The role of family structure on stunting (low height-for-age) in Argentinian preschool children aged 2-5

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Abstract

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The role of family structure on stunting (low height-for-age) in Argentinian preschool children aged 2-5This study assesses the relationship between family structure and stunting among children aged 2-5 in Argentina. Data for this study was drawn from the first wave of the Argentinian National Nutrition and Health Survey 2005 (N = 11 632). Results from logistic regression models show that, although socioeconomic variables have a significant effect on stunting, family structure also matters. The odds of stunting among children living in extended nuclear families are lower than those of children living in strictly nuclear ones. Furthermore, children from single parent households do not have higher odds of stunting than those from two-parent families. Our work highlights the importance of family structure for child nutrition.

Key words: Family structure, child nutrition, stunting.

Resumen

El rol de la estructura familiar en el acortamiento de la estatura (baja talla por edad) de preescolares argentinos entre dos a cinco años

El presente estudio investiga la relación entre estructura familiar y acortamiento de la estatura en preescolares argentinos (dos-cinco años). Los datos utilizados corresponden a la primera ronda de la Encuesta Nacional de Nutrición y Salud 2005 (N = 11 632). Aunque las características socioeconómicas tienen un efecto significativo sobre el acortamiento, nuestro análisis identifica el rol independiente que tiene la estructura familiar. Los resultados de las regresiones logísticas muestran que las chances de acortamiento de preescolares en familias nucleares extensas son menores que las de aquellos en familias estrictamente nucleares. El pertenecer a una familia monoparental no aumenta las chances de acortamiento con respecto a las de un niño en una familia con ambos padres. Nuestro trabajo ofrece evidencias sobre la importancia de la estructura familiar en la nutrición de los niños/as.

Palabras clave: Estructura familiar, nutrición infantil, acortamiento.

Introduction

Changes in family patterns, observed since the second half of the last century in high-income countries of Europe and North America (Andersson, 2003; Bianchi and Casper, 2000), have generated a considerable amount of research aimed at analyzing the effect of these changes on a variety of indicators of children's welfare. Among them, Aquilino (1996) and Cavanagh *et al*., (2006) focused on educational attainment, Carlson and Corcoran (2001) on development of cognitive abilities, Amato (2005), Deleire and Kalil (2002) and Wen (2008) on social and emotional well-being and, Blackwell (2010), Beck (2011) and Bramlett and Blumberg (2007) on the physical and mental health status of children living in nontraditional households[1].

Families in Latin America and the Caribbean, particularly urban ones, have also become more diverse, according to their stage in the demographic transition. During the last decades, there has been a considerable increase in the number of single-person households and female-headed households in the region, as well as a marked decrease in the number of nuclear families (ECLAC, 2004).

In low- and middle-income countries, studies on young children's health have focused primarily on their nutritional status, especially on undernutrition[2].The combination of undernutrition and infectious diseases is still one of the major public health problems in these countries (Rice et al., 2000). Undernutrition includes manifestations such as being underweight for one's age, too short for one's age (stunted) and dangerously thin for one's height (wasted) (UNICEF, 2006).

Undernutrition is considered an important risk factor for the development of a number of diseases and other adverse outcomes not limited to health (Grantham-McGregor *et al*., 2007). For example, studies for Latin America and the Caribbean have shown that stunting and wasting are related to the development of negative emotions (Flores Villavicencio *et al*., 2005) and that stunting at early ages is related to educational and cognitive deficits, both in childhood (Freeman *et al*., 1980) and in adolescence (Walker *et al*., 2005). Stunting and obesity have also been found to detrimentally affect the motor and social-emotional development of very young children (Bove *et al*., 2012).

[1] In this context, a traditional household is a nuclear family (two parents and children).
[2] Undernutrition is defined as the outcome of insufficient food intake and repeated infectious diseases (UNICEF, 2006).

Studies from Africa, Asia and the United States show additional evidence on the relationship between family structure and undernutrition in childhood. For example, Gurmu and Etana (2013) observed that in Ethiopia the risk of stunting is higher among children living in single-parent families, particularly those where only the mother is present, than among children living in nuclear or extended families. Similarly, DeRose et al. (2014) used data from the Demographic and Health Surveys (DHS) for Africa[3] and Asia[4] and their findings indicate that children of mothers who divorced, or whose union dissolved, are at a higher risk of stunting than those born to mothers continuously in their first union.

In contrast, using data from the DHS 1986-1988 for West African countries[5], other authors found no significant relationship between family structure (monogamous marriage, polygamous marriage, mother not in a union) and child stunting (Desai, 1992).

