DOI: 10.1590/1413-81232018235.23162015

Associating socioeconomic position and maternal depression with the health of children: an evaluation of the 2008 Brazilian household survey

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Abstract *The study analyzed the association between socioeconomic position (income), maternal depression and the health of children in Brazil, using information from the 2008 National Household Survey (PNAD/IBGE). The analysis considered the sampling design for the research and included 46,874 individuals up to the age of nine. The Poisson models were estimated for three health outcomes for children: health as reported by the parents or the responsible person, restrictions on habitual activities for health reasons and periods when they were confined to bed two weeks before the interviews in the study. The results showed an association between the mothers' depression and the three health outcomes, even after taking into account the following: socioeconomic position, maternal characteristics (health self-referral, age, level of education and smoking), age, gender, the child's race, geographical region, the situation as noted in the census and the number of residents in a household. It was found that there still exists an association between maternal depression and children's health irrespective of socioeconomic position. Therefore public policies that aim to reduce the adverse effects of maternal depression on the health of children need to also take into account the higher income segments of society.*

Key words *Children's health, Maternal depression, Socioeconomic position, Poisson regression*

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Introduction

Children's health, and the innumerable factors that may influence it, has generated a lot of interest from researchers throughout the years. Amongst these factors, the following can be highlighted: socioeconomic level, the dynamics of the family, nutritional aspects, the type of health services used, any health plan coverage that exists and the health and hygiene of the household[1-13]. There is evidence that a child's health can be very important in relation to many aspects of their adolescence and their adult life[14-16]. Cognitive development and learning, for example, can be compromised when the child experiences adverse events in their lives[14]. These cognitive deficits and learning difficulties ultimately mean poor performance in the job market, resulting in low salaries and underemployment[15]. Thus, individuals that face health problems in their childhood, when they become adults they invariably have low socioeconomic status and the worst health conditions[16].

The most common factors that are often associated with health in an individual's childhood are: socioeconomic factors such as family income[1-13] and the level of education of their parents[2,5,7,13,17] particularly their mothers, the parents behavior (principally the mother's behavior when pregnant and the associated risk factors such as smoking, alcoholism, taking illegal drugs, obesity amongst others[2,4-6,13,17]), the eating habits of the children (such as breastfeeding, eating vegetables and fruits or drinking drinks that contain an excessive amount of sugar and eating food with a lot of fat and sodium[5,10,18,19]) and the health of the parents, particularly the mother's health[4,5,9,18].

One of the maternal health dimensions that have been pointed out as relevant for the innumerable health aspects and the development of children, is mental health and particularly depression[20-25]. In a recent study, it was found that 20% of women in developing countries presented signs of depression after having given birth[26] which is figure well above that which has been found in developed countries[27]. In spite of some of the transmission mechanisms for the effects of maternal depression on the health and development of children being genetic in nature[4], it is reasonable to suggest that there is a type of behavioral path through which the mental health of a mother affects the child[4,25].

In this context the object of this study was to explore the association between children's health, socioeconomic positions and maternal depression whilst taking into account other factors that are possibly associated with the aforementioned outcomes. Aside from this, we also looked to see whether there were any associations between children's health and maternal depression in relation to the different levels of income. Even if the adverse effects of mental depression on the health and development of children (especially in relation to psychopathological questions) were established in medical journals, any relations with the physical health of children such as variations in the association of socioeconomic positions, have been subject to few studies. Also this work has contributed to the discussions on the factors associated with children's health through bringing an analysis using the National Household Survey of 2008 which is a national survey and which is the most recent that is available (the most recent results from the National Health Survey of 2013 did not take into account socioeconomic position). The majority of studies that have conducted this type of analysis, have used more specific data and have focused on certain regions or in cities.

Method

The study used information from the National Household Survey (PNAD) of 2008 and its supplementary research on health which was done in 2008. The Brazilian Institute of Geography and Statistics (IBGE) carried out the PNAD annually in five studies (1981, 1986, 1998, 2003 e 2008)[28], where research was done on the health characteristics of the population. The research is done through the use of random samples obtained through a three stage selection process. In the first stage the municipalities were classified as self-representative with a probability of 1 of belonging to the sample and there was also non self-representative. These last ones were stratified and from each strata municipalities were selected with replacements and proportional probability for the resident population in accordance with the Demographic Census of 2000. In the second stage, the census sectors in each of the sample municipalities were also selected with replacements and with proportional probability for the number of households units that were in existence for the 2000 Demographic Census. In the third stage, the households units were selected with equal probability in each one of the census sectors for the sample[29]. Thus, the PNAD for the year 2008 included 850 municipalities, 150,591 households and 391,868 individuals.

