions. It can be concluded that children’s cognitive function and performance are influenced by their nutritional history, the psychosocial environment, and the family environment that frames their growth and development.

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**References**

Aguilar, F. (2003). Plasticidad cerebral. Parte 1. Rev Med IMSS, 41 (1), 55–64. [https://bit.ly/3nBZKrz](https://bit.ly/3nBZKrz)  
Amar, J. (1998). Educación infantil y desarrollo local. Investigación y Desarrollo, 7, 1–17.  
Amar, J., Abello, R., & Tirado, D. (2014). Desarrollo infantil y construcción del mundo social. Editorial Universidad del Norte. [https://www.jstor.org/stable/j.ctt1c3pwv4](https://www.jstor.org/stable/j.ctt1c3pwv4)  
Amar, J., & Martínez-González, M. B. (2011). El ambiente imperativo (1.a ed.). Editorial Universidad del Norte; JSTOR. [https://doi.org/10.2307/j.ctt1c3q0ft](https://doi.org/10.2307/j.ctt1c3q0ft)  
Amar, J., Palacio, J., Madariaga, C., Abello, R., De los Reyes Aragón, C., De Castro, A., … Ramos, J. (2016). *Infantia: Prácticas de cuidado en la primera infancia*. Barranquilla: Editorial Universidad del Norte.
Armstrong-Carter, E., Finch, J. E., Siyal, S., Yousafzai, A. K., & Obradović, J. (2020). Biological sensitivity to context in Pakistani preschoolers: Hair cortisol and family wealth are interactively associated with girls' cognitive skills. *Developmental Psychobiology, 62*(8), 1046–1061. https://doi.org/10.1002/dev.21981

Barboza-Salerno, G. E. (2020). Cognitive readiness to parent, stability and change in postpartum parenting stress and social-emotional problems in early childhood: A second order growth curve model. *Children and Youth Services Review, 113*(104958), 1–11. https://doi.org/10.1016/j.childyouth.2020.104958

Beauregard, J. L., Drews-Botsch, C., Sales, J. M., Flanders, W. D., & Kramer, M. R. (2018). Preterm birth, poverty, and cognitive development. *Pediatrics, 141*(1), e20170509. doi:10.1542/peds.2017-0509

Berlinski Samuel & Schady, Norbert. (2015). The Early Years: Child Well-being and the Role of Public Policy (pp. 1–285). New York : Inter American Development Bank. https://eg2.novatechset.com/home/article/84557%7C71

Black, M., Walker, S., Wachs, T., Ulkuer, N., Gardner, J., Grantham-McGregor, S., … De Mello, M. (2008). Policies to reduce undernutrition include child development. *Lancet, 371*(9611), 454–455. doi:10.1016/S0140-6736(08)60215-9

Blanco, A., & Valera, S. (2007). Los fundamentos de la intervención psicosocial. In A. En Blanco y J. Rodríguez Marín (Eds.), *Interdisciplinariedad: Su valor en un programa de nutrición comunitaria*. (pp. 3–44). Pearson Educación.

Brito-Timauri, C. E. (2010). Interdisciplinariedad: Su valor en un programa de nutrición comunitaria. *Revista Española de Nutrición Comunitaria, 16*(1), 21–23. doi:10.1016/S1135-3074(10)70007-7

Campo, L. (2010). Importancia del desarrollo motor en relación con los procesos evolutivos del lenguaje y la cognición en niños de 3 a 7 años de la ciudad de Barranquilla (Colombia). *Salud Uninorte, 26*(1), 65–76. https://bit.ly/3eFQZsk

Fiore, D. J. (2001). School, family, and community partnerships: Preparing educators and improving schools. *Bulletin Banco Mundial* – 136. doi:10.4067/S0718-83582001000100004

Junquera, C. (2020, julio). *Cuatro motivos por los que hay que invertir en los niños*. UNICEF para cada niño

Hansen, K. (2016, abril). *Desarrollo en la primera infancia: Una inversión inteligente para toda la vida*. Banco Mundial Blogs. https://bit.ly/3zYoKxx

Hernández, A. (2005). La familia como unidad de supervivencia, de sentido y de cambio en las intervenciones psicosociales: Intenciones y realidades. *Revista Latinoamericana de Ciencias Sociales, Niñez y Juventud, 3*(1), 57–71.

