

DOCUMENT DE TREBALL

XREAP2012-13

**Intermediary and structural determinants of
early childhood health in Colombia:
exploring the role of communities**

Ana María Osorio (RFA-IREA, XREAP)
Catalina Bolancé (RFA-IREA, XREAP)
Nyovani Madise

**Intermediary and structural determinants of early childhood health in Colombia:
exploring the role of communities**

Ana María Osorio^a, Catalina Bolancé^b and Nyovani Madise^c

June 2012

^a University of Barcelona, Department of Econometrics, Barcelona-Spain and Pontificia Universidad Javeriana, Department of Economics, Cali-Colombia.

^b University of Barcelona, Department of Econometrics, Barcelona-Spain.

^c University of Southampton, Division of Social Statistics and Centre for Global Health, Population, Poverty, and Policy, Southampton-United Kingdom

Abstract

This study examines how structural determinants influence intermediary factors of child health inequities and how they operate through the communities where children live. In particular, we explore individual, family and community level characteristics associated with a composite indicator that quantitatively measures intermediary determinants of early childhood health in Colombia. We use data from the 2010 Colombian Demographic and Health Survey (DHS). Adopting the conceptual framework of the Commission on Social Determinants of Health (CSDH), three dimensions related to child health are represented in the index: behavioural factors, psychosocial factors and health system. In order to generate the weight of the variables and take into account the discrete nature of the data, principal component analysis (PCA) using polychoric correlations are employed in the index construction. Weighted multilevel models are used to examine community effects. The results show that the effect of household's SES is attenuated when community characteristics are included, indicating the importance that the level of community development may have in mediating individual and family characteristics. The findings indicate that there is a significant variance in intermediary determinants of child health between-community, especially for those determinants linked to the health system, even after controlling for individual, family and community characteristics. These results likely reflect that whilst the community context can exert a greater influence on intermediary factors linked directly to health, in the case of psychosocial factors and the parent's behaviours, the family context can be more important. This underlines the importance of distinguishing between community and family intervention programmes.

Keywords: child health, intermediary determinants, structural determinants, communities, Colombia.

1. Introduction

There is vast evidence of the association between the place where children live and their health (Marmot, Friel, Bell, Houweling, & Taylor, 2008). The place where children are born may have considerable influence on their growth, development and survival. It is clear that life chances may be very different whether a child is born in Sweden or in an African country. But even within countries, these differences in life chances persist between social groups.

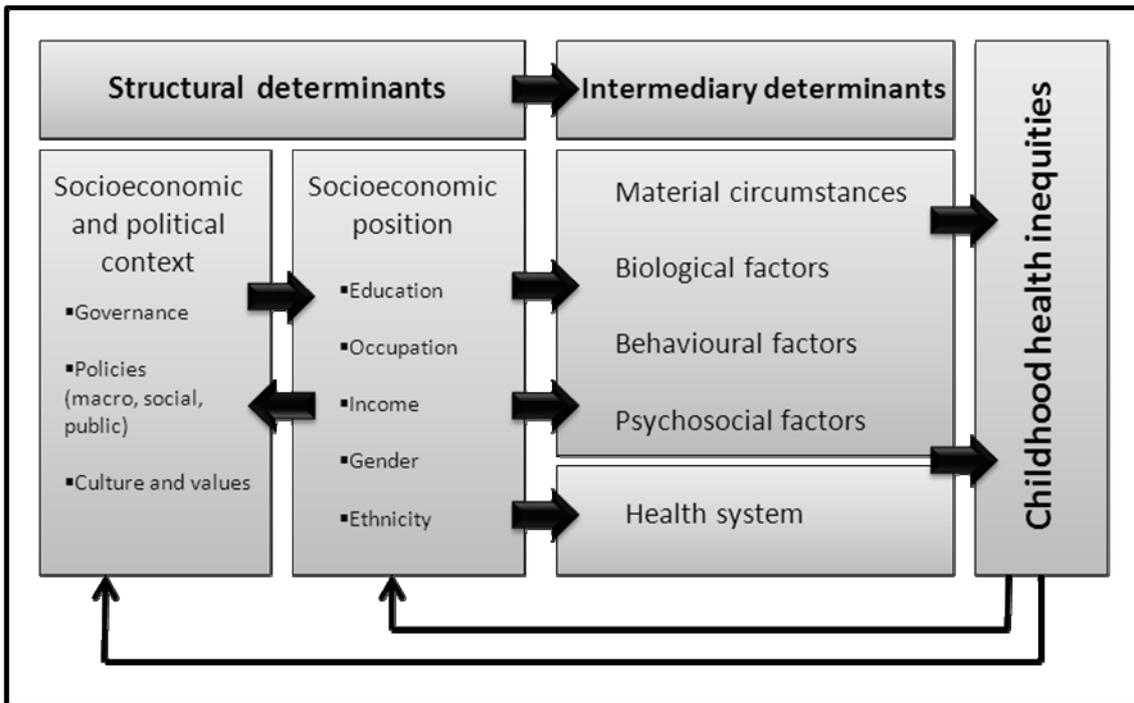
In order to obtain a better understanding of the differences in health status, their determinants and consequences on health inequities, the Commission on Social Determinants of Health (CSDH) was set up in 2005 by the World Health Organization (WHO). The CSDH conceptual framework highlights the importance for policy-making of the distinctions between the social factors that influence health and the social processes that determine their unequal distribution, giving special attention to the context and the structural mechanisms, this means the factors that generate or reinforce the social stratification (Solar & Irwin, 2010).

The conceptual framework for childhood health inequities adapted from CSDH is showed in Figure 1. The framework includes two key components: structural determinants and intermediary determinants of health inequities. The framework shows how the causes of health inequities are rooted in the socioeconomic and political context, which give rise a set of socioeconomic positions, whereby societies are stratified mainly according to income, education, occupation, gender, and ethnicity. These socioeconomic positions in turn have an indirect effect on health status, they operate through a set of specific determinants (intermediary determinants) of health to shape health inequities (Solar & Irwin, 2010).

The main intermediary determinants are: material circumstances, biological and behavioural factors, psychosocial factors and health system. Material circumstances are related to living and working conditions and food availability in households. The behavioural and biological factors category is associated to differences in lifestyle, such as nutritional habits and physical activity, as well as, including genetic factors. Psychosocial circumstances are linked to stressful events in the life course. Finally, the model includes the health system itself as a social determinant of health

The intermediary determinants are the most immediate mechanism through which socioeconomic position operates on child health inequities and, therefore, their identification may contribute to determine intervention policies at this level. This indicates the relevance these factors have, to the extent that they can be more easily modifiable, for instance, through programmes aimed at child and maternal care.

Figure 1. Conceptual framework of social determinants of child health



Source: Adapted from Solar and Irwin (2010)

In a similar vein, in recent years there has been a growing interest in analysing the causal pathways by which place where people live -communities, neighbourhoods or areas- influences health outcomes and shapes health inequities (Bernard et al., 2007; Cummins, Curtis, Diez-Roux, & Macintyre, 2007; Cummins, Macintyre, Davidson, & Ellaway, 2005; Diez Roux, 2001; Macintyre, Ellaway, & Cummins, 2002). From the point of view of public policy, understanding and disentangling the effects of context on individual health outcomes is important because not only can this lead to more effective policy design, but it can help determine the appropriate level of intervention of those policies, and hence contribute to the reduction of health disparities.

Additionally, using multilevel models as appropriate statistical technique to estimate contextual effects in health research, has been extensively examined in the literature (Diez Roux, 2000; Duncan, Jones, & Moon, 1998; Pickett & Pearl, 2001; Rice & Jones, 1997). Multilevel modelling represents an opportunity to take into account hierarchically clustered data into the analysis and explicitly modelling of variances at each level of the hierarchy. Thus, allowing us to identify the nature of variability and the effect of contextual factors on child health.

In the context of child health the majority of empirical research for developing countries using multilevel models, focus on health outcomes such as nutritional status (Boyle et al., 2006; Fotso, 2006, 2007; Fotso & Kuate-Defo, 2005, 2006; Griffiths, Madise, Whitworth, & Matthews, 2004; Larrea & Kawachi, 2005; Madise, Matthews, & Margetts, 2010; Reichman, Teitler, & Hamilton, 2009; Uthman, 2009), mortality rates (Ahamad, Tasnima, Khaled, Bairagi, & Deb, 2010; Antai & Moradi, 2010; Bocquier, Madise, & Zulu, 2011; Chin, Montana, & Basagaña, 2011) and immunization (Antai, 2009; Babalola, 2009). These studies mainly examine community contextual effects and

repeatedly find that even after controlling for relevant individual characteristics and contextual effects, significant variations at the community level persist.

Against this background, in our study we examine the underlying causes of child health inequities by exploring the influence that socioeconomic context may have on the more immediate determinants of child health and how they operate through the communities where children live.

The study uses Colombia as context of empirical enquiry. This is a lower-middle income country, heterogeneous both in its geography and in the level of socioeconomic development among its departments and municipalities. The country is divided into 32 departments and one capital district (Bogotá), in turn departments are formed by municipalities. There are 1,102 municipalities, which are the fundamental territorial entity of the political-administrative subdivision and they have political, fiscal and administrative autonomy.

Reducing inequity among Colombian departments and the care in early childhood are two of the priorities of the Colombian government's strategy included in the National Plan of Development 2010-2014 (Departamento Nacional de Planeación-DNP, 2011). The country has shown significant progress in child health. For example, in the last five years the under-five mortality rate has fallen from 24 to 19 deaths per 1000 live births, births attended by a doctor have increased by 5 percentage points to 93% and immunization coverage rates have reached 84%. However, there are still large differences between departments as well as within municipalities. For instance, the proportion of chronic childhood malnutrition by department ranges from 3.8% to 34.7%.

Although some studies have included the Colombian case in comparative analysis of child health outcomes (Hatt & Waters, 2006; Larrea & Freire, 2002; McQuestion, 2001), there are few studies that examine the influence of context on child health within the country (Acosta, 2012; Attanasio, Gómez, Gómez, & Vera-Hernández, 2004; Gaviria & Palau, 2006). Moreover, we are not aware of any research that has explored the role of communities on child health in Colombia.

The analysis proposed here by communities beyond the regional and national averages not only allows us to analyse contextual disparities in key areas for child health, but also may lead to differential intervention strategies in order to reduce place-based health inequalities (Coulton & Fischer, 2010; Coulton, Korbin, & McDonell, 2009).

Taking this on board, the purpose of this study is to improve our understanding of the pathways through which structural determinants influence different dimensions of intermediary determinants of child health and how they operate according to the communities where children live. We adopt the CSDH framework and construct an overall composite index of intermediary determinants of early childhood health. Furthermore, we analyse the different dimensions of these intermediary factors through the construction of two subindices. While one of them attempt to represent factors linked to the health system, the other one grouped together psychosocial and behavioural factors that can influence child well-being.

In order to generate the weight of the variables and take into account the discrete nature of the data, principal component analysis (PCA) using polychoric correlations are employed in the index construction. Weighted multilevel models are used in order to

examine community effects. Specifically, we focused on answering the following questions: i) What is the role of communities in shaping intermediary determinants of child health?, ii) Do such roles vary when different dimensions of intermediary determinants are taken into account?, iii) Is there significant variation in intermediary determinants of child health across communities? and iv) What is the relative contribution of individual and family characteristics to intermediary determinants of child health?.