Although there are not many studies on child undernutrition and family structure for Latin America and the Caribbean, the existing results are broadly consistent with those reported in the previous paragraph for other regions of the world. For example, DeRose *et al.* (2014)'s findings on child stunting and mother not in a union for Africa and Asia also hold for Central/South American and Caribbean countries[6]. However, contrary to the results for West Africa, Desai (1992) found that in three Latin America and the Caribbean countries[7] a mother's marital status matters for child stunting. Specifically, children living in homes whose parents are in a consensual union are at higher risk of stunting than those whose parents are formally married. Similarly, Bronte-Tinkew and DeJong (2004), using data from the 1996 round of Jamaica's *Living Standard Measurement Study Surveys*, show that children living in nuclear families whose parents are in a consensual union or in single-parent families are exposed to a higher risk of stunting than those living in nuclear families whose parents are formally married. Fernald and Neufeld (2007), with data for seven Mexican states as part of Mexico's 2003 National Social Welfare Survey, find that children living in families where the father is absent are exposed to a higher risk of stunting than the others. It is important to highlight that all

[3] Cameroon (2011), Chad (2004), Ethiopia (2011), Ghana (2008), Kenya (2008-2009), Nigeria (2008), Democratic Republic of Congo (2007), Tanzania (2010) and Uganda (2011).
[4] Bangladesh (2011), Philippines (2008), India (2005-2006), Indonesia (2012), Pakistan (2006-2007) and Vietnam (2002).
[5] Ghana, Mali and Senegal.
[6] Bolivia (2008), Colombia (2010), Haiti (2012), Honduras (2011-2012), Peru (2012), and Dominican Republic (2007).
[7] Brasil, Colombia and Dominican Republic.

the above-mentioned studies control for demographic and socioeconomic characteristics in order to evaluate the independent effect of family structure on child undernutrition.

For the particular case of Argentina, although there are several studies on children's nutritional status (Bejarano *et al.,* 2005; Bolzán *et al*., 2005; Cesani *et al*., 2013; Kovalskys *et al*., 2011), its causes and relationship with cognitive and educational level, blood pressure, and both visual and oral health (Acosta *et al.*, 2009, Calvo *et al*., 2005, and Martínez and Lucas, 2004) we are not aware of any studies that analyze the effect the family structure on the nutritional status of preschool children.

Therefore, the main goal of this study is to explore the influence of family structure on the health of Argentine preschool children, characterized by their nutritional status. Our data comes from the 2005 National Nutrition and Health Survey (ENNyS), the first national survey that has anthropometric data and the only one available so far[8]. With our work, we hope to contribute to the literature that explores the influence of the family on the health and well-being of children in Latin America and the Caribbean.

UNICEF (1998) articulated the conceptual framework underlying studies on children's nutritional status. This theoretical approach introduced undernutrition in the broader context of economic and social development and considered undernutrition to be the result of a set of multisector factors that operate at individual, family and society levels. Furthermore, this framework provides a holistic approach to identify the risks associated with various factors (immediate, underlying and basic). A natural implication of this approach is that it is not possible to study undernutrition without taking into account, for example, the influence of socioeconomic and cultural factors. The family can then be understood as an intermediate unit of analysis that provides the connection between these factors. In other words, the family has a mediating role between the socio-economic context and the child[9].

This study is organized as follows. The first section presents the methodology used to measure a child's nutritional status; the second and third ones describe the data and the variables and statistical method, respectively. Finally, the results and conclusions of the study are presented.

[8] The 2005 ENNyS is the first national survey on health and nutrition in Argentina. Although a second round was scheduled for 2015, to date no data are available.
[9] See UNICEF (1998) and Sandoval-Priego *et al*. (2002).

Methods

Assessment of Children's Nutritional Status

The international recommendation for the evaluation of undernutrition at the population level is to look at anthropometric measures, such as height and weight in relation to child's age (de Onis and Blössner, 2003). The most common indicators are weight-for-age, weight-for-height, and height -for-age. The estimation of these indicators requires comparisons with a reference group. For this purpose, we use the WHO Anthro[10] statistical package developed by the World Health Organization (WHO). The package uses the WHO Child Growth Standards based on a study involving healthy children from different countries (WHO Multicentre Growth Reference Study Group, 2006).

For comparison with standard values, the WHO Anthro package uses the Z-score statistic which is defined as the deviation of an individual value (observed) from the mean value of the reference population divided by the value of the standard deviation (SD) of the reference population (de Onis and Blössner, 1997). That is, the Z-score measure is used to calculate the number of SD above or below the mean reference value of the anthropometric measure being considered.