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The reference population for this study included individuals aged up to the age of 9 years old who were children of the reference person in a household totaling 46,874 observations. Also individuals up to the age of 9 were considered in order to lessen potential problems of reverse causality between the health conditions and incomes, since the proportion of children in this age range that worked and contributed to the household income was very small[30]. Aside from this, the evidence suggests that in general, children's health does not influence the decision of the parents to work nor does the family income[31].

The questions in the PNAD questionnaire sought to obtain a wide understanding of the profile of households, families and individuals covering: income, level of education, smoking, health and incidence of chronic disease amongst others[32].

Three health outcomes for the children's health were used; one being subjective and two being objective. The subjective one related to the health of the child as reported by the child's parents. The results were codified to indicate their health status being either regular or bad (regular, bad or very bad = 1, very good or good = 0). The objective health outcomes were: 1) If the child presented some restrictions in their activities that were considered to be habitual due to health reasons in the two weeks that led up to the research (yes/no). 2) If the child had to be confined to bed during the same period (yes/no).

There were independent variables in relation to socioeconomic position that were represented by monthly income per capita (in quintiles, being the 1st quintile with the less amount of income) and the following maternal characteristics were taken into account: age (15-29/30 - 39/≥40 years old), level of education in years of study that were completed (zero/1-3/4-7/8-10/≥11 years), currently smoking on a daily basis (yes/no), self-referred health (very good and good = 1, regular, bad or very bad = 0), and depression (yes/no). This last one that obtained through the following question: Has any doctor or health care professional told you that you are suffering from depression? Aside from these, other controls were used: age (in months), sex (male/female), race (white/non-white) of the child, geographical region (central western, north east, northern, south east and south), situation as stated in the census (urban/rural) and number of residents in the household.

The data was analyzed using the *Stata*, version 13.0. software. As this was a piece of research with a complex sample structure with multiple selection stages, the scope of the PNAD was considered in all of our calculations for this study. Therefore, this study used the command *svyset* to identify the weight and conglomerates of the sample. Afterwards the prefix *svy* was used in all of the measurements. The method used in the estimates was the model known as the Poisson regression which permits estimates of the prevalence ratio or the relative risk directly through the model's regression coefficients[33]. Thus, the gross prevalence and adjusted prevalence was calculated for each of the health outcomes. The level of significance was considered as 5%.

The present study did not need to go through the any approval process such as through an Ethics Committee in Research, as the data that was used in this study was already in the public domain with unrestricted access and the individuals could not be identified[34].

Results

In 2008, the household income per capita on average was R$378.06 (DP: R$ 5.36) (data not shown in the tables), which corresponds to a little more than 91% of the minimum salary (R$ 415.00). Table 1 shows a description of the sample used in the present study. Of the children that made up the sample, 37.7% were 3 years old, 30.1% were between 4 and 6 years old and 35.2% were in the age range of 7 to 9 years old. The proportion of boys was a little over (50.7%) and out of all the races that were represented, the majority were white (48.2%) and mixed (47.2%).

More than 90% of the parents or guardians considered the health of their children to be very good or good and only 0.65% considered them to be bad or very bad. The prevalence of periods confined to bed in the two weeks that preceded the research was 3.6%. 8.4% of the children stopped doing habitual activities for health reasons during the period of reference.

The majority of the mothers (85.6%) were between the ages of 15 to 39 and 35.1% had 11 or more years of schooling. The prevalence of health being very good or good was 76.7% whilst 5.5% reported that a doctor or a health care professional told them that they had depression. In relation to smoking, 12.5% stated that they smoked a tabaco related product on a daily basis.

Table 2 shows the prevalence and both the gross and adjusted prevalence ratios for regular or ill health of the child, based on their socioec-

Table 1. Description of the sample of mothers and children in the National Household Survey 2008/2009, Brazil. (N = 46.874).