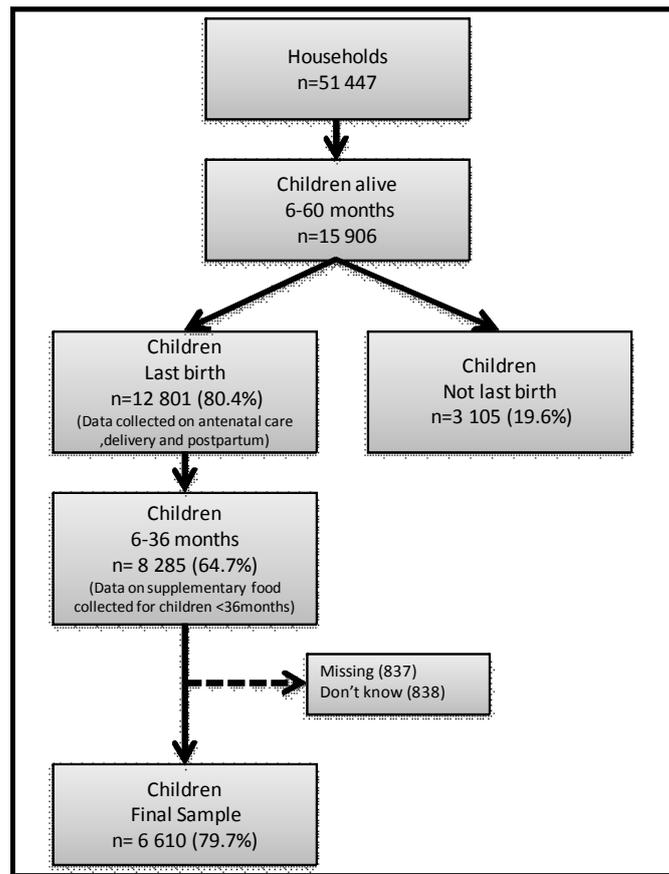
2. Data and Methods

2.1 Data

The data used in this analysis are from the Colombian Demographic and Health Survey (DHS) conducted in 2010. Profamilia has carried out this survey in Colombia every 5 years since 1990. The survey is nationally representative and covers the urban and rural areas of 6 regions (Caribbean, Eastern, Bogotá, Central, Pacific, and Amazon and Orinoco), 16 subregions and 33 departments (administrative subdivisions).

The DHS sample was obtained by a stratified, multistage and cluster sampling design. The sample included about 51,000 households in both urban and rural areas of 258 municipalities. Within municipalities, households with similar characteristics were grouped to form clusters on average of 13 households. We used these sampling clusters as proxy for community. The sample selection process is showed in Figure 2. The sample included a total of 15,906 children between 6 and 60 months who were alive at the time of the interview. The data on antenatal care, delivery conditions and postpartum were collected only for the last child born alive (n=12,801). On the other hand, the data on supplementary food were collected only for children under 36 months, which reduced the sample to 8,245 children. Finally, for all variables included in the study, values of “don’t know” or “missing” were excluded. Thus, our final sample comprised 6,610 children between 6 and 36 months alive and for whom we had complete information.

Figure 2. Flow chart for sample selection



2.2 Variables

Dependent variable: Intermediary Determinants of Early Childhood Health Index (IDECHI)

The dependent variable is a composite indicator of intermediary determinants of early childhood health (IDECHI)¹. Composite indicators have proven to be an efficient tool for analysing and formulating public policies, as well as for bench-marking country performances (Saltelli, 2007). They are useful tools for simplifying complex or multidimensional phenomena and making it easier to measure, visualize, monitor and compare trends in several distinct indicators over time and/or across geographic regions.

Adopting the conceptual framework of the CSDH, three dimensions related to child health were represented in the index: behavioural factors, psychosocial factors and health system. Since the dimension of material circumstances is highly correlated with the socioeconomic position, we do not include such dimension as part of the IDECHI.

In order to generate the weight of the index variables and take into account the discrete nature of the data, we employed principal component analysis (PCA) using polychoric correlations (Olsson, 1979; Olsson, Dragow, & Dorans, 1982). We used polychoric

¹ For more details of methodology used in the index construction, see our previous work (Osorio, Bolancé, & Alcañiz, 2011)

PCA as opposed to the strategy proposed by Filmer and Pritchett (2001), which breaks down the categorical variables into a set of dummy variables. Filmer–Pritchett procedure does not perform well with ordinal data and the proportion of explained variance estimated by this method is underestimated (Kolenikov & Angeles, 2009).

Based on Kaiser criterion (Kaiser, 1960), four principal components (PC1, PC2, PC3 and PC4) were selected. These four PC represent variables related to maternal care (PC1), child care (PC2), nutritional habits (PC3), physical activity (PC3) and parenting style (PC3 and PC4). The index was estimated using a weighted average of the components retained. The dimensions, indicators and variables represented by each component are presented in table 1.

Additionally, in order to examine the influences that communities may have on different dimensions of intermediary determinants; we used two subindexes (IDECHI_1 and IDECHI_2) as dependent variables. The health system dimension is represented by aggregating PC1 and PC2 (IDECHI_1), while PC3 and PC4 are combined into one subindex (IDECHI_2) representing behavioural and psychosocial factors dimension. The scores of indices range from 0 to 1, where 1 represents the best health conditions in intermediary determinants and 0 the worst circumstances.

Independent variables

The description of variables used in the analysis is presented in the third column of Table 2. We include as explanatory variables a set of background controls, family socioeconomic characteristics and community characteristics, which are likely to affect intermediary determinants of child health.

As background controls, child-specific variables (age, age-squared, sex, birth order and preceding birth interval and the fraction of child's life spent in a community nursery), mother's characteristics (age at first birth) and household composition (number of under-five children) were considered in the models.

Socioeconomic family characteristics included mother's education, mother's occupation, mother's autonomy, father's education, household socioeconomic status and place of residence. Mother's autonomy was represented by a composite indicator based on women's decisions on their own health care, large and daily household purchases, visits to family or relatives, food to be cooked, money husband earns, studying and having sexual intercourse. Household socioeconomic status index (SES) was constructed based on ownership of consumer durable goods and quality of housing. These two composite indicators were constructed using polychoric PCA.

Given the importance that communities have for the purpose of this study, we tested specific characteristics of the community context that may influence intermediary determinants of child health. Community maternal education was measured by the mean years of the mother's education in the community. Community maternal employment was defined as the proportion of women currently working in the community. Community socioeconomic status was constructed as the mean level of socioeconomic status index in the community.

The influence of community child care programmes was assessed through the children exposure to community nurseries programme (Hogares Comunitarios de Bienestar-HCB). This is one of the main Colombian government programmes in favour of early

childhood. Each HCB benefits approximately 12 to 14 pre-school children, who receive care from one of the mothers in the community. Currently, there are nearly 80,000 HCB in the country and about one million children from the poorest households participating in the programme (Attanasio, Di Maro, & Vera-Hernández, 2010; Attanasio & Vera-Hernández, 2004). Finally, community female autonomy was created as the level mean per community of the individual mother's autonomy index.

Additionally, cross-level interactions between mother's own education and community education were assessed. The aim was to test whether living in a community with more educated mothers, can modify the impact of mother's own education on the performance in intermediary determinants of child health. Similarly, cross-level interactions between household SES and community SES were examined. However, none of them were statistically significant, and hence, were taken out from the final models.

Table 1. Intermediary Determinants of Early Childhood Health Index (IDECHI)

Component	Dimension	Indicator	Variable	Description
PC1	Health system	Maternal care	Delivery by doctor	Doctor assisted the delivery: no (0), yes (1)
			Delivery place	Delivery in a health facility: no (0), yes (1)
			Antenatal care	Number of antenatal visits: 0 (0), 1-3 visits (1), 4 or more (2)
PC2		Child care	Tetanus injection	Mother received tetanus toxoid injection: no (0), yes (1)
			Immunization	Child received third doses of polio: no (0), yes (1)
PC3	Behavioural and psychosocial factors	Nutritional habits	Food intake	Mother gave child mangoes, papayas or other vitamin A fruits in the last 24 hours: no (0), yes (1)
			Breastfeeding	Months of breastfeeding: never (0), up to 2 years (1), more than 2 years (2)
		Physical exercise	Physical activity	Mother or household member spent time with child in physical activities last week: never (0), once (1), 2-4 times (2), 5 or more times (3)
		Parenting style	Play	Frequency played with child last week: never (0), once (1), 2-4 times (2), 5 or more times (3)
Punish	Mother punish children physically: no (0), yes (1)			
PC4			Care	Who cares for child when respondent is out of home: mother (0), father (1), grandparents (2), others (3)
			Marital status	Mother is cohabitating with partner: no (0), yes (1), no partner (2)

2.3 Statistical analysis: Multilevel models

The role of communities on intermediary determinants of child health was examined using multilevel models. Multilevel modelling allows us to take into account the hierarchical structure of the data and explore variations between and within clusters. Having hierarchical data, such as DHS data, individuals from the same cluster tend to be more similar among themselves than individuals from different groups. Consequently, the assumption of independence of observations which standard statistical tests are based, is violated. Thus, if clustering is not considered standard

errors will be underestimated, confidence intervals will be too narrow and p-values will be too small, giving rise to spurious significances (Steele, 2008).

Multilevel models not only allow us to obtain statistically efficient estimations of the regression coefficients, but they enable us to analyse variables at different levels simultaneously (Hox, 2002). That is, enable us to investigate the extent to which differences in intermediary determinants of child health are accounted for by contextual characteristics, such as the level of community socioeconomic development. Furthermore, estimating the variance at each level allows us to differentiate between the variation in child health that is due to differences at context level and those that are the result of differences in family characteristics.

In this study, given that the number of children per mother and mother per household is very small, children, mothers and households are considered as part of a same level labelled: family. Thus, two-level regression models were fitted with 6,610 families at level 1, nested within 3,023 communities at level 2. The models had the following general specification:

$$y_{ij} = \beta_0 + \sum_{k=1}^p \beta_k X_{kij} + \sum_{l=1}^q \beta_l Z_{lj} + (u_j + e_{ij}) \quad (1)$$

where y_{ij} is the score of the intermediary determinants of early childhood health index for the i th child in the j th community; β_0 is the overall mean across communities; X_{ij} refers to the family-level covariates; Z_j refers to the community-level covariates; e_{ij} and u_j are the residuals at the family and community levels, respectively. These residuals are assumed to follow a normal distribution with mean zero and variances σ_e^2 and σ_u^2 .

Sample design: weighting and scaling in multilevel modelling

Like most of the samples from the DHS, the sample design of the Colombian DHS incorporates sampling weights in order to reduce the estimation bias due to unequal selection probabilities. However, as many authors have argued the use of sampling weights in the context of multilevel models is not straightforward and should be treated with caution (Asparouhov, 2004; Pfeffermann, Skinner, Holmes, Goldstein, & Rasbash, 1998; Rabe-Hesketh & Skrondal, 2006). Multilevel models that incorporate sampling weights use pseudomaximum likelihood estimation where weights enter into the function at different levels of the hierarchy, and hence, it is not sufficient with the inclusion of the level-1 weights. Moreover, in order to include design weights properly is also necessary to scale them (Carle, 2009).