The standard cut off points are:

- Height-for-age: < - 2 SD - is considered low height with respect to age (stunting).
- Weight-for-height: < - 2 DS - is considered low weight with respect to height (wasting)
- Weight -for- age: < - 2 DS - is considered low weight with respect to age (underweight).

Data

Our data comes from the 2005 National Nutrition and Health Survey (ENNyS) collected by the Ministry of Health of Argentina. One of the objectives of the survey was the evaluation of the nutritional status and health of women and children, based on food intakes, anthropometric and biochemical indicators. The target population was children aged 6 to 23 months, children between ages 2 to 5, women and pregnant women ages 10 to 49 (Ministry of Health, 2007). Although the survey was conducted at the na-

[10] WHO Anthro (version 3.2.2, January 2011): http://www.who.int/childgrowth/software/en/

tional level, only cities of five thousand or more inhabitants (according to the 2001 National Population Census) were included. The survey used a probabilistic sample that covered all social segments of the target population.

The ENNyS only considers private households and defines them as follows: a private household is made up of any person or persons (related by kinship or not) residing together sharing food expenses and other "vital" expenditures (Ministry of Health, 2007: 22).

Although household and family are clearly different concepts, they will be used interchangeably in our work since we decided to exclude children who live in households that include non-relatives.

The Head of Household is the person who serves as a reference point for the determination of the family arrangement within the household through the relationship of kinship of each individual with respect to this person. Certain personal attributes of the Head of Household are usually used to deduce characteristics of the household as a whole.

Since the kinship relationship of household members is obtained in relation to the Head of Household, it is only possible to fully identify a child's family when he or she is this person's son or daughter. These children make up about 80 percent of the children between ages 2 to 5 years for whom the ENNyS provides some kind of information.

For the present study, we classify families in four groups:

- Nuclear: consists of the Head of Household, his / her partner, one or more children 2 to 5 years of age and older children if they live in the household being considered. Unfortunately, ENNyS does not differentiate between couples in consensual unions and couples in formal unions.
- Extended: is a Nuclear family that includes one or more relatives.
- Single-parent: consists of the Head of Household, one or more children 2 to 5 years of age and children of other ages if they live in the household being considered.
- Single-parent Extended: A single-parent family that includes one or more relatives.

There are 12 336 children aged 2 to 5 who have an identifiable family structure and for whom the corresponding height-for-age and/or weight-for-height Z-scores can be obtained.

Statistical methods and variables

The descriptive statistics show that the prevalence of stunting is 7.5 percent (925 cases), of underweight 2.1 percent (261 cases) and of wasting 1.2 percent (142 cases). These prevalences are similar to those obtained for Argentina based on another data source using the same WHO standards for the age group under consideration (Padula *et al*., 2012). In Latin America, in general, a low prevalence of wasting has been documented (Victora, 1992), similar to that found in the present study.

Due to the low prevalence of underweight and wasting, we will only focus on stunting. The relationship between family structure and stunting is modeled using a logistic function.

Control Variables. The models are adjusted by Children's Age and Sex, Region, Head of Household's Sex and Education, Household Size, Wealth Index, and Food Assistance.

Region: There are seven regions with very diverse characteristics in Argentina. Therefore, the Region variable is a categorical variable with seven categories: City of Buenos Aires (CABA)[11], which is the reference category, Greater Buenos Aires, Cuyo, Northeast (NEA)[12], Northwest (NOA)[13], Pampa, and Patagonia (Ministry of Health, 2007). Argentina's vast northern area (NEA and NOA regions), although not homogeneous, presents socioeconomic, demographic and health characteristics that differentiate it from the rest of the country: a high percentage of children and adolescents, poverty, rural population, illiteracy, uninsured population, and unemployment/ underemployment (UNDP, 2005).

Household Size: The Household Size variable controls by the number of people in the household adjusted by the household demographic composition. We compute what is known as an *equivalent adult* measure. This measure of equivalence reflects the energy/caloric needs specific for age and sex, using as reference unit an adult male aged 30 to 59 years. This unit is called an equivalent adult and is assigned a value equal to one (INDEC, 2012, Morales 1998)[14].

Head of Household Education Level: As noted earlier, in many cases it is not possible to determine who the mother of the child being considered is. Therefore, the educational level of the head of hosuehold, not the edu-

[11] The acronym CABA stands for Autonomous City of Buenos Aires in Spanish.
[12] The acronym NEA stands for Northeastern Argentina in Spanish.
[13] The acronym NOA stands for Northwestern Argentina in Spanish.
[14] For example, a household consisting of a 35-year-old man, a 30-year-old woman, and a one-year-old child is 2.17 in size. This number is obtained by adding the equivalent adult measures of its members: 1 (male 30-59 years old), 0.74 (female 18-59 years old) and 0.43 (male or female one-year-old).

cational level of the child's mother, was taken as an approximation to the educational level of the person making consumption decisions that may affect the entire household.