Variables	N	%	IC 95%
Children's characteristics			
Age (in years)			
0 to 3	16.362	34.7	34.3-35.2
4 to 6	14.125	30.1	29.7-30.5
7 to 9	16.387	35.2	34.7-35.6
Sex (male)	23.922	50.7	50.3-51.2
Race			
Native Indian	101	0.2	0.1-0.4
White	21.179	48.2	47.3-49.1
Black	2.071	4.1	3.8-4.4
Asian	151	0.4	0.3-0.5
Mixed-race	23.372	47.2	46.3-48.0
Health Self-Referral			
Very good	15.730	34.9	33.9-35.9
Good	26.223	56.2	55.2-57.2
Regular	3.906	8.2	7.9-8.7
Bad or very bad	326	0.65	0.6-0.8
She/He was confined to bed in the last 14 days	1.758	3.6	3.4-3.9
Restrictions in the habitual activities for health reasons in the last 14 days	3.975	8.4	8.0-8.7
Maternal Characteristics			
Age (in years)			
15 to 29	20.328	42.68	41.9-43.4
30 to 39	20.018	42.9	42.2-43.6
≥ 40	6.528	14.4	13.9-14.8
Level of Education			
0	3.261	7.0	6.7-7.6
1 to 3	4.547	9.8	9.3-10.3
4 to 7	13.524	28.8	28.1-29.5
8 to 10	9.106	19.2	18.7-19.8
11 years of study or more	16.436	35.1	34.3-35.9
Very good health or good health	35.691	76.7	76.1-77.4
Suffering from depression	2.495	5.5	5.2-5.8
Smoking daily	5.696	12.6	12.1-13.1

onomic position and maternal characteristics. In relation to socioeconomic position. In the gross analysis that was conducted health prevalence was regular or bad in the quintile for the lower incomes, being 3.26 times greater than the higher incomes. After adjustments, the prevalence of children with a state of health being regular or bad in the first quintile was 1.97 time greater than the prevalence that was observed in the fifth quintile. In a general way, the prevalence of regular or bad health was significantly less in the quintile having the greater income when compared to the rest.

In relation to the maternal characteristics, in the gross analysis, we noted that amongst the mothers that were suffering from depression, 13.9% had children whose health was regular or bad compared with 8.6% of them not having depression. After the adjustments in the socioeconomic position and the other maternal characteristics shown in Table 2, the prevalence of health being bad for children was 1.18 times greater amongst mothers with depression compared with those without depression.

On analyzing the results adjusted for the other maternal characteristics, we observed that the self-reported health, age and level of education (11 or more year of education) of the mothers showed associations with the health of the child which was not the case for smoking where we did not observe any associations that were statistically significant.

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Table 2. Prevalence, gross and adjusted prevalence ratios for the regular or poor reported health of the children by the parents according to socioeconomic position and maternal characteristics. National Household Survey 2008/2009, Brazil.

Variables	Prevalence of health, regular or poor for children (%)	Prevalence ratio					
		Gross	CI 95%	p value#	Adjusted	CI 95%	p value#
Income (quintile)							
1st (least)	13.0	3,26**	(2.84 - 3.75)	< 0.001	1.97**	(1.68 - 2.31)	< 0.001
2nd	10.9	2.74**	(2.39 - 3.14)		1.68**	(1.45 - 1.95)	
3rd	9.8	2.45**	(2.14 - 2.81)		1.69**	(1.47 - 1.95)	
4th	7.2	1.81**	(1.57 - 2.09)		1.42**	(1.24 - 1.64)	
5th (greater)	4.0	1.00			1.00		
Maternal Characteristics							
Maternal Depression							
No	8.6	1.00		< 0.001	1.00		0.011
Yes	13.9	1.61**	(1.43 - 1.82)		1.18*	(1.04 - 1.33)	
Health Self-Referral							
Regular/bad/really bad	19.2	1.00		< 0.001	1.00		< 0.001
Very good/good	5.8	0.30**	(0.28 - 0.33)		0.35**	(0.32 - 0.38)	
Age (years)							
15 to 29	10.1	1.00		< 0.001	1.00		< 0.001
30 to 39	7.9	0.78**	(0.72 - 0.85)		0.85**	(0.79 - 0.92)	
≥ 40	8.7	0.86**	(0.78 - 0.96)		0.85**	(0.76 - 0.94)	
level of education (years)							
0	11.6	1.00		< 0.001	1.00		< 0.001
1 to 3	13.2	1.14	(0.99 - 1.31)		1.09	(0.95 - 1.25)	
4 to 7	10.5	0.91	(0.80 - 1.02)		0.97	(0.85 - 1.09)	
8 to 10	9.6	0.82**	(0.73 - 0.94)		0.96	(0.84 - 1.10)	
≥ 11	5.5	0.47**	(0.42 - 0.54)		0.77**	(0.66 - 0.89)	
Daily Smoking							
No	8.8	1.00		0.023	1.00		0.781
Yes	9.9	1.12*	(1.02 - 1.24)		0.99	(0.89 - 1.09)	