Despite this, weights and scale can be incorporated into the model with Stata12 through the estimation command “xtmixed”. Our DHS sample includes only an overall weighting variable for individual level observations. Following Goldstein (1999), we calculate level-2 weights (w_j) from the individual-level weights (w_{ij}):

$$w_j = \frac{\sum_i w_{ij}/n_j}{\left(\sum_j \sum_i w_{ij}/n_j\right)/J} \quad (2)$$

where J is the total number of clusters. Given that we have small cluster sizes (on average 13 households per community), we used the “effective” method for standardizing weights so that the level-1 weights sum to the effective cluster size (Carle, 2009).

3. Results

3.1 Descriptive analysis

The index of intermediary determinants of early childhood health (IDECHI) by Colombian departments is illustrated by Figure 2. The map shows that departments that relatively perform better in most of the specific determinants of early childhood health are located in the centre of the country. In contrast, those departments where intermediary determinants of child health perform worse, are located in the peripheral region.

The sample characteristics are shown in Table 2. All descriptive statistics are weighted by sampling weights. The average age of children included in the sample is 20 months. They are almost evenly distributed between boys and girls. About 40% of the children do not have siblings and have been exposed 6% of their lives to a community nursery. In terms of family socioeconomic characteristics, most children were born to mothers and fathers with secondary studies and to mothers employed mainly in activities that require skilled labour. Furthermore, while about 28% of the children live in poor or very poor households, about 12% live in the richest households. The majority of children (72%) reside in urban areas.

Figure 3 depicts the relationship between the overall index and selected characteristics. The overall index shows evidence of a socioeconomic gradient in intermediary determinants of child health, i.e. the better education and socioeconomic status, the higher the score of the index. For instance, the score of the overall index is 30% higher among children born to parents with higher education than in children born to uneducated parents.

3.2 Intermediary determinants of early childhood health

Tables 3-5 show the results of multilevel models for the overall index (IDECHI) and the two subindexes (IDECHI_1 and IDECHI_2). Note that all indicators range from 0 to 1 and are interpreted positively; therefore a positive regression coefficient should be interpreted as increasing in index score.

In order to explore, to what extent the variation between-communities changes when individual, family and community characteristics are added, four sequential models were fitted. Model 0 (null model) included no explanatory variables. Model 1 incorporated background controls (child’s sex and age, birth order and preceding birth interval, exposure to community nurseries programme, mother’s age at birth of first child and number of under-five children in the household). Model 2 added family

socioeconomic characteristics (mother's education, mother's occupation, mother's autonomy, partner's education and household's SES). Finally, Model 3 accounts for community characteristics (mean years of mother's education, mean level of SES, proportion of women working, mean level of children exposure to community nurseries programme and mean level of female autonomy). The community effects are discussed in section 3.4. Here we focus on the results of models for the overall index and the subindexes (Tables 3, 4 and 5).

The overall index

When IDECHI was controlled for by background controls (Model 1a), findings showed that except child's sex, all coefficients are statistically significant. However, when socioeconomic family characteristics were added (Model 2a) the effect of higher birth orders (4th +), child's exposure to community nurseries programme and the association with mother's age disappeared.

As we expected, mother's education and household socioeconomic status were strongly associated with intermediary determinants of child health. Mothers working in skilled sectors positively influenced IDECHI's performance compared to mothers who do not work. Regarding the partner's education, the coefficients for higher educational level and no partner, were found to be statistically significant. Mother's autonomy and place of residence does not reach statistical significance in the models.

Finally, controlling for community characteristics (Model 3a), little changes were observed in background and socioeconomic variables. The most remarkable change was observed in the significance and magnitude of wealth quintiles coefficients. The results showed that they lose statistical significance and their effect is reduced by almost half. Community characteristics showed that children living in communities with higher levels of education and socioeconomic status have a higher score index. In contrast, children living in communities with greater exposure to community nurseries programme have lower score in the overall index.

The health system index

The results of the models for the health system dimension (IDECHI_1) indicated that when background controls are considered (Model 1b), the coefficients for child's sex and exposure to community nurseries programme were not statistically significant (see Table 4).

With the introduction of the family socioeconomic characteristics in Model 2b, the effects of background controls remained the same. The mother's education and occupation and household's SES were found to be strongly associated with the IDECHI_1. In contrast to the models for the overall index, the coefficients for mother's autonomy and place of residence were statistically significant in the case of health system dimension. Children of mothers with higher levels of autonomy and living in urban areas had higher performance in the index score. However, when community characteristics were included (Model 3b), the effect of place of residence disappeared and the influence of household wealth was less. In relation to community variables, only the mean years of maternal education in the community and the mean level of SES were found to be associated with the IDECHI_1.

The behavioural and psychosocial factors index

The results of the models for the behavioural and psychosocial factors index (IDECHI_2) are showed in table 5. In Model 1c only the age of child and birth order and preceding birth interval were associated with the IDECHI_2. Nevertheless, when family socioeconomic characteristics were included in Model 2c, the sex of child and the age of mother at first birth reached statistical significance. As in the other indexes mother's education, mother's occupation and household's SES were associated with the behavioural and psychosocial dimension. Finally, in Model 3c with the inclusion of community characteristics, the effect of household wealth practically disappeared. The community variables that were associated with the index were the proportion of women currently working in the community and the children exposure to HCB programme.

3.3 Comparing the health system and the behavioural and psychosocial factors dimensions

Table 6 shows the full models (Models 3a, 3b and 3c) for the three indicators. Comparing the models for the health system dimension and the behavioural and psychosocial dimension (Models 3b and 3c), the results indicated that child's sex was only associated with the IDECHI_2. Girls had worse performance in the indicator of behavioural and psychosocial factors than boys. On the other hand, child's exposure to HCB programme was only positively associated with the health system index.

In general, age of child showed a curvilinear association with intermediary determinants of child health. However, it is observed that its effect is very small. There was a significant association between mother's age at first birth and the two subindexes. This showed that the older the mother, the better the performance of intermediary factors related to health system, but the worse the performance of psychosocial and behavioural factors indicator. The number of under-five children in the household was only significantly associated with health system model.

Regarding to family socioeconomic characteristics, the mother's education and occupation were significantly associated with the two subindexes. However, in Model 3c the occupation effect was stronger and educational effect weaker than Model 3b. Mothers' autonomy, on the other hand, was only associated with health system dimension. In addition, the results suggest that household socioeconomic status is more clearly associated with health system dimension than behavioural and psychosocial factors dimension. No significant differences by place of residence were observed.

In relation to community characteristics, community mothers' education and community SES were positively associated with the health system index. In the case of behavioural and psychosocial factors index, the results showed that while women employment was positively associated with the index, community exposure to HCB child care program was negatively associated with the indicator.

3.4 Community effects

Table 7 presents the variances (random effects) at the community and family level, as well as the variance partition coefficient (VPC) and the percentage change in variance. The VPC permits identification of the extent to which between-community variation is explained by individual and community characteristics. All estimated coefficients for

the community level variances were significant, indicating that there is some variance in intermediary determinants of child health that is attributed to unobserved heterogeneity at the community level.

The VPC for the overall index showed that 17.4% of the variability in the IDECHI is explained by community characteristics, while when the health system dimension is taken into account this variability is 22.7%. In the case of behavioural and psychosocial dimension the variability due to community characteristics is almost one third of the health system model.

When background controls are added to the models, the variability in intermediary determinants attributable to between-communities differences is reduced approximately 46% in Models 1a and 1b, and 31% in Model 1c. In comparison to models 1, with the inclusion of family socioeconomic variables (Models 2), the VPC is reduced about 25% in the models for IDECHI and IDECHI_1, and only 8% for IDECHI_2 model.

Finally, when community characteristics are included (Models 3), the greatest reduction in the VPC is observed with the overall index, where this is reduced to 1.4% (81% of change in variance compared to Model 2a). For IDECHI_1 the variance is reduced by 16.5%, while for IDECHI_2, the community effect remains constant after controlling for community characteristics.

Table 2. Sample characteristics and description of variables

Variables	Mean/ Proport	Description
Dependent		
IDECHI: overall index	0.61	A composite index of intermediary determinants of early childhood health (range between 0-1)
IDECHI_1: health system dimension	0.78	A composite index based on health system characteristics (range between 0-1)
IDECHI_2: Behavioural and psychosocial factors dimension	0.39	A composite index based on behavioural and psychosocial factors (range between 0-1)
Independent		
<i>Background controls</i>		
Age of child	19.52	Child's age in months
Sex of child		
boy	50.37	Child's sex
girl	49.63	
Birth order/preceding birth interval		
first-birth	39.89	Child's birth order and preceding birth interval
2nd-3rd and <2 years	4.31	
2nd-3rd and >2 years	41.61	
4th + and <2 years	2.89	
4th + and >2 years	11.29	
Exposure to community nurseries	0.056	Fraction of child's life spent in a community nursery (HCB): months spent in a HCB/child's age
Age of mother	20.36	Mother's age at first birth in years
Number of under-five children	1.47	Number of under-five children in the household
<i>Family socioeconomic characteristics</i>		
Educational level of mother		
no education	1.81	Mother's highest level of education
primary	23.74	
secondary	55.34	
higher	19.1	
Occupation of mother		
not working	14.88	Mother's occupation
professional/technical/manager	5.45	
clerical/sales/services/skilled manual	73.86	
agricultural/unskilled manual	5.81	
Level of mother's autonomy	0.59	A composite index based on women's decisions on own health care, purchases, money, visits to family, cooking, studying and having sexual intercourse) (range between 0-1)
Educational level of partner		
no education	2.71	Partner's highest level of education
primary	27.54	
secondary	45.05	
higher	12.27	
no partner	12.42	
Socioeconomic status		
very poor	11.48	A composite index based on ownership of consumer durable goods (radio, tv, fridge, motorcycle, and car/truck) and quality of housing (source of drinking water, type of toilet facility, floor and wall material and whether the household has electricity) (range between 0-1)
poor	16.23	
medium	21.32	
rich	38.33	
very rich	12.64	
Place of residence		
rural	27.92	Current place of residence
urban	72.08	
<i>Community characteristics</i>		
Maternal education	8.94	Mean years of mother's education in the community
Socioeconomic status	0.72	Mean level of SES in the community
Maternal employment	0.44	Proportion of women currently working in the community
Children exposure to community nurseries programme	0.06	Mean fraction of child's life spent in a community nursery
Female autonomy	0.56	Mean level of female autonomy in the community

Figure 2. Intermediary Determinants of Early Childhood Health Index (IDECHI) 2010 by Colombian departments