Four categories were considered: incomplete primary, complete primary, incomplete secondary, and complete secondary and more.

Wealth Index: This index is a summary measure of the economic well-being of households. The procedure followed for its construction is the one proposed by Filmer and Pritchett (2001) who showed that this type of index is robust and reliable for the estimation of long run wealth. The variables that were used for the construction of this index are: housing type, floor material, number of people per room (excluding kitchen and bathroom), water supply, type of sanitary service and if the dwelling has electricity service, refrigerator, and landline telephone. The principal components method[15] was used to assign weights to the different components resulting in an index with a mean of 0 and a SD of 1. However, in order to facilitate its interpretation, it was re-scaled by adding 5 units so that its values are all positive. For the statistical analysis, we considered the quartile distribution of the Wealth Index, so that four segments[16] were defined. The first segment represents the group of households with the "highest economic status" while the fourth segment represents the group of households with "lowest economic status."

The calculation of the Wealth Index was done using the complete sample of ENNyS children (six months to five years of age). Although the sample only includes households in urban areas, some of them are located in precarious settlements without, or with minimal access to, standard city services. Therefore, this indicator, although broad, captures reasonably well the variation of the economic well-being of the households across the sample.

Food Assistance: At the time of data collection, there were several governmental programs in Argentina to assist nutritionally vulnerable populations (children, pregnant women, the disabled, and the elderly) with food. These government plans provide food in kind, including milk, vouchers, and/or meals in community facilities (Aulicino, 2012). In addition to state-funded programs, there were programs supported by non-governmental, religious, and other organizations.

[15] The principal components method is a mathematical algorithm used to reduce the dimensionality of the data, in this case the number of variables that were used for the construction of the index, without losing the variability of the data.
[16] These segments are not perfectly balanced due to the high number of repeated values, which has made it difficult to determine the cut-off points.

To reflect the fact that the household receives some type of food aid, a dichotomous variable with a value of 1 is used in the analysis if any household member received any kind of food aid in the last three months and 0 otherwise.

Results

Descriptive Analysis

Out of the 12 363 children aged 2 to 5 in the sample, only 11 632 cases have information on all variables of interest. Table 1 shows a full description of the analytical sample. Every child in the sample lives in a household with one or both parents, with or without relatives. A huge percentage of children, 78.6 percent, live in nuclear families (including siblings, if any); 8.4 percent live in single-parent families; 13.0 percent of cases are extended families or single-parent families living with relatives. In general, these relatives are grandparents. Only 10.4 percent live in extended families. The rest, 2.7 percent, live in single-parent families (Table 1).

Only 20.5 percent of the households that include relatives are single-parent households. In general, in single-parent households the head of household is female (87.8 percent). On the contrary, in nuclear households the great majority of household heads are males (89.2 percent). This result could be due to cultural reasons since it is a common practice to assign the role of head of household to a male. On average, the size of a household (measured in units of equivalent adults) is 3.8. In addition, 38.9 percent of households receive some type of food assistance.

Regarding the socioeconomic variables, around 40 percent of children live in households where the household head had completed high school education. Only 10 percent of children live in households where the head did not finish his or her elementary education. The wealth index captures important differences in economic well-being, particularly between households in the first quartile (highest level of economic well-being) and the fourth quartile (lowest level of economic well-being).

Table 2 shows the prevalence of stunting according to the socioeconomic variables included in the multivariate analysis. Although the prevalence of stunting is higher among single-parent families than among nuclear families and extended families, in both cases the difference is only significant at a 10 percent level. Similarly, although the prevalence of stunting is higher among nuclear families with female household heads than among those with male household heads, the difference is significant only at a 10 percent level.

Table 1: Descriptive Analysis: Analytical sample composed of 11 632 children 2 to 5 years of age