Notes: #Value p refers to the Wald test under the null theory of equality between the PRs. Aside from the socioeconomic position and the maternal characteristics shown in the table, the prevalence ratios were adjusted by: age, sex, race of child, geographical region, situation as mentioned in the census and the number of residents in a household. Where **p < 0.01, *p < 0.05.

The prevalence, gross and adjusted prevalence ratios for children with restrictions on their habitual activities for health reasons in the two weeks before interviews were conducted, according to the socioeconomic position and maternal characteristics, are shown in Table 3. We noted that socioeconomic position did not show any associations with the health outcomes. In relation to the results on depression amongst the mothers with the condition, 12.7% had children with restrictions on their habitual activities compared to 8.1% amongst mother without depression. This was the case whilst the prevalence of children with restrictions on their habitual activities after adjustments was 35% greater amongst the mothers with depression.

Looking at Table 3, we noted that self-reported health and maternal age presented themselves as factors significantly associated with occurrences of restrictions in habitual activities. The level of education and whether the mothers were smokers, on the other hand, did not present any associations with the health outcomes when considering the adjusted model.

Table 4 shows the prevalence and the gross and adjusted prevalence ratios for children who were confined to beds during the two weeks that preceded the PNAD interviews that covered so-

Table 3. Prevalence, and gross and adjusted prevalence ratios for restrictions on the habitual activities due to health reasons in the two weeks preceding the study. Research based on socioeconomic position and maternal characteristics. National Household Survey 2008/2009, Brazil.

Variables	Prevalence of restrictions in habitual activities (%)	Prevalence ratio					
		Gross	CI 95%	p value#	Adjusted	CI 95%	p value#
Income (quintile)							
1st (least)	8.2	0.98	(0.87 - 1.09)		1.03	(0.90 - 1.18)	
2nd	8.1	0.96	(0.86 - 1.08)		0.94	(0.82 - 1.07)	
3rd	8.8	1.04	(0.94 - 1.16)	0.706	1.01	(0.90 - 1.14)	0.467
4th	8.3	0.99	(0.89 - 1.09)		0.96	(0.86 - 1.06)	
5th (greater)	8.4	1.00			1.00		
Maternal Characteristics							
Maternal Depression							
No	8.1	1.00		< 0.001	1.00		< 0.001
Yes	12.7	1.56**	(1.38 - 1.77)		1.35**	(1.19 - 1.54)	
Health Self-Referral							
Regular/bad/really bad	12.0	1.00		< 0.001	1.00		< 0.001
Very good/good	7.3	0.61**	(0.56 - 0.65)		0.59**	(0.54 - 0.64)	
Age (years)							
15 to 29	9.0	1.00			1.00		
30 to 39	8.0	0.88**	(0.82 - 0.95)	< 0.001	0.91*	(0.84 - 0.98)	0.005
≥ 40	7.5	0.83**	(0.75 - 0.93)		0.85**	(0.76 - 0.95)	
level of education (years)							
0	7.2	1.00			1.00		
1 to 3	7.9	1.10	(0.92 - 1.30)		1.03	(0.86 - 1.22)	
4 to 7	8.1	1.12	(0.96 - 1.32)	0.067	1.04	(0.88 - 1.22)	0.387
8 to 10	8.7	1.21*	(1.03 - 1.43)		1.09	(0.92 - 1.30)	
≥ 11	8.7	1.21*	(1.03 - 1.41)		1.14	(0.96 - 1.37)	
Daily Smoking							
No	8.3	1.00		0.345	1.00		0.145
Yes	8.7	1.05	(0.95 - 1.16)		1.08	(0.97 - 1.20)	