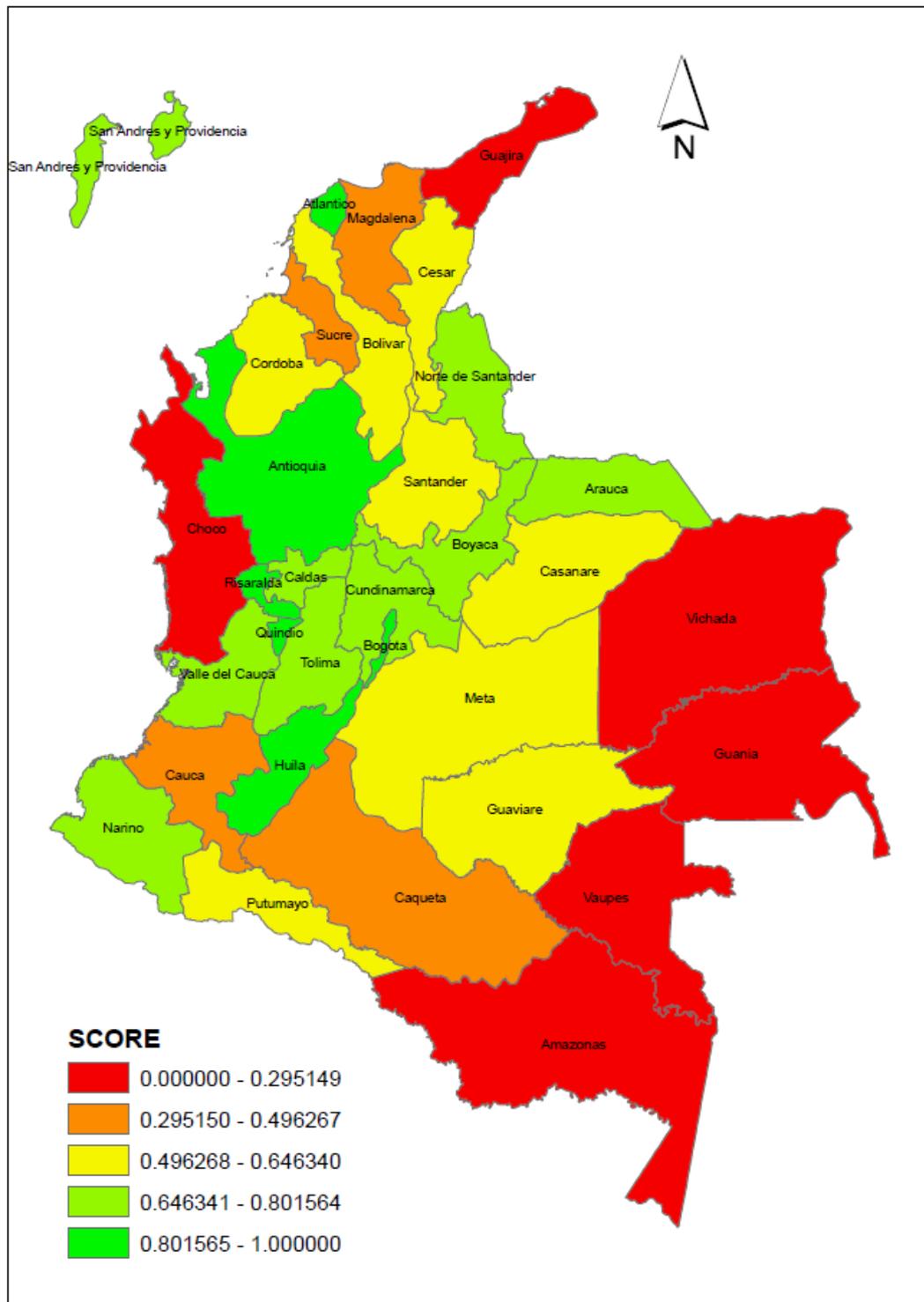


Figure 3. Social Gradient in Intermediary determinants of child health

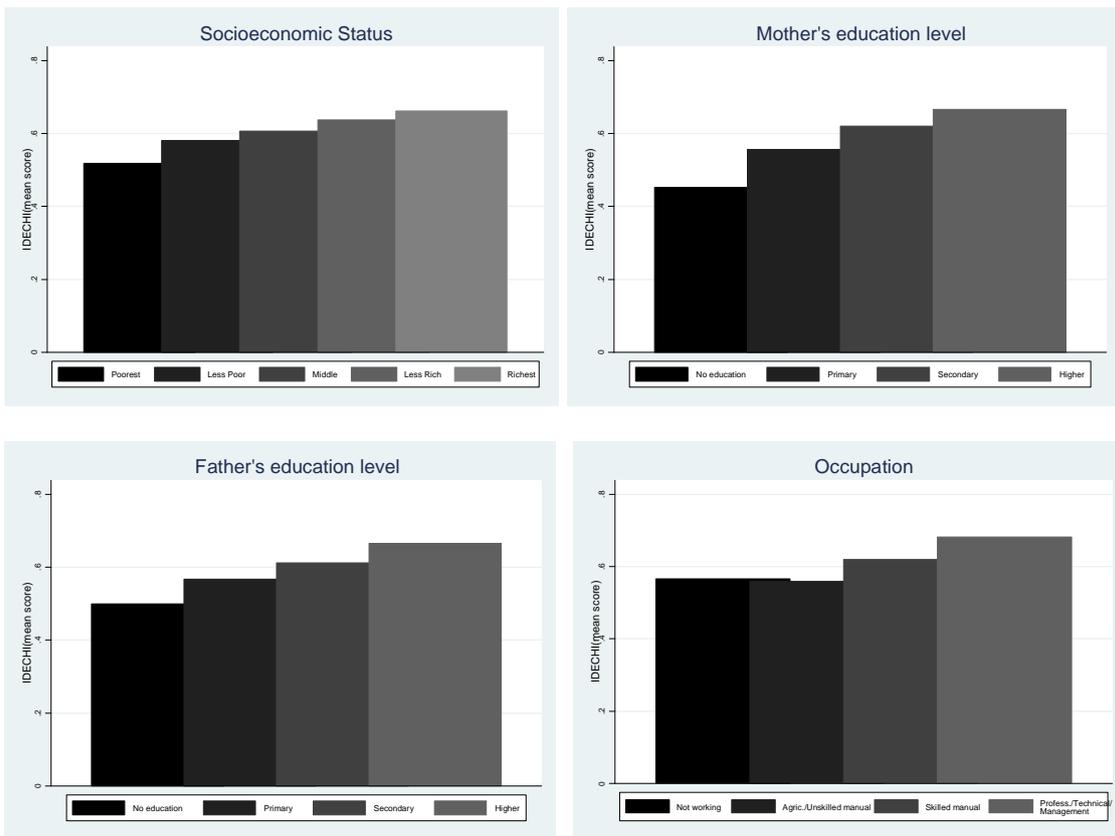


Table 3. Weighted multilevel models for Intermediary Determinants of Early Childhood Health Index –IDECHI-

Variable	Model 1a	Model 2a	Model 3a
Background controls			
Age (months)	0.005***	0.005***	0.005***
Age squared	-0.000***	-0.000***	-0.000***
Sex			
boy (Reference)			
1girl	-0.007	-0.009*	-0.010*
Birth order/preceding birth interval			
first-birth (Reference)			
2nd-3rd and <2 years	-0.053***	-0.030**	-0.031**
2nd-3rd and >2 years	-0.029***	-0.015**	-0.015**
4th + and <2 years	-0.065***	-0.018	-0.019
4th + and >2 years	-0.062***	-0.014	-0.014
Exposure to community nurseries programme	0.035*	0.017	0.046**
Age at first birth (years)	0.002***	-0.000	-0.001
Number of under-five children	-0.016***	-0.012***	-0.011***
Family socioeconomic characteristics			
Mother's education level			
no education (Reference)			
primary		0.068***	0.061***
secondary		0.099***	0.086***
higher		0.113***	0.095***
Mother's occupation			
not working (Reference)			
professional, technical, manager		0.048***	0.043***
clerical, sales, services, skilled manual		0.030***	0.026***
agricultural, unskilled manual		0.013	0.010
Mother's autonomy		0.010	0.010
Partner's education level			
no education (Reference)			
primary		0.015	0.014
secondary		0.024	0.022
higher		0.046**	0.042*
no partner		0.089***	0.086***
Socioeconomic status			
very poor (Reference)			
poor		0.037***	0.021*
medium		0.045***	0.021*
rich		0.058***	0.028**
very rich		0.069***	0.031*
Place of residence			
rural (Reference)			
urban		0.006	-0.001
Community characteristics			
Mean years of mother's education			0.002*
Mean level of SES index			0.084***
Proportion of women currently working			0.010
Children exposure to community nurseries programme			-0.060*
Mean level of female autonomy index			-0.004

* p<0.05, ** p<0.01, *** p<0.001

Table 4. Weighted multilevel models for IDECHI_1 (Health system index)

Variable	Model 1b	Model 2b	Model 3b
Background controls			
Age (months)	0.002***	0.002***	0.002***
Age squared	-0.000***	-0.000***	-0.000***
Sex			
boy (Reference)			
1girl	-0.006	-0.006	-0.006
Birth order/preceding birth interval			
first-birth (Reference)			
2nd-3rd and <2 years	-0.033**	-0.030**	-0.030**
2nd-3rd and >2 years	-0.007	-0.009*	-0.009*
4th + and <2 years	-0.044**	-0.021	-0.023
4th + and >2 years	-0.049***	-0.023**	-0.023**
Exposure to community nurseries programme	0.011	0.018	0.035*
Age at first birth (years)	0.003***	0.001**	0.001*
Number of under-five children	-0.026***	-0.020***	-0.019***
Family socioeconomic characteristics			
Mother's education level			
no education (Reference)			
primary		0.075***	0.068***
secondary		0.102***	0.089***
higher		0.107***	0.091***
Mother's occupation			
not working (Reference)			
professional, technical, manager		0.020*	0.021*
clerical, sales, services, skilled manual		0.013**	0.014**
agricultural, unskilled manual		-0.010	-0.008
Mother's autonomy		0.034***	0.032**
Partner's education level			
no education (Reference)			
primary		0.022	0.022
secondary		0.028	0.026
higher		0.032*	0.029
no partner		0.022	0.020
Socioeconomic status			
very poor (Reference)			
poor		0.034***	0.018*
medium		0.050***	0.026**
rich		0.058***	0.027**
very rich		0.060***	0.023*
Place of residence			
rural (Reference)			
urban		0.014**	0.007
Community characteristics			
Mean years of mother's education			0.002*
Mean level of SES index			0.088***
Proportion of women currently working			-0.009
Children exposure to community nurseries programme			-0.031
Mean level of female autonomy index			0.001

* p<0.05, ** p<0.01, *** p<0.001

Table 5. Weighted multilevel models for IDECHI_2 (Behavioural and psychosocial factors index)

Variable	Model 1c	Model 2c	Model 3c
Background controls			
Age (months)	0.007***	0.008***	0.008***
Age squared	-0.000***	-0.001***	-0.001***
Sex			
boy (Reference)			
1girl	-0.009	-0.011*	-0.011*
Birth order/preceding birth interval			
first-birth (Reference)			
2nd-3rd and <2 years	-0.063***	-0.023	-0.024
2nd-3rd and >2 years	-0.048***	-0.018**	-0.019**
4th + and <2 years	-0.076***	-0.010	-0.012
4th + and >2 years	-0.063***	-0.001	-0.001
Exposure to community nurseries programme	0.031	0.012	0.049
Age at first birth (years)	0.001	-0.002**	-0.002**
Number of under-five children	-0.001	-0.000	-0.000
Family socioeconomic characteristics			
Mother's education level			
no education (Reference)			
primary		0.045*	0.040*
secondary		0.075***	0.065**
higher		0.094***	0.080***
Mother's occupation			
not working (Reference)			
professional, technical, manager		0.071***	0.059***
clerical, sales, services, skilled manual		0.042***	0.035***
agricultural, unskilled manual		0.037**	0.029*
Mother's autonomy		-0.018	-0.017
Partner's education level			
no education (Reference)			
primary		0.004	0.003
secondary		0.015	0.013
higher		0.052*	0.050*
no partner		0.145***	0.142***
Socioeconomic status			
very poor (Reference)			
poor		0.031**	0.020
medium		0.029**	0.011
rich		0.045***	0.022
very rich		0.064***	0.034*
Place of residence			
rural (Reference)			
urban		-0.005	-0.011
Community characteristics			
Mean years of mother's education			0.001
Mean level of SES index			0.059
Proportion of women currently working			0.029***
Children exposure to community nurseries programme			-0.080*
Mean level of female autonomy index			-0.008