Variables	%	Mean	SD	Median	10th Percentile	90th Percentile
Child's Age (months)		43.0	10.7	43.2	28.0	57.7
Age-Height Z-score		-0.5	1.1	-0.5	-1.8	0.9
Stunting						
Yes	7.6					
Child's Sex						
Female	49.9					
Region						
City of Buenos Aires	3.5					
Greater Buenos Aires	3.5					
Cuyo	12.4					
Northeast	17.5					
Northwest	21.7					
Pampa	16.7					
Patagonia	24.8					
Family Type						
Nuclear	78.6					
Extended	10.4					
Single Parent	8.4					
Single-Parent + Relatives	2.7					
Head of Household's Sex						
Female	19.3					
Household Size		3.8	1.5	3.4	2.3	5.7
Small Sized	34.8	2.5	0.4	2.6	2.2	2.9
Medium Sized	48.7	3.8	0.6	3.7	3.1	4.6
Large Sized	16.5	6.4	1.3	6.0	5.2	8.1
Head of Household's Education						
Less than Elementary	10.0					
Elementary	26.2					
Less than Secondary	23.9					
Secondary and More	39.8					
Wealth Index		5.0	1.0	5.3	3.4	5.8
1st Quartile	21.3	5.9	0.2	5.8	5.7	6.2
2nd Quartile	26.3	5.6	0.1	5.6	5.5	5.7
3rd Quartile	25.6	5.1	0.2	5.1	4.7	5.3
4th Quartile	26.9	3.5	0.9	3.7	2.3	4.4
Food Assistance						
Yes	38.9					

Note: SD stands for standard deviation.
Source: Authors´ own elaboration based on data from 2005 ENNyS.

Table 2: Stunting prevalence among 11 632 children 2 to 5 years of age according to selected characteristics

Variables	Stunting %	Variables	Stunting %
Child's Sex		Household Size	
Female (N=5 831)	7.5	Small Sized (N=4 036)	5.7
Male (N=5 801)	7.6	Medium Sized (N=5 671)	7.0
		Large Sized (N=1 925)	13.0
Region		Wealth Index	
City of Buenos Aires (N=408)	6.1	1st Quartile (N=2 476)	3.9
Greater Buenos Aires (N=406)	7.4	2nd Quartile (N=3 074)	5.1
Cuyo (N=1 446)	6.0	3rd Quartile (N=2 977)	7.2
Northeast (N=2 033)	10.0	4th Quartile (N=3 132)	13.2
Northwest (N=2 524)	8.0		
Pampa (N=1 934)	8.0		
Patagonia (N=2 881)	6.4		
Head of Household's Education		Food Assistance	
Secondary and More (N=4 631)	4.8	No (N=7 101)	4.8
Less than Secondary (N=2 778)	6.8	Yes (N=4 531)	11.9
Elementary (N=3 053)	9.8		
Less than Elementary (N=1 170)	14.6		
Family Type			
Nuclear (N=9 144)	7.4	Single Parent (N=974)	9.1
Male Head of Household (N=8 209)	7.3	Male Head of Household (N= 109)	11.0
Female Head of Household (N=935)	8.8	Female Head of Household (N=77)	8.9
Extended (N=1 204)	7.0	Single-Parent + Relatives (N=310)	8.1
Male Head of Household (N=1 025)	6.7	Male Head of Household (N=47)	6.4
Female Head of Household (N=179)	8.4	Female Head of Household (N=263)	8.4

Source: Authors´ own elaboration based on data from 2005 ENNyS.

As expected, the highest stunting prevalence is found among provinces in the Northeast region of Argentina. Not surprisingly, there is a clear stunting prevalence gradient according to quartiles of the wealth index (lowest stunting prevalence among households in the first quartile, those with the highest level of economic well-being, and highest stunting prevalence among households in the fourth quartile, those with the lowest level of economic well-being). Taking into account the household head, and as expected, there is a clear educational gradient (highest stunting prevalence among children living in households with a household head with incomplete elementary education and lowest among children living in households with a household head with more than secondary education).

Results also show that the stunting prevalence increases according to household size, varying from around six percent among children living in small-sized households to almost the double among those living in large-sized households. It is worthwhile noticing that the variable Household

Size is based on the so-called adult equivalent unit. Using this measure, what we defined as a small-sized household is composed, in 99.4 percent of cases, of two to four members; a medium-sized household is composed of four to six members, in 94.7 percent of cases, and a large-sized household of seven to eleven members, in 91.3 percent of cases.

Regarding food assistance, results show a stunting prevalence of five percent among children living in households that do not receive any type of food assistance. However, stunting prevalence doubles among children living in households receiving food assistance.

Bivariate analysis

Table 3 reports results obtained estimating bivariate logistic regressions. In all cases, the dependent variable is the logit of the probability of stunting among children 2 to 5 years of age.[17] The analysis reveals that each previously described variable, except the one associated with the sex of the child, is related to the probability of stunting and that their coefficients are statistically significant. As anticipated, living in the Northeast region, in a single-parent family, in a medium- or large-sized household, receiving food assistance, in a household where the educational attainment of the household head is less than complete high school, and in a household with low economic well-being increases the likelihood of a child to be stunted.