Junquera, C. (2020, julio). *Cuatro motivos por los que hay que invertir en los niños*. UNICEF para cada niño

Li, J., Liang, J. H., Li, Y. J., Qian, S., Jia, R. X., Wang, Y. Q., & Xu, Y. (2021). Optimal approaches for preventing depressive symptoms in children and adolescents based on the psychosocial interventions: A Bayesian network meta-analysis. *Journal of Affective Disorders, 280*(A), 364–372. doi:10.1016/j.jad.2020.11.023

Mustard, J. F. (2010). Early brain development and human development. *Encyclopedia on Early Childhood Development*. https://bit.ly/3taPFCM

OECD. (2017). *Starting Strong 2017: Key OECD Indicators on Early Childhood Education and Care*. OECD. https://doi.org/10.1787/9789264276116-en

Orozco-Hormaza, M., Sánchez-Ríos, H., & Cerchiaro-Ceballos, E. (2011). Relación entre desarrollo cognitivo y contextos de interacción familiar de niños que viven en sectores urbanos pobres. *Universitas Psychologica, 11*(2), 427–440. doi:10.11144/Javeriana.upsy11-2.rdcc

Portellano, J., Mateos, R., Martínez, R., Granados, J., & Tapia, A. (2000). *Cuestionario de madurez neuropsicológica infantil (CUMANIN)*. Madrid: TEA Ediciones.

Razeto Pavez, A. C. (2013). Potenciando el desarrollo local de comunidades afectadas por desastres. *Revista INVI, 28*(77), 111–136. doi:10.4603/05718-83582013000100004

Rosenzweig, M., & Bennett, E. (1996). Psychobiology of plasticity: Effects of training and experience on brain and behavior. *Behavioural Brain Research, 78*(1), 57–65. doi:10.1016/0166-4389(95)00216-2

Sabri, N. A. I., Gan, W. Y., Law, L. S., Chin, Y. S., & Mohd Shariff, Z. (2020). Factors associated with cognitive and motor delays in Malaysian infants aged 6–12 months. *Early Child Development and Care, 1*–14. https://www.tandfonline.com/doi/full/10.1080/03004430.2020.1801666

Sastre, S. (2006). Condiciones tempranas del desarrollo y el aprendizaje: El papel de las funciones ejecutivas. *Revista de Neurología, 42* (Supl. 2), 143–151. doi:10.33588/m.42502.2005782

Universidad de Los Andes, Profamilia, & DNP. (2009). *Evaluación de impacto del Programa Hogares Comunitarios de Bienestar del ICBF*. DNP. https://www.icbf.gov.co/sites/default/files/impacto_hcb.pdf

Vacher, C., Goujon, A., Romo, L., & Purper-Ouakil, D. (2020). Efficacy of psychosocial interventions for children with ADHD and emotion dysregulation: a systematic review. *Psychiatry Research, 291*, 113151. https://doi.org/10.1016/j.psychres.2020.113151

Van Praag, H., Kempermann, G., & Gage, F. (2000). Neural consequences of environmental enrichment. *Nature Reviews Neuroscience, 1*, 191–198. doi:10.1038/35044558

Vegas, E., & Santibáñez, L. (2010). *La promesa del desarrollo en la primera infancia en américa latina y el caribe*. Bogotá: Banco Mundial – Mayol Ediciones S.A.
Villanueva, K., Badland, H., Kvalsvig, A., O’Connor, M., Christian, H., Woolcock, G.,… Goldfeld, S. (2016). Can the neighborhood built environment make a difference in children’s development? Building the research agenda to create evidence for place-based children’s policy. *Academic Pediatrics, 16*(1), 10–19. doi:10.1016/j.acap.2015.09.006

Wang, M. T., Degol, J. L., & Henry, D. A. (2019). An integrative development-in-sociocultural-context model for children’s engagement in learning. *American Psychologist, 74*(9), 1086–1102. doi:10.1037/amp0000522

Yotyodying, S., Dettmers, S., & Jonkmann, K. (2020). Quality features of family–school partnerships in German schools: Measurement and association with parent–child communication about school. *Children and Youth Services Review, 115*(105078). DOI: 10.1016/j.childyouth.2020.105078