* p<0.05, ** p<0.01, *** p<0.001

Table 6. Full models for IDECHI, IDECHI_1 and IDECHI_2

Variable	Model 3a	Model 3b	Model 3c
	IDECHI (Overall index)	IDECHI 1 (Health system)	IDECHI 2 (Behav/psychsc)
Background controls			
Age (months)	0.005***	0.002***	0.008***
Age squared	-0.000***	-0.000***	-0.001***
Sex			
boy (Reference)			
1 girl	-0.010*	-0.006	-0.011*
Birth order/preceding birth interval			
first-birth (Reference)			
2nd-3rd and <2 years	-0.031**	-0.030**	-0.024
2nd-3rd and >2 years	-0.015**	-0.009*	-0.019**
4th + and <2 years	-0.019	-0.023	-0.012
4th + and >2 years	-0.014	-0.023**	-0.001
Exposure to community nurseries programme	0.046**	0.035*	0.049
Age at first birth (years)	-0.001	0.001*	-0.002**
Number of under-five children	-0.011***	-0.019***	-0.000
Family socioeconomic characteristics			
Mother's education level			
no education (Reference)			
primary	0.061***	0.068***	0.040*
secondary	0.086***	0.089***	0.065**
higher	0.095***	0.091***	0.080***
Mother's occupation			
not working (Reference)			
professional, technical, manager	0.043***	0.021*	0.059***
clerical, sales, services, skilled manual	0.026***	0.014**	0.035***
agricultural, unskilled manual	0.010	-0.008	0.029*
Mother's autonomy	0.010	0.032**	-0.017
Partner's education level			
no education (Reference)			
primary	0.014	0.022	0.003
secondary	0.022	0.026	0.013
higher	0.042*	0.029	0.050*
no partner	0.086***	0.020	0.142***
Socioeconomic status			
very poor (Reference)			
poor	0.021*	0.018*	0.020
medium	0.021*	0.026**	0.011
rich	0.028**	0.027**	0.022
very rich	0.031*	0.023*	0.034*
Place of residence			
rural (Reference)			
urban	-0.001	0.007	-0.011
Community characteristics			
Mean years of mother's education	0.002*	0.002*	0.001
Mean level of SES index	0.084***	0.088***	0.059
Proportion of women currently working	0.010	-0.009	0.029***
Children exposure to community nurseries programme	-0.060*	-0.031	-0.080*
Mean level of female autonomy index	-0.004	0.001	-0.008

* p<0.05, ** p<0.01, *** p<0.001

Table7. Variance for the multilevel models of intermediary determinants of early childhood health indexes

IDECHI	model0a	model1a	model2a	model3a
Random effect variances				
Community level	0.003***	0.002***	0.0012***	0.0006**
Family level	0.017***	0.014***	0.014***	0.014***
VPC				
Community level	0.174	0.095	0.075	0.014
Percentage change in variance		45.53	21.32	80.97
IDECHI_1	model0b	model1b	model2b	model3b
Random effect variances				
Community level	0.003***	0.001***	0.001***	0.0004**
Family level	0.011***	0.011***	0.011***	0.010***
VPC				
Community level	0.227	0.121	0.089	0.075
Percentage change in variance		46.65	26.27	16.46
IDECHI_2	model0c	model1c	model2c	model3c
Random effect variances				
Community level	0.003**	0.002*	0.001*	0.001*
Family level	0.034***	0.027***	0.027***	0.027***
VPC				
Community level	0.076	0.053	0.049	0.048
Percentage change in variance		30.82	7.95	1.04

* p<0.05, ** p<0.01, *** p<0.001

VPC: measures the proportion of total variance that is due to differences between-communities $\sigma_u^2 / \sigma_e^2 + \sigma_u^2$

4. Discussion

In this paper we have explored individual, family and community level characteristics associated with a composite indicator that quantitatively measures intermediary determinants of early childhood health in Colombia. In particular, we have examined how structural determinants influence intermediary determinants of child health and how they operate through the families and communities where children live.

Intermediary determinants refer to those more immediate mechanisms through which the socioeconomic position operates on child health inequities, and therefore, their identification may contribute to determine intervention policies at this level. Such intermediary factors encompass different dimensions, ranging from the biological characteristics to the physical and psychosocial environment surrounding the child. Furthermore, the health system by its own constitutes a significant determining factor of child health inequities (Solar & Irwin, 2010).

In contrast to earlier studies that mainly focus on individual intermediary indicators, this study tries to compile into a single index different dimensions of intermediary determinants of child health outcomes. Beyond the intermediary factors of child health usually studied in the literature, such as the use of maternal health facilities (Ahmed, Creanga, Gillespie, & Tsui, 2010; Johnson, Padmadas, & Brown, 2009; Magadi, Madise, & Rodrigues, 2000; Sagna & Sunil, 2012; Stephenson, Baschieri, Clements, Hennink, & Madise, 2006), this study includes psychosocial and behavioural factors that can be associated with child health.

The composite indicators approach may contribute towards a better understanding and visualization of differences in intermediary determinants of child health, in the extent that it enables us to analyse the phenomenon, both in an overall perspective and exploring its dimensions. In view of this, we have fitted weighted multilevel models for our overall index of intermediary determinants of child health and for the two dimensions represented by constructed subindexes: health system dimension and the dimension of behavioural and psychosocial factors.

The results demonstrate that intermediary factors of child health in Colombia are associated with individual characteristics as well as family and community characteristics. Variables positively associated with the overall index (IDECHI) include child exposure to community nurseries program, the mother's education, the mother's occupation as professional/technical/manager and clerical/sales/services/skilled manual activities, partners with a higher educational level, households in higher economic quintiles and communities with higher mother's education and higher mean levels of SES.

In general, our results suggest that regardless of the dimension taken into account, the family's socioeconomic position, measured as the educational level of the mother and her partner, the mother's occupation and the household's SES, exert a fundamental role on the mediation of child health outcomes.

The main purpose of this study focuses on the role of communities on different intermediary factors and our results show an important point in this vein. The effect of household's SES is attenuated when community characteristics are added, indicating the importance that the level of community development may have in mediating individual and family characteristics. Similar results are found in previous studies that examine the

role of the community's SES (Fotso & Kuate-Defo, 2005, 2006). This result suggests that the physical and socioeconomic environment and the facilities available in the residential communities can substantially influence the early childhood development (Irwin, Siddiqi, & Clyde, 2007). Children from households with low SES, living in mixed communities in terms of socioeconomic conditions, generally have better development than children from low households SES who reside in poor communities (Kohen, Brooks-gunn, Leventhal, & Hertzman, 2002).

With respect to the health system indicator, the findings show that additionally to the influence of socioeconomic characteristics, the mother's autonomy has a positive effect on factors linked to child and maternal health care. These results are consistent with findings of other studies on use of maternal health facilities (Ahmed et al., 2010; Stephenson et al., 2006) and underline the importance of women empowerment within the household, allowing them to have a greater power of decision on both their own health and their children.

The positive association between variables linked to maternal-child care and maternal education has been examined in previous researches (Addai, 2000; Elo, 1992; Sagna & Sunil, 2012). Mother's education enables greater access and knowledge to the practices during pregnancy, enhances woman's empowerment and it is also associated with the income level. However, the effect of the partner's education has been less explored in the literature. Our results suggest that more educated partners can contribute to a better performance in intermediary factors of child health, reflecting the direct or indirect influence that they might have on maternal and child care. Furthermore, the positive effect of community maternal education is consistent with other studies (Corsi et al., 2011; Stephenson et al., 2006), suggesting that beyond the positive influence of the mother's education, there may be a positive externality in terms of community education that can help in the performance of intermediary factors of child health

In terms of the index of behavioural and psychosocial factors, our results point out the importance of the mother's occupation role. While it is clear that parental education affects the style of parenting, some aspects of education are mediated by the type of occupation. Menaghan & Parcel (1995) find that the working conditions of parents are linked to child outcomes. In particular, mothers with jobs requiring more complex activities, are capable of providing home environments cognitively, emotionally and physically more convenient for child development (Whitbeck et al., 1997).

In addition, our results show that the household's SES is not strongly associated with the dimension of behavioural and psychosocial factors. This may be due to the fact that poverty can negatively influence parenting style, but once a certain threshold is reached, additional income does not produce significant changes in the parents' behaviours (Hoff, Laursen, & Tardif, 2002).

On the other hand, it is perhaps not surprising to find the negative effect of community exposure to HCB programme, since this programme is mainly aimed to the poorest households, and hence, it is likely that such result is capturing the impact of community socioeconomic level. Nevertheless, further work is required in order to evaluate the programme and its impact on psychosocial factors.

Regarding to the community effects, our results are consistent with findings of previous studies that analyse the contextual effects on child health (Griffiths et al., 2004; Uthman, 2009). Although variations in intermediary determinants among communities

are explained above all by family characteristics, our results indicate that there is a significant variance in intermediary determinants of child health between-community, especially for those determinants linked to the health system, even after controlling for individual, family and community characteristics. These results likely reflect that whilst the community context can exert a greater influence on intermediary factors linked directly to health, in the case of psychosocial factors and the parent's behaviours, the family context can be more important. This underlines the importance of distinguishing between community and family intervention programmes.

However, it is worth noting that there are also other community characteristics that are not accounted for in this study. For instance, socially accepted behaviours and practices within the community that can affect child environment, as well as violent and safety conditions. Additionally, community access barriers to health facilities and nurseries can be important intermediary factors of child health.

Finally, to our knowledge, this is the first study that operationalizes the CSDH framework and focuses on disentangling the pathways through which the family and the community's socioeconomic characteristics influence more downstream determinants of child health in Colombia.

It is clear that those environments responsible for promoting healthy conditions to childhood development go from the immediate context, i.e the family, to the socioeconomic context of the communities, municipalities and departments. Such as our indicator of intermediary determinants of early childhood health reflects, firstly, the maternal access to reproductive health services is fundamental, followed by child immunization and access to health system, and in addition to this, parents' practices and behaviours providing the appropriate environments for child development.

Limitations

There are obvious limitations in this study. First, the impossibility to compare the results of our index with previous Colombian DHS due to the fact that they do not include some of the psychosocial factors assessed here, and also considering the difficulty in establishing comparisons with other Latin American countries due to lack of recent DHS or unavailability of such data. Second, the significant between-community variation, even after controlling for individual, family and community characteristics, highlights the need for further research on the pathways through which communities influence intermediary factors of child health.

5. Conclusion

This study has shown some pathways through which communities can influence intermediary factors of childhood health. Our findings point out relevant information on the role of communities for the improvement of child health and highlight the importance, in terms of policy, of targeting programmes towards communities.