Notes: #Value p refers to the Wald test under the null theory of equality between the PRs. PR adjusted by (aside from household income and maternal characteristics): age, sex, race of child, geographical region, situation as mentioned in the census and the number of residents in a household. Where ** $p < 0.01$, * $p < 0.05$.

cioeconomic position and maternal characteristics. In relation to the socioeconomic position, the gross prevalence ratio showed that the prevalences of periods confined to bed were greater in the first, second and third quintiles when compared with the prevalence observed in the fifth quintile. After the adjustments, however, the result was statistically significant only for the first quintile.

As what occurred with the other two health outcomes, maternal depression showed an association with periods confined to bed for children. In the gross analysis, this health outcome was 6.7% amongst mothers that showed signs of depression. This was a value 1.95 times greater than what was observed amongst mothers that did not have the condition. In the adjusted model, the prevalence of children that were confined to bed for about one day in the two weeks before the research was 54% greater amongst the mothers that showed signs of depression compared with those that did not show any signs. Concerning the other maternal characteristics, only health self-referral and age (30 to 39) showed associations with periods of time confined to bed.

Finally, Table 5 shows the gross and adjusted prevalence ratios for children with poor health according to their confinement to bed amongst socioeconomic position and maternal depression. Through an analysis of socioeconomic

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Table 4. Prevalence, and gross and adjusted prevalence ratios in the periods of confinement to bed due to health reasons in the two weeks preceding the study. Research based on socioeconomic position and maternal characteristics. National Household Survey 2008/2009, Brazil.

Variables	Prevalence of periods spent in a hospital bed (%)	Prevalence ratio					
		Gross	CI 95%	p value#	Adjusted	CI 95%	p value#
Income (quintile)							
1st (least)	4.1	1.32**	(1.11 - 1.58)		1.29*	(1.04 - 1.61)	
2nd	3.8	1.22*	(1.02 - 1.47)		1.10	(0.89 - 1.35)	
3rd	3.8	1.21*	(1.01 - 1.44)	0.0214	1.09	(0.90 - 1.32)	0.088
4th	3.4	1.08	(0.90 - 1.29)		1.00	(0.83 - 1.20)	
5th (greater)	3.1	1.00			1.00		
Maternal Characteristics							
Maternal Depression							
No	3.5	1.00		< 0.001	1.00		< 0.001
Yes	6.7	1.95**	(1.62 - 2.34)		1.54**	(1.27 - 1.86)	
Health Self-Referral							
Regular/bad/really bad	6.3	1.00		< 0.001	1.00		< 0.001
Very good/good	2.8	0.45**	(0.41 - 0.51)		0.47**	(0.42 - 0.53)	
Age (years)							
15 to 29	4.0	1.00			1.00		
30 to 39	3.3	0.82**	(0.73 - 0.92)	0.002	0.84**	(0.74 - 0.95)	0.017
≥ 40	3.5	0.88	(0.75 - 1.04)		0.87	(0.73 - 1.03)	
level of education (years)							
0	3.7	1.00			1.00		
1 to 3	3.8	1.02	(0.80 - 1.29)		0.94	(0.75 - 1.19)	
4 to 7	3.8	1.03	(0.83 - 1.27)	0.514	0.97	(0.79 - 1.21)	0.845
8 to 10	3.6	0.97	(0.77 - 1.22)		0.92	(0.73 - 1.18)	
≥ 11	3.4	0.91	(0.73 - 1.14)		1.01	(0.77 - 1.31)	
Daily Smoking							
No	3.6	1.00		0.029	1.00		0.131
Yes	4.2	1.19*	(1.02 - 1.38)		1.13	(0.96 - 1.32)	

Notes: #Value p refers to the Wald test under the null theory of equality between the PRs. PR adjusted by (aside from household income and maternal characteristics): age, sex, race of child, geographical region, situation as mentioned in the census and the number of residents in a household. Where**$p < 0.01$, *$p < 0.05$.

positions of the mothers that were not suffering from depression, it was possible to observe a direct association between income and the health of the children. We also noted a prevalence for children with poor health in the first quintile of income, amongst the mothers that did not have depression. For example it was 133% greater when compared to the prevalence observed in the fifth quintile of the highest income between the mothers than for those that were not suffering from depression. Aside from this, upon analyzing the difference between the prevalence ratio in each income quintile given the presence or not of depression, we were able to observed that they were statistically significant - with the exception of the second quintile - being a difference that was less in the quintile with the highest income.