Multivariate analysis

Table 4 shows results obtained estimating three nested logistic regression models. The first model (Model 1), the simplest one, includes the variables related with region of the country, age and sex of children, and family structure.[18] As in the case of the bivariate analysis, results show that among children living in the Northeast region of the country the likelihood of being stunted is 70 percent higher than among those living in the City of Buenos Aires. Model 1 also shows that the likelihood of being stunted is 25 percent higher among children living in single-parent households than among those living in nuclear families.

[17] Because more than one child may be living in the same household, all regressions adjust for household clustering; this adjustment is expressed by means of robust standard errors.
[18] Due to the reasons mentioned earlier, we use the terms family and household interchangeably.

Table 3: Bivariate Logistic Regressions - Dependent Variable: logit of the probability of stunting among 11 632 children 2 to 5 years of age

Variables	OR		SE
Region (Ref. City of Buenos Aires)			
Greater Buenos Aires	1.22		0.34
Cuyo	0.98		0.23
Northeast	1.70	*	0.37
Northwest	1.33		0.29
Pampa	1.26		0.28
Patagonia	1.05		0.23
Constant	0.07	***	0.01
Wald Chi^2			28.28
Prob> Chi^2			0.000
Pseudo R^2			0.005
Family Type (Ref. Nuclear)			
Extended	0.93		0.11
Single Parent	1.25	†	0.15
Single-Parent + Relatives	1.09		0.23
Constant	0.08	***	0.00
Wald Chi^2			4.19
Prob> Chi^2			0.242
Pseudo R^2			0.001
Head of Household's Sex (Ref. Male)			
Female	1.22	*	0.11
Constant	0.08	***	0.01
Wald Chi^2			5.45
Prob> Chi^2			0.020
Pseudo R^2			0.001
Head of Household's Education (Ref. Secondary and More)			
Less than Elementary	3.43	***	0.37
Elementary	2.18	***	0.20
Less than Secondary	1.46	***	0.15
Constant	0.05	***	0.00
Wald Chi^2			148.32
Prob> Chi^2			0.000
Pseudo R^2			0.024
Child's Age (months)	0.99	†	0.00
Constant	0.11	***	0.02
Wald Chi^2			3.66
Prob> Chi^2			0.056
Pseudo R^2			0.001
Child's Sex (Ref. Male)			
Female	0.99		0.00
Constant	0.08	***	0.00
Wald Chi^2			0.010
Prob> Chi^2			0.924
Pseudo R^2			0.000
Food Assistance (Ref. No)			
Yes	2.67	***	0.19
Constant	0.05	***	0.00
Wald Chi^2			184.36
Prob> Chi^2			0.000
Pseudo R^2			0.031
Household Size (Ref. Small Sized)			
Medium Sized	1.24	*	0.11
Large Sized	2.46	***	0.24
Constant	0.06	***	0.00
Wald Chi^2			98.29
Prob> Chi^2			0.000
Pseudo R^2			0.015
Wealth Index (Ref. 1st Quartile)			
2nd Quartile	1.31	*	0.17
3rd Quartile	1.9	***	0.24
4th Quartile	3.73	***	0.43
Constant	0.04	***	0.00
Wald Chi^2			198.93
Prob> Chi^2			0.000
Pseudo R^2			0.033

Statistical Significance: †: p<0.10, *: p<0.05, **: p<0.01, ***: p<0.001.

Note: SE stands for standard error. Standard errors of all models are adjusted for household clustering.

Source: Authors´ own elaboration based on data from 2005 ENNyS.

Table 4: Multivariate Logistic Regression - Dependent Variable: logit of the probability of stunting among 11 632 children 2 to 5 years of age

Variables	Model 1		Model 2		Model 3	
	OR	SE	OR	SE	OR	SE
Region (Ref. City of Buenos Aires)						
Greater Buenos Aires	1.22	0.34	1.12	0.32	0.85	0.25
Cuyo	0.98	0.23	0.87	0.21	0.77	0.19
Northeast	1.69 *	0.37	1.41	0.31	0.93	0.21
Northwest	1.33	0.29	1.12	0.25	0.80	0.18
Pampa	1.25	0.28	1.13	0.26	0.90	0.21
Patagonia	1.04	0.23	0.95	0.21	0.86	0.20
Child's Age (months)	0.99 †	0.00	0.99 **	0.00	0.99 *	0.00
Child's Sex (Ref. Male)						
Female	0.99	0.07	1.00	0.07	1.00	0.07
Family Type (Ref. Nuclear)						
Extended	0.91	0.11	0.67 **	0.08	0.75 *	0.10
Single Parent	1.25 †	0.15	1.35 *	0.17	1.10	0.16
Single-Parent + Relatives	1.06	0.23	0.93	0.20	0.90	0.21
Household Size (Ref. Small Sized)						
Medium Sized			1.36 **	0.12	1.17 †	0.11
Large Sized			2.74 ***	0.28	1.80 ***	0.21
Head of Household's Sex (Ref. Male)						
Female					1.00	0.11
Head of Household's Education (Ref. Secondary and More)						
Less than Elementary					1.54 ***	0.19
Elementary					1.23 *	0.13
Less than Secondary					1.04	0.11
Wealth Index (Ref. 1st Quartile)						
2nd Quartile					1.07	0.14
3rd Quartile					1.21	0.17
4th Quartile					1.88 ***	0.26
Food Assistance (Ref. No)						
Yes					1.72 ***	0.15
Constant	0.09 ***	0.02	0.08 ***	0.02	0.08 ***	0.02
Df	12			14		22
AIC	6 218			6 122		5 942
BIC	6 306			6 225		6 104