As our results indicated, the community mother's education is a factor that contributes to a better performance of intermediary determinants of child health. Although the Colombian government has been developing strategies to promote early childhood care through the community context, there are still inequalities in the access to such programmes. In this vein, we recommend the promotion of education of community

mothers, expanding coverage programmes such as the “Educational Support Units programme (UPA)⁵”, for example, through the public-private partnership. But above all, is a priority to ensure that programmes reach the most vulnerable mothers, i.e. those living in the peripheral region and the rural areas of the country.

More educated mothers, not only will have access to better job opportunities, which in turns it will be reflected in higher household income, but it also can mean lower stress levels and therefore, a more appropriate home environment for child development. However, the negative effect on psychosocial factors that may have a greater proportion of women working in the community, highlights the importance of child care centres in the community that promote psychosocial qualities, as well as training programmes aimed at parents, which promote good parenting practices.

On the other hand, a suitable and relatively easy conglomerate available to provide information and to educate families in the community is the community’s media. One strategy would be to provide information and training through different media options (television, radio and short illustrative magazines with a high content of images rather than text) about: i) maternal health seeking behaviour during pregnancy, childbirth and postpartum; ii) the rights and benefits of social security affiliation; iii) the services and programmes of the “*Instituto Colombiano de Bienestar Familiar (ICBF)*” available in the community; and iv) the importance of healthier nutritional habits, physical exercise and playing activities to child development.

Summarizing, the community’s involvement is a key component of child health outcomes. Essentially, it is necessary that municipal and departmental governments involve local communities in the development, execution, monitoring and evaluation of childhood care policies.

Acknowledgements

The authors acknowledge the support by the Spanish Ministry of Science FEDER (grants ECO201021787-C03-01 and ECO2008-01223), as well as, the support by the Agència de Gestió d’Ajuts Universitaris i de Recerca –AGAUR– (grant ECO/1689/2011) to Ana María Osorio for doing a visiting as PhD researcher in the University of Southampton. Ana María Osorio also has been supported by the Pontificia Universidad Javeriana, Cali-Colombia.

⁵ The UPA is a programme mainly targeted at urban children attending community nurseries (HCB), as well as their respective community mothers. The programme seeks to add an education component to the care and nutrition services (<http://www.mineducacion.gov.co/primerainfancia/1739/article-177848.html>).

References

- Acosta, K. (2012). La desnutrición en los primeros años de vida: Un análisis regional para Colombia. Cartagena.
- Addai, I. (2000). Determinants of use of maternal-child health services in rural Ghana. *Journal of biosocial science*, 32(1), 1-15. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/10676056>
- Ahamad, M. ., Tasnima, K., Khaled, N., Bairagi, S. ., & Deb, U. K. (2010). Infant Mortality Situation in Bangladesh in 2007: A District Level Analysis. Munich.
- Ahmed, S., Creanga, A. a, Gillespie, D. G., & Tsui, A. O. (2010). Economic status, education and empowerment: implications for maternal health service utilization in developing countries. *PloS one*, 5(6), e11190. Retrieved from <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=2890410&tool=pmcentrez&rendertype=abstract>
- Antai, D. (2009). Inequitable childhood immunization uptake in Nigeria: a multilevel analysis of individual and contextual determinants. *BMC infectious diseases*, 9, 181. Retrieved from <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=2787508&tool=pmcentrez&rendertype=abstract>
- Antai, D., & Moradi, T. (2010). Urban area disadvantage and under-5 mortality in Nigeria: the effect of rapid urbanization. *Environmental health perspectives*, 118(6), 877-883. Retrieved from <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=2898867&tool=pmcentrez&rendertype=abstract>
- Asparouhov, T. (2004). Weighting for Unequal Probability of Selection in Multilevel Modeling. *Mplus web notes*, 8.
- Attanasio, O., Di Maro, V., & Vera-Hernández, M. (2010). Community nurseries and the nutritional status of poor children. London.
- Attanasio, O., Gómez, L. C., Gómez, A., & Vera-Hernández, M. (2004). Child health in rural Colombia: determinants and policy interventions. London.
- Attanasio, O., & Vera-Hernández, M. (2004). Medium and long run effects of nutrition and child care: Evaluation of a communiy nursery programme in rural Colombia. London.
- Babalola, S. (2009). Determinants of the uptake of the full dose of diphtheria-pertussis-tetanus vaccines (DPT3) in Northern Nigeria: a multilevel analysis. *Maternal and Child Health Journal*, 13(4), 550-558. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/18607704>
- Bernard, P., Charafeddine, R., Frohlich, K. L., Daniel, M., Kestens, Y., & Potvin, L. (2007). Health inequalities and place: a theoretical conception of neighbourhood.

Social science & medicine, 65(9), 1839-1852. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/17614174>

Bocquier, P., Madise, N. J., & Zulu, E. M. (2011). Is there an urban advantage in child survival in sub-saharan Africa? Evidence from 18 countries in the 1990s.

Demography, 48(2), 531-558. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/21590463>

Boyle, M. H., Racine, Y., Georgiades, K., Snelling, D., Hong, S., Omariba, W., Hurley, P., et al. (2006). The influence of economic development level, household wealth and maternal education on child health in the developing world. *Social science & medicine*, 63(8), 2242-2254. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/16790308>

Carle, A. C. (2009). Fitting multilevel models in complex survey data with design weights: Recommendations. *BMC medical research methodology*, 9(49), 1-13. Retrieved from <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=2717116&tool=pmcentrez&rendertype=abstract>

Chin, B., Montana, L., & Basagaña, X. (2011). Spatial modeling of geographic inequalities in infant and child mortality across Nepal. *Health & place*, 17(4), 929-936. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/21555234>

Corsi, D. J., Chow, C. K., Lear, S. a, Rahman, M. O., Subramanian, S. V., & Teo, K. K. (2011). Shared environments: a multilevel analysis of community context and child nutritional status in Bangladesh. *Public health nutrition*, 14(6), 951-959. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/21310102>

Coulton, C. J., & Fischer, R. L. (2010). Using early childhood wellbeing indicators to influence local policy and services. In S. B. Kamerman, S. Phipps, & A. Ben-Arieh (Eds.), *From Child Welfare to Child Well-Being, Children's Well-being: Indicators and Research I* (Vol. 1, pp. 101-116). Dordrecht: Springer Netherlands. Retrieved from <http://www.springerlink.com/index/10.1007/978-90-481-3377-2>

Coulton, C. J., Korbin, J. E., & McDonell, J. (2009). Editorial: Indicators of Child Well-Being in the Context of Small Areas. *Child Indicators Research*, 2(2), 109-110. Retrieved from <http://www.springerlink.com/index/10.1007/s12187-009-9040-z>

Cummins, S., Curtis, S., Diez-Roux, A. V., & Macintyre, S. (2007). Understanding and representing "place" in health research: a relational approach. *Social science & medicine* (1982), 65(918), 1825-38. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/17706331>

Cummins, S., Macintyre, S., Davidson, S., & Ellaway, A. (2005). Measuring neighbourhood social and material context: generation and interpretation of ecological data from routine and non-routine sources. *Health & place*, 11(3), 249-260. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/15774331>

- Departamento Nacional de Planeación-DNP. (2011). Convergencia y desarrollo regional Caracterización, dinámica y desafíos. *Plan Nacional de Desarrollo Colombia 2010-2014 : Prosperidad para todos* (p. 621).
- Diez Roux, A. V. (2000). Multilevel analysis in public health research. *Annual review of public health, 21*, 171-192.
- Diez Roux, A. V. (2001). Investigating neighborhood and area effects on health. *American journal of public health, 91*(11), 1783-1739. Retrieved from <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=1446876&tool=pmcentrez&rendertype=abstract>
- Duncan, C., Jones, K., & Moon, G. (1998). Context, composition and heterogeneity: using multilevel models in health research. *Social Science & Medicine, 46*(1), 97-117.
- Elo, I. (1992). Utilization of maternal health-care services in Peru : the role of women's education. *Health Transition Review, 2*, 1-20.
- Filmer, D., & Pritchett, L. H. (2001). Estimating wealth effects without expenditure data--or tears: an application to educational enrollments in states of India. *Demography, 38*(1), 115-32. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/11227840>
- Fotso, J.-C. (2006). Child health inequities in developing countries : differences across urban and rural areas. *International Journal for Equity in Health, 5*(9), 1-10.
- Fotso, J.-C. (2007). Urban-rural differentials in child malnutrition: trends and socioeconomic correlates in sub-Saharan Africa. *Health & place, 13*(1), 205-223. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/16563851>
- Fotso, J.-C., & Kuate-Defo, B. (2005). Socioeconomic inequalities in early childhood malnutrition and morbidity: modification of the household-level effects by the community SES. *Health & place, 11*(3), 205-225. Retrieved from <http://www.sciencedirect.com/science/article/B6VH5-4D5KS18-1/2/b7211cb698eac56b9e20e50fff973af0>
- Fotso, J.-C., & Kuate-Defo, B. (2006). Household and community socioeconomic influences on early childhood malnutrition in Africa. *Journal of biosocial science, 38*(3), 289-313. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/16613617>
- Gaviria, A., & Palau, M. . (2006). Nutrición y salud infantil en Colombia : determinantes y alternativas de política. *Coyuntura Económica, 36*(2), 33-63.
- Goldstein, H. (1999). *Multilevel Statistical Models* (p. 163). London: Institute of Education, Multilevel Models Project, April 1999.
- Griffiths, P., Madise, N., Whitworth, A., & Matthews, Z. (2004). A tale of two continents: a multilevel comparison of the determinants of child nutritional status

- from selected African and Indian regions. *Health & place*, 10(2), 183-199.
Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/15019912>
- Hatt, L. E., & Waters, H. R. (2006). Determinants of child morbidity in Latin America: a pooled analysis of interactions between parental education and economic status. *Social science & medicine* (1982), 62(2), 375-386. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/16040175>
- Hoff, E., Laursen, B., & Tardif, T. (2002). Socioeconomic status and parenting. In M. H. Bornstein (Ed.), *Handbook of Parenting (Volume 2): Biology and Ecology of Parenting* (Vol. 58, p. 376). London: Lawrence Erlbaum associates.
- Hox, J. J. (2002). *Multilevel analysis: techniques and applications*. (Routledge, Ed.) (p. 304).
- Irwin, L., Siddiqi, A., & Clyde, H. (2007). *Desarrollo de la Primera Infancia : Un Potente Ecuatorializador* (p. 74).
- Johnson, F. A., Padmadas, S. S., & Brown, J. J. (2009). On the spatial inequalities of institutional versus home births in Ghana: a multilevel analysis. *Journal of community health*, 34(1), 64-72. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/18830808>
- Kaiser, H. F. (1960). The application of electronic to factor analysis. *Educational and Psychological Measurement*, 20, 141-151.
- Kohen, D. E., Brooks-gunn, J., Leventhal, T., & Hertzman, C. (2002). Neighborhood Income and Physical and Social Disorder in Canada : Associations with Young Children ' s Competencies. *Child Development*, 73(6), 1844-1860.
- Kolenikov, S., & Angeles, G. (2009). Socioeconomic status measurement with discrete proxy variables: is principal component analysis a reliable answer? *Review of Income and Wealth*, 55(1), 128-165. Retrieved from <http://doi.wiley.com/10.1111/j.1475-4991.2008.00309.x>
- Larrea, C., & Freire, W. (2002). Social inequality and child malnutrition in four Andean countries. *Revista panamericana de salud pública = Pan American journal of public health*, 11(5-6), 356-64. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/12162832>
- Larrea, C., & Kawachi, I. (2005). Does economic inequality affect child malnutrition? The case of Ecuador. *Social science & medicine*, 60(1), 165-178. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/15482876>
- Macintyre, S., Ellaway, A., & Cummins, S. (2002). Place effects on health: how can we conceptualise, operationalise and measure them? *Social Science & Medicine*, 55(1), 125-139. Retrieved from <http://linkinghub.elsevier.com/retrieve/pii/S0277953601002143>