Discussion

Childhood health and the passive factors that can influence it is an area that is being studied on a regular basis. This is because it is thought that health at this period in someone's life can greatly influence many other aspects of a person's life in their future[14-16]. In this study we sought to analyze the association between children's health, socio-

Table 5. Gross and adjusted prevalence ratios for children with regular or poor health according to interactions between socioeconomic position and maternal depression. National Household Survey 2008/2009, Brazil. (N = 46.874).

	Gross PR	CI 95%	Difference	Value p#	Adjusted PR	CI 95%	Difference	Value p#
1º Q. x Without depression	3.36**	(2.90 - 3.89)	2.179	< 0.001	2.33**	(1.97 - 2.76)	1.601	< 0.001
1º Q. x With depression	5.54**	(4.21 - 7.27)			3.93**	(2.92 - 5.30)		
2º Q. x Without depression	2.89**	(2.50 - 3.33)	0.275	0.496	2.06**	(1.75 - 2.42)	0.465	0.126
2º Q. x With depression	3.16**	(2.38 - 4.19)			2.52**	(1.90 - 3.35)		
3º Q. x Without depression	2.48**	(2.14 - 2.87)	2.078	< 0.001	1.91**	(1.64 - 2.23)	1.729	< 0.001
3º Q. x With depression	4.56**	(3.56 - 5.83)			3.64**	(2.83 - 4.69)		
4º Q. x Without depression	1.83**	(1.57 - 2.13)	1.575	< 0.001	1.55**	(1.33 - 1.81)	1.401	< 0.001
4º Q. x With depression	3.40**	(2.58 - 4.49)			2,95**	(2.23 - 3.92)		
5º Q. x Without depression	1.00		1.137	< 0.001	1.00		1.091	< 0.001
5º Q. x Without depression	2.14**	(1.45 - 3.15)			2.09**	(1.42 - 3.08)		

Notes: #Value p refers to the Wald test under the null theory of equality between the RPs. The prevalence ratios were adjusted by: age, sex, race of child, geographical region, level of education, whether the mother smoked, situation as mentioned on the census and the number of residents in a household. Where ** $p < 0.01$, * $p < 0.05$.

economic position and some maternal characteristics including depression, in Brazil. We used information from the 2008 National Household Survey (PNAD) which included supplementary data on health. From the PNAD we were able to obtain a national panoramic view of the factors associated with children's health which can contribute to the forming of policies in the ambit of public health.

Socioeconomic position[1-13] and the maternal characteristics such as health[1,4,5,9,18], age, level of education[2,5,7,10,12,13,17,30] and whether someone smokes[2,13,17] have been designated as having an association with the health of children, by many studies. Being in the highest socioeconomic position provides individuals with the opportunity to acquire goods and services related to health[9] and which means that children with health problems have a better chance of recovering. They can even be protected from the occurrence of adverse events[30] that may harm their health[35]. The results of this study showed that there were associations between socioeconomic positions and children's health only for the health that was reported. This was probably due to the short term nature of the health outcomes and the high presence of morbidity that did not restrict their activities nor did it leave the children confined to bed. Health that was very good or good for the mothers, showed a strong inverse association with the three health outcomes, proving that mothers with poor health have a greater chance of having a child that is unhealthy, either due to genetic causes or on account of the limitations of an ill mother to look after her child adequately[1,9,30]. Maternal age was shown as a protective factor for children's health. This was possibly due to a greater capacity in providing adequate care that experience in life brings. Unexpectedly, the level of education and maternal smoking did not show any association with children's health.