Statistical Significance: †: p<0.10, *: p<0.05, **: p<0.01, ***: p<0.001.

Note: SE stands for standard error. Standard errors of all models are adjusted for household clustering. Df stands for degrees of freedom.

Source: Authors´ own elaboration based on data from 2005 ENNyS.

Like the bivariate model, the multivariate model shows no relationship between being stunted and the sex of the child. However, the likelihood of being stunted decreases in one percent for every month of age. Model 2 includes not only the variables present in Model 1, but also the variable associated with household size, in terms of adult equivalent.

Model 2 shows that including Household Size in Model 1, the likelihood of stunting among children living in any region of the country is not different than among children living in the City of Buenos Aires. Results obtained estimating Model 2 also show that among children living in single-parent families the likelihood of stunting, as compared to those living in nuclear families, is ten percent higher than the estimation obtained in Model 1. In addition, Model 2 shows that the likelihood of stunting among children living in extended families is 30 percent lower than the likelihood of stunting among those living in nuclear families. However, the beneficial effect of living in an extended family is compensated by the negative effect of living in a medium-sized household and is eliminated living in a large-sized family (the likelihood of stunting among children living in large-sized families is almost three times the likelihood of children living in small-sized households).

Model 3, the one that better fits to the data, adds to Model 2 the variables related with the socioeconomic level of the household (Sex of the Head of Household, Household Size, Wealth Index, and Food Assistance). Estimations from Model 3 show the adverse effect of living in single-parent families. The value of the coefficient associated with single-parent households is lower than the same coefficient estimated in Model 2 and it loses its statistical significance. The favorable effect of living in extended families has not changed.

In addition, as expected, among children living in households where the educational level of the household head is only elementary schooling (54 percent did not complete elementary schooling and 23 percent did it) the stunting likelihood is higher than among those living in households where the educational attainment of the head of household is at least complete secondary schooling. Stunting likelihood among children living in households in the lowest level of the wealth index (88 percent of children living in households in the fourth quartile of the wealth index) is higher than among those children living in households in the highest level of the wealth index.

Food assistance (given by governmental institutions or other type of institutions), is an adequate indicator of socioeconomic status. Therefore,

as expected, the likelihood of stunting among children living in households receiving this type of assistance (72 percent) is higher than among those living in households that do not receive this type of assistance.

Discussion

The main goal of this study is to analyze the role of family structure on stunting among preschool Argentinian children. Results show that the relationship between family structure and the likelihood of stunting among children two to five years of age is mediated by the socioeconomic status of the family. Specifically, our analysis indicates that the likelihood of stunting is higher among children living in single-parent families, as compared to those living in nuclear families, through the economic status of the family. Unexpectedly, the likelihood of stunting among children living in extended families is lower than among those living in nuclear families.

This last result is consistent with previous results obtained by Crookston and colleagues (2010)[19] showing that stunting is less severe among infants 6 to 18 months of age living in households with co-residing grandparents, than among those living in other types of households. Their results also show that the likelihood of reaching an adequate height between ages four and six years among those who were previously stunted is higher if they had co-resident grandparents. Our results for children in single-parent households living with relatives show similar protective effects against stunting as for children living in extended families. Although in the case of single-parent families with relatives, the associated coefficient is not statistically significant (may be due to the small number of this type of families included in the analytical sample, 310, only 2.7 percent of households). It is noteworthy to mention that in more than 80 percent of households with co-resident relatives, that is to say, single-parent families with relatives and extended families, these relatives are grandparents.

In addition, our results are somewhat consistent, with those obtained by Schmeer (2013)[20] who studied anemia (another undernutrition indicator) among Mexican children 3 to 12 years of age. Schmeer´s results show that co-residence with maternal grandparents have a beneficial effect on anemia in children, independently of the type of living arrangement.