- Madise, N., Matthews, Z., & Margetts, B. (2010). Heterogeneity of child nutritional status between households: A comparison of six sub-Saharan African countries. *Population Studies*, 53, 331-343.
- Magadi, M. a, Madise, N. J., & Rodrigues, R. N. (2000). Frequency and timing of antenatal care in Kenya: explaining the variations between women of different communities. *Social science & medicine*, 51(4), 551-61. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/10868670>
- Marmot, M., Friel, S., Bell, R., Houweling, T. A. J., & Taylor, S. (2008). Closing the gap in a generation: health equity through action on the social determinants of health. *The Lancet*, 372(9650), 1661-1669. Retrieved from <http://www.sciencedirect.com/science/article/pii/S0140673608616906>
- Mcquestion, M. J. (2001). Los comportamientos de salud correlacionados y la transición de la mortalidad en América Latina. *Notas de Población*, 72, 189-228.
- Menaghan, E. G., & Parcel, T. L. (1995). Social sources of change in children's home environments: The effects of parental occupational experiences and family conditions. *Journal of Marriage and Family*, 57(1), 69-84.
- Olsson, U. (1979). Maximum likelihood estimation of the polychoric correlation coefficient. *Psychometrika*, 44(4), 443-460. Retrieved from <http://www.springerlink.com/index/10.1007/BF02296207>
- Olsson, U., Drasgow, F., & Dorans, N. J. (1982). The polyserial correlation coefficient. *Psychometrika*, 47(3), 337-347. Retrieved from <http://www.springerlink.com/index/10.1007/BF02294164>
- Osorio, A. M., Bolancé, C., & Alcañiz, M. (2011). Measuring early childhood health : a composite index comparing Colombian departments. Barcelona.
- Pfeffermann, D., Skinner, C. J., Holmes, D. J., Goldstein, H., & Rasbash, J. (1998). Weighting for unequal selection probabilities Weighting in multilevel models. *Journal of the Royal Statistical Society: Series B (Statistical Methodology)*, 60(1), 23-40.
- Pickett, K. E., & Pearl, M. (2001). Multilevel analyses of neighbourhood socioeconomic context and health outcomes: a critical review. *Journal of epidemiology and community health*, 55(2), 111-22. Retrieved from <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=1731829&tool=pmcentrez&rendertype=abstract>
- Rabe-Hesketh, S., & Skrondal, A. (2006). Multilevel modelling of complex survey data. *Journal of the Royal Statistical Society: Series A (Statistics in Society)*, 169(4), 805-827. Retrieved from <http://doi.wiley.com/10.1111/j.1467-985X.2006.00426.x>
- Reichman, N. E., Teitler, J. O., & Hamilton, E. R. (2009). Effects of neighborhood racial composition on birthweight. *Health & place*, 15(3), 784-791. Retrieved from

<http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=2673338&tool=pmcentrez&rendertype=abstract>

- Rice, N., & Jones, A. (1997). Multilevel models and health economics. *Health Economics*, 6, 561-575.
- Sagna, M., & Sunil, T. . (2012). Effects of individual and neighborhood factors on maternal care in Cambodia. *Health & Place*, 18, 415-423.
- Saltelli, A. (2007). Composite Indicators between Analysis and Advocacy. *Social Indicators Research*, 81(1), 65-77. doi:10.1007/s11205-006-0024-9
- Solar, O., & Irwin, A. (2010). A conceptual framework for action on the social determinants of health. Geneva.
- Steele, F. (2008). Module 5 : Introduction to Multilevel Modelling (Concepts) (Vol. 5). Centre for Multilevel Modelling, University of Bristol.
- Stephenson, R., Baschieri, A., Clements, S., Hennink, M., & Madise, N. (2006). Contextual influences on the use of health facilities for childbirth in Africa. *American journal of public health*, 96(1), 84-93. doi:10.2105/AJPH.2004.057422
- Uthman, O. (2009). A multilevel analysis of individual and community effect on chronic childhood malnutrition in rural Nigeria. *Journal of tropical pediatrics*, 55(2), 109-115. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/18845589>
- Whitbeck, L. B., Simons, R. L., Conger, R. D., Wickrama, K. A. S., Ackley, K. A., & Elder Jr, G. H. (1997). The effects of parents' conditions and family economic hardship on parenting behaviors and children's self-efficacy. *Social Psychology Quarterly*, 60(4), 291-303.



2006

CREAP2006-01

Matas, A. (GEAP); **Raymond, J.Ll.** (GEAP)

"Economic development and changes in car ownership patterns"
(Juny 2006)

CREAP2006-02

Trillas, F. (IEB); **Montolio, D.** (IEB); **Duch, N.** (IEB)

"Productive efficiency and regulatory reform: The case of Vehicle Inspection Services"
(Setembre 2006)

CREAP2006-03

Bel, G. (PPRE-IREA); **Fageda, X.** (PPRE-IREA)

"Factors explaining local privatization: A meta-regression analysis"
(Octubre 2006)

CREAP2006-04

Fernández-Villadangos, L. (PPRE-IREA)

"Are two-part tariffs efficient when consumers plan ahead?: An empirical study"
(Octubre 2006)

CREAP2006-05

Artís, M. (AQR-IREA); **Ramos, R.** (AQR-IREA); **Suriñach, J.** (AQR-IREA)

"Job losses, outsourcing and relocation: Empirical evidence using microdata"
(Octubre 2006)

CREAP2006-06

Alcañiz, M. (RISC-IREA); **Costa, A.**; **Guillén, M.** (RISC-IREA); **Luna, C.**; **Rovira, C.**

"Calculation of the variance in surveys of the economic climate"
(Novembre 2006)

CREAP2006-07

Albalade, D. (PPRE-IREA)

"Lowering blood alcohol content levels to save lives: The European Experience"
(Desembre 2006)

CREAP2006-08

Garrido, A. (IEB); **Arqué, P.** (IEB)

"The choice of banking firm: Are the interest rate a significant criteria?"
(Desembre 2006)



CREAP2006-09

Segarra, A. (GRIT); Teruel-Carrizosa, M. (GRIT)

"Productivity growth and competition in spanish manufacturing firms:

What has happened in recent years?"

(Desembre 2006)

CREAP2006-10

Andonova, V.; Díaz-Serrano, Luis. (CREB)

"Political institutions and the development of telecommunications"

(Desembre 2006)

CREAP2006-11

Raymond, J.L.(GEAP); Roig, J.L.. (GEAP)

"Capital humano: un análisis comparativo Catalunya-España"

(Desembre 2006)

CREAP2006-12

Rodríguez, M.(CREB); Stoyanova, A. (CREB)

"Changes in the demand for private medical insurance following a shift in tax incentives"

(Desembre 2006)

CREAP2006-13

Royuela, V. (AQR-IREA); Lambiri, D.; Biagi, B.

"Economía urbana y calidad de vida. Una revisión del estado del conocimiento en España"

(Desembre 2006)

CREAP2006-14

Camarero, M.; Carrion-i-Silvestre, J.LL. (AQR-IREA); Tamarit, C.

"New evidence of the real interest rate parity for OECD countries using panel unit root tests with breaks"

(Desembre 2006)

CREAP2006-15

Karanassou, M.; Sala, H. (GEAP); Snower, D. J.

"The macroeconomics of the labor market: Three fundamental views"

(Desembre 2006)



2007

XREAP2007-01

Castany, L (AQR-IREA); **López-Bazo, E.** (AQR-IREA); **Moreno, R.** (AQR-IREA)
"Decomposing differences in total factor productivity across firm size"
(Març 2007)

XREAP2007-02

Raymond, J. Ll. (GEAP); **Roig, J. Ll.** (GEAP)
"Una propuesta de evaluación de las externalidades de capital humano en la empresa"
(Abril 2007)

XREAP2007-03

Durán, J. M. (IEB); **Esteller, A.** (IEB)
"An empirical analysis of wealth taxation: Equity vs. Tax compliance"
(Juny 2007)

XREAP2007-04

Matas, A. (GEAP); **Raymond, J.Ll.** (GEAP)
"Cross-section data, disequilibrium situations and estimated coefficients: evidence from car ownership demand"
(Juny 2007)

XREAP2007-05

Jofre-Montseny, J. (IEB); **Solé-Ollé, A.** (IEB)
"Tax differentials and agglomeration economies in intraregional firm location"
(Juny 2007)

XREAP2007-06

Álvarez-Albelo, C. (CREB); **Hernández-Martín, R.**
"Explaining high economic growth in small tourism countries with a dynamic general equilibrium model"
(Juliol 2007)

XREAP2007-07

Duch, N. (IEB); **Montolio, D.** (IEB); **Mediavilla, M.**
"Evaluating the impact of public subsidies on a firm's performance: a quasi-experimental approach"
(Juliol 2007)

XREAP2007-08

Segarra-Blasco, A. (GRIT)
"Innovation sources and productivity: a quantile regression analysis"
(Octubre 2007)



XREAP2007-09

Albalate, D. (PPRE-IREA)

“Shifting death to their Alternatives: The case of Toll Motorways”
(Octubre 2007)

XREAP2007-10

Segarra-Blasco, A. (GRIT); **Garcia-Quevedo, J.** (IEB); **Teruel-Carrizosa, M.** (GRIT)

“Barriers to innovation and public policy in catalonia”
(Novembre 2007)

XREAP2007-11

Bel, G. (PPRE-IREA); **Foote, J.**

“Comparison of recent toll road concession transactions in the United States and France”
(Novembre 2007)

XREAP2007-12

Segarra-Blasco, A. (GRIT);

“Innovation, R&D spillovers and productivity: the role of knowledge-intensive services”
(Novembre 2007)

XREAP2007-13

Bermúdez Morata, Ll. (RFA-IREA); **Guillén Estany, M.** (RFA-IREA), **Solé Auró, A.** (RFA-IREA)

“Impacto de la inmigración sobre la esperanza de vida en salud y en discapacidad de la población española”
(Novembre 2007)

XREAP2007-14

Calaeys, P. (AQR-IREA); **Ramos, R.** (AQR-IREA), **Suriñach, J.** (AQR-IREA)

“Fiscal sustainability across government tiers”
(Desembre 2007)

XREAP2007-15

Sánchez Hugalbe, A. (IEB)

“Influencia de la inmigración en la elección escolar”
(Desembre 2007)



2008

XREAP2008-01

Durán Weitkamp, C. (GRIT); Martín Bofarull, M. (GRIT) ; Pablo Martí, F.
“Economic effects of road accessibility in the Pyrenees: User perspective”
(Gener 2008)

XREAP2008-02

Díaz-Serrano, L.; Stoyanova, A. P. (CREB)
“The Causal Relationship between Individual’s Choice Behavior and Self-Reported Satisfaction: the Case of Residential Mobility in the EU”
(Març 2008)

XREAP2008-03

Matas, A. (GEAP); Raymond, J. L. (GEAP); Roig, J. L. (GEAP)
“Car ownership and access to jobs in Spain”
(Abril 2008)