Maternal depression has been mentioned as an important risk factor for health and the development of a child[20-25]. Goodman and Gotlib[25] have offered up a model for understanding the transmission mechanisms of the risk for psychopathology in children with mothers who are suffering from depression. The authors suggest that about four mechanisms are in existence, amongst them are: the exposure to cognitive and behavioral problems and problems related to affection which mothers with depression are more likely to show. This is the same as the stressful life of their children. The consequences of maternal depression on the physical health of children have been receiving less attention in comparison to the general health of children. This is in spite of the fact that a mother's depression can directly affect both of them[4,36].

The behavior of mother's suffering from depression can affect, in a negative way, innumerable aspects of a child's life such as: generating be-

havioral problems, problems regarding the display of affections, and both cognitive and social problems. All of these can present adverse consequences covering the period from childhood to the initial stages of adulthood[20,37]. This is because mothers with depression tend to be less attentive to their children which can result in their being more accidents in the home or the parents having difficulties in recognizing the symptoms of morbidity and as a result they end up seeking medical assistance at a very late stage. They may also be inconsistent in relation to the care that they give and in the use of preventative measures for children suffering from chronic diseases[4].

Aside from this, the depressive behavior of mothers can have adverse effects on children's health for being related to the deterioration of the child-mother relationship[20]. Also, a mother's depression increases the risk of a child showing alterations in their cerebral activity[38]. Such negative results on the health and development of children occur because mother's with depression are subject to displaying: difficulties in connecting with their child[36] , thus becoming less sensitive to responding to signs from their children[21], not being attentive in looking after their child, psychological unavailability, sadness, anxiety and problems with imposing discipline on their child[20]. Also, depression can affect the capacity of mothers in breastfeeding and caring for the health of their baby[22]. This in turn becomes a risk factor for a child being malnourished[23].

The results of this study suggests maternal depression has an important influence on the health of children in Brazil. For the three health outcomes that were considered, we observed a significant association between mothers with depression and children's health, even when considering the controlling influence of socioeconomic positions, the other maternal characteristics and the characteristics of the children. This was also the case even after considering geographical factors and relations with households.

Aside from this, on exploring the interaction between socioeconomic positions and maternal depression, we sought to understand how the association between these factors presented themselves in the different income levels. The difference between the prevalence ratio in each income quintile, where depression was presence or not, allowed us to conclude that the relationship between children's health and maternal depression is relevant even amongst the most richest people in societies. In the third quintile for the intermediate income, this quintile showed the greatest difference amongst the prevalence ratios. Such a result seems to suggest that any relations between maternal depression and children's health does not depend on socioeconomic position. However, on comparing extremes, there is some evidence that suggests that this relationship is more accentuated between the poorest, which can be seen in their having less resources to deal with depression.

In summary, this study has contributed to reinforcing some theories that were proposed in previous studies as well as bring evidence of the effect of depression. This was done through the use of national, representative data. In relation to the economic situation, we found a positive effect of income on children's health which had been recognized by innumerable other studies. In relation to the maternal characteristics, the evidence found in this study showed that the mother's health, be it based on her own general perception or due to depression, is strongly associated with the child's health. Maternal depression tends to produce adverse effects on a child's health and their development that can extend into adulthood. However, other contributions that were made to this work showed that there was an association between maternal depression and children's health, which did not depend on the level of income. This also affects also the richest people. With this in mind, public health policies that seek to mitigate the adverse effects of maternal depression on the health of children, need to consider this strata of society.

It is worth noting, however, some limitation that we had with this study. Firstly, due to the transversal nature of the PNAD, the associations were not able to be interpreted as causal relations. Secondly, in the case of reported health, there is a possibility of there being a problem with reverse causality in the associations that we observed. This is because mothers that were recently diagnosed with depression may have shown morbidity due to the fact that their child was ill. Continuing on this vein, the associations shown may have been reflecting the effect of children's health on depression instead of the opposite.

Collaborations

PHS Leivas, CAO Tejada, AH Dâmaso, AMA Santos and PA Jacinto contributed equally in the elaboration of the project, writing the article, reviewing the relevant literature and reviewing the intellectual content, analyzing and interpreting the results and approving the final version for publication.

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Article submitted 13/05/2015
Approved 22/07/2016
Final version submitted 24/07/2016