Aubel (2012) also highlights the important role of grandmothers in the family and in the community in nonwestern societies of Asia, Africa, and

[19] The study done by Crookston *et al*. (2010) analyzed 1 674 Peruvian children participating in the Young Lives Study.
[20] This study is based on a simple of 4 649 children of the Mexican Family Life Survey,

Latin America. Grandmothers advise and educate young women in every aspect related to household well-being and have a great influence on the decision-making processes of fathers and other male family members.

When including in Model 2 an interaction between family type and sex of the household head (results not shown), the likelihood of stunting is higher (and statistically significant at a 10 percent level) among children living in single-parent families with a female head of household than among children living in nuclear families. In Model 3, which includes variables adjusting for socioeconomic status, the coefficient associated with single-parent families with female head losses statistical significance. These results suggest, as previously mentioned, that the nutritional disadvantages of living in single-parent households with female head are mediated by factors related to the economic well-being of the household.

Several studies highlighted the higher stunting prevalence observed in the Argentinian provinces of the Northwest and Northeast regions (Acosta *et al*., 1993; Bolzán *et al*., 2005; Bolzán and Mercer, 2009). However, our results show that once the variable related with household size, adjusted for the energetic needs of the household members according to age and sex, is considered, the stunting likelihood among children in any region of the country is not statistically different from the stunting likelihood among children in the City of Buenos Aires. The City of Buenos Aires is the wealthiest of the country. It is worth mentioning that the households defined as large-sized household are mainly clustered in the Northeast and Northwest regions (23.4 y 27.9 percent, respectively).

According to previous findings in the literature, our results show the favorable influence of a higher educational attainment of the head of household on the stunting likelihood of children (Desai, 1992; Frost *et al.*, 2005). Prevalence likelihood is higher among children living in households where the household head has less than, or at least has, high school education. Results obtained from the other socioeconomic indicator, the wealth index, also are in accordance with previous research findings. The likelihood of stunting is higher among children living in households of lower economic status (Castro *et al*., 2005).

The result about food assistance has a more difficult interpretation. On the one hand, not being a longitudinal study causality cannot be established. On the other hand, the coefficient associated with the Food Assistance variable has a counterintuitive sign that is to say that, the fact of living in a household receiving any type of food assistance is detrimental for the nutritional status of children. Our interpretation is that this result reflects

the needs of the households receiving the assistance. Following this reasoning, the result is similar to results obtained from the other socioeconomic variables.

Several studies about the determinants of child undernutrition show differences between sexes that are contradictory, particularly regarding stunting. For example, while Castro and colleagues (2005) found a higher likelihood of stunting among girls than among boys,[21] Martorell and Young (2012) found a higher likelihood of stunting among boys than among girls.[22] The present study did not show differences between males and females regarding the likelihood of stunting.

A strength of our study is the sample size that is composed of more than 11 thousand children between two and five years of age. Despite the large sample size, this study has some limitations. First, being a cross-sectional study we cannot establish causality but only associations. Second, the categories defined as nuclear families and single-parent families include different groups which, given the characteristics of the ENNyS study, are not completely identifiable. These groups may have different parenting attitudes and styles, including decisions about meals and food consumption. For example, parents in nuclear families may be married or cohabiting; mothers and fathers in single-parent families may differ among them from divorced or never-married parents. Third, the sample does not include households where the household head is not the father or the mother of the index child, nor does it include households with members that are not relatives. Therefore, results of the present study are not generalizable to this type of families and the sample ends up not being nationally representative. Finally, this study has the typical limitation of non-observable factors that may have selected children to belong to a particular type of family, which may also be related to undernutrition.

Conclusions

Although socioeconomic characteristics show a significant effect on the likelihood of stunting among Argentinian preschool children, our analysis also identifies the independent role of family structure on the nutritional status of this population. Results suggest that the likelihood of stunting among preschool children living in extended families that include one or both of their grandparents is lower than the likelihood of stunting among

[21] Castro *et al*. (2005) studied 3 240 children 11 years of age living in the Colombian department of Antioquia.
[22] Martorel and Young (2012) analyzed a sample of 10 317 children five years of age in Guatemala (Reproductive Health Survey)

children in nuclear families. Results also suggest that the relationship between single-parent families and the likelihood of stunting is mediated by the socioeconomic status of the family.

Research on stunting during childhood is important in terms of future social interventions given the long lasting effects of stunting identified in several areas like cognitive development, educational attainment, and economic productivity in adulthood (Dewey y Begum, 2011).

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