XREAP2008-04

Bel, G. (PPRE-IREA) ; Fageda, X. (PPRE-IREA)
“Privatization and competition in the delivery of local services: An empirical examination of the dual market hypothesis”
(Abril 2008)

XREAP2008-05

Matas, A. (GEAP); Raymond, J. L. (GEAP); Roig, J. L. (GEAP)
“Job accessibility and employment probability”
(Maig 2008)

XREAP2008-06

Basher, S. A.; Carrión, J. Ll. (AQR-IREA)
Deconstructing Shocks and Persistence in OECD Real Exchange Rates
(Juny 2008)

XREAP2008-07

Sanromá, E. (IEB); Ramos, R. (AQR-IREA); Simón, H.
Portabilidad del capital humano y asimilación de los inmigrantes. Evidencia para España
(Juliol 2008)

XREAP2008-08

Basher, S. A.; Carrión, J. Ll. (AQR-IREA)
Price level convergence, purchasing power parity and multiple structural breaks: An application to US cities
(Juliol 2008)

XREAP2008-09

Bermúdez, Ll. (RFA-IREA)
A priori ratemaking using bivariate poisson regression models
(Juliol 2008)



XREAP2008-10

Solé-Ollé, A. (IEB), **Hortas Rico, M.** (IEB)

Does urban sprawl increase the costs of providing local public services? Evidence from Spanish municipalities

(Novembre 2008)

XREAP2008-11

Teruel-Carrizosa, M. (GRIT), **Segarra-Blasco, A.** (GRIT)

Immigration and Firm Growth: Evidence from Spanish cities

(Novembre 2008)

XREAP2008-12

Duch-Brown, N. (IEB), **García-Quevedo, J.** (IEB), **Montolio, D.** (IEB)

Assessing the assignation of public subsidies: Do the experts choose the most efficient R&D projects?

(Novembre 2008)

XREAP2008-13

Bilokach, V., **Fageda, X.** (PPRE-IREA), **Flores-Fillol, R.**

Scheduled service versus personal transportation: the role of distance

(Desembre 2008)

XREAP2008-14

Albalate, D. (PPRE-IREA), **Gel, G.** (PPRE-IREA)

Tourism and urban transport: Holding demand pressure under supply constraints

(Desembre 2008)



2009

XREAP2009-01

Calonge, S. (CREB); Tejada, O.

“A theoretical and practical study on linear reforms of dual taxes”
(Febrer 2009)

XREAP2009-02

Albalate, D. (PPRE-IREA); Fernández-Villadangos, L. (PPRE-IREA)

“Exploring Determinants of Urban Motorcycle Accident Severity: The Case of Barcelona”
(Març 2009)

XREAP2009-03

Borrell, J. R. (PPRE-IREA); Fernández-Villadangos, L. (PPRE-IREA)

“Assessing excess profits from different entry regulations”
(Abril 2009)

XREAP2009-04

Sanromá, E. (IEB); Ramos, R. (AQR-IREA), Simon, H.

“Los salarios de los inmigrantes en el mercado de trabajo español. ¿Importa el origen del capital humano?”
(Abril 2009)

XREAP2009-05

Jiménez, J. L.; Perdiguero, J. (PPRE-IREA)

“(No)competition in the Spanish retailing gasoline market: a variance filter approach”
(Maig 2009)

XREAP2009-06

Álvarez-Albelo, C. D. (CREB), Manresa, A. (CREB), Pigem-Vigo, M. (CREB)

“International trade as the sole engine of growth for an economy”
(Juny 2009)

XREAP2009-07

Callejón, M. (PPRE-IREA), Ortún V, M.

“The Black Box of Business Dynamics”
(Setembre 2009)

XREAP2009-08

Lucena, A. (CREB)

“The antecedents and innovation consequences of organizational search: empirical evidence for Spain”
(Octubre 2009)

XREAP2009-09

Domènech Campmajó, L. (PPRE-IREA)

“Competition between TV Platforms”
(Octubre 2009)



XREAP2009-10

Solé-Auró, A. (RFA-IREA), **Guillén, M.** (RFA-IREA), **Crimmins, E. M.**

“Health care utilization among immigrants and native-born populations in 11 European countries. Results from the Survey of Health, Ageing and Retirement in Europe”

(Octubre 2009)

XREAP2009-11

Segarra, A. (GRIT), **Teruel, M.** (GRIT)

“Small firms, growth and financial constraints”

(Octubre 2009)

XREAP2009-12

Matas, A. (GEAP), **Raymond, J.Ll.** (GEAP), **Ruiz, A.** (GEAP)

“Traffic forecasts under uncertainty and capacity constraints”

(Novembre 2009)

XREAP2009-13

Sole-Ollé, A. (IEB)

“Inter-regional redistribution through infrastructure investment: tactical or programmatic?”

(Novembre 2009)

XREAP2009-14

Del Barrio-Castro, T., **García-Quevedo, J.** (IEB)

“The determinants of university patenting: Do incentives matter?”

(Novembre 2009)

XREAP2009-15

Ramos, R. (AQR-IREA), **Suriñach, J.** (AQR-IREA), **Artís, M.** (AQR-IREA)

“Human capital spillovers, productivity and regional convergence in Spain”

(Novembre 2009)

XREAP2009-16

Álvarez-Albelo, C. D. (CREB), **Hernández-Martín, R.**

“The commons and anti-commons problems in the tourism economy”

(Desembre 2009)



2010

XREAP2010-01

García-López, M. A. (GEAP)

“The Accessibility City. When Transport Infrastructure Matters in Urban Spatial Structure”
(Febrer 2010)

XREAP2010-02

García-Quevedo, J. (IEB), **Mas-Verdú, F.** (IEB), **Polo-Otero, J.** (IEB)

“Which firms want PhDs? The effect of the university-industry relationship on the PhD labour market”
(Març 2010)

XREAP2010-03

Pitt, D., Guillén, M. (RFA-IREA)

“An introduction to parametric and non-parametric models for bivariate positive insurance claim severity distributions”
(Març 2010)

XREAP2010-04

Bermúdez, Ll. (RFA-IREA), **Karlis, D.**

“Modelling dependence in a ratemaking procedure with multivariate Poisson regression models”
(Abril 2010)

XREAP2010-05

Di Paolo, A. (IEB)

“Parental education and family characteristics: educational opportunities across cohorts in Italy and Spain”
(Maig 2010)

XREAP2010-06

Simón, H. (IEB), **Ramos, R.** (AQR-IREA), **Sanromá, E.** (IEB)

“Movilidad ocupacional de los inmigrantes en una economía de bajas cualificaciones. El caso de España”
(Juny 2010)

XREAP2010-07

Di Paolo, A. (GEAP & IEB), **Raymond, J. Ll.** (GEAP & IEB)

“Language knowledge and earnings in Catalonia”
(Juliol 2010)

XREAP2010-08

Bolancé, C. (RFA-IREA), **Alemany, R.** (RFA-IREA), **Guillén, M.** (RFA-IREA)

“Prediction of the economic cost of individual long-term care in the Spanish population”
(Setembre 2010)

XREAP2010-09

Di Paolo, A. (GEAP & IEB)

“Knowledge of catalan, public/private sector choice and earnings: Evidence from a double sample selection model”
(Setembre 2010)



XREAP2010-10

Coad, A., Segarra, A. (GRIT), Teruel, M. (GRIT)
“Like milk or wine: Does firm performance improve with age?”
(Setembre 2010)

XREAP2010-11

Di Paolo, A. (GEAP & IEB), Raymond, J. Ll. (GEAP & IEB), Calero, J. (IEB)
“Exploring educational mobility in Europe”
(Octubre 2010)

XREAP2010-12

Borrell, A. (GiM-IREA), Fernández-Villadangos, L. (GiM-IREA)
“Clustering or scattering: the underlying reason for regulating distance among retail outlets”
(Desembre 2010)

XREAP2010-13

Di Paolo, A. (GEAP & IEB)
“School composition effects in Spain”
(Desembre 2010)

XREAP2010-14

Fageda, X. (GiM-IREA), Flores-Fillol, R.
“Technology, Business Models and Network Structure in the Airline Industry”
(Desembre 2010)

XREAP2010-15

Albalate, D. (GiM-IREA), Bel, G. (GiM-IREA), Fageda, X. (GiM-IREA)
“Is it Redistribution or Centralization? On the Determinants of Government Investment in Infrastructure”
(Desembre 2010)

XREAP2010-16

Oppedisano, V., Turati, G.
“What are the causes of educational inequalities and of their evolution over time in Europe? Evidence from PISA”
(Desembre 2010)

XREAP2010-17

Canova, L., Vaglio, A.
“Why do educated mothers matter? A model of parental help”
(Desembre 2010)



2011

XREAP2011-01

Fageda, X. (GiM-IREA), **Perdiguero, J.** (GiM-IREA)

“An empirical analysis of a merger between a network and low-cost airlines”

(Maig 2011)

XREAP2011-02

Moreno-Torres, I. (ACCO, CRES & GiM-IREA)

“What if there was a stronger pharmaceutical price competition in Spain? When regulation has a similar effect to collusion”

(Maig 2011)

XREAP2011-03

Miguélez, E. (AQR-IREA); **Gómez-Miguélez, I.**

“Singling out individual inventors from patent data”

(Maig 2011)

XREAP2011-04

Moreno-Torres, I. (ACCO, CRES & GiM-IREA)

“Generic drugs in Spain: price competition vs. moral hazard”

(Maig 2011)

XREAP2011-05

Nieto, S. (AQR-IREA), **Ramos, R.** (AQR-IREA)

“¿Afecta la sobreeducación de los padres al rendimiento académico de sus hijos?”

(Maig 2011)

XREAP2011-06

Pitt, D., Guillén, M. (RFA-IREA), **Bolancé, C.** (RFA-IREA)

“Estimation of Parametric and Nonparametric Models for Univariate Claim Severity Distributions - an approach using R”

(Juny 2011)

XREAP2011-07

Guillén, M. (RFA-IREA), **Comas-Herrera, A.**

“How much risk is mitigated by LTC Insurance? A case study of the public system in Spain”

(Juny 2011)

XREAP2011-08

Ayuso, M. (RFA-IREA), **Guillén, M.** (RFA-IREA), **Bolancé, C.** (RFA-IREA)

“Loss risk through fraud in car insurance”

(Juny 2011)

XREAP2011-09

Duch-Brown, N. (IEB), **García-Quevedo, J.** (IEB), **Montolio, D.** (IEB)

“The link between public support and private R&D effort: What is the optimal subsidy?”

(Juny 2011)



XREAP2011-10

Bermúdez, Ll. (RFA-IREA), **Karlis, D.**

“Mixture of bivariate Poisson regression models with an application to insurance”
(Juliol 2011)

XREAP2011-11

Varela-Irimia, X-L. (GRIT)

“Age effects, unobserved characteristics and hedonic price indexes: The Spanish car market in the 1990s”
(Agost 2011)

XREAP2011-12

Bermúdez, Ll. (RFA-IREA), **Ferri, A.** (RFA-IREA), **Guillén, M.** (RFA-IREA)

“A correlation sensitivity analysis of non-life underwriting risk in solvency capital requirement estimation”
(Setembre 2011)

XREAP2011-13

Guillén, M. (RFA-IREA), **Pérez-Marín, A.** (RFA-IREA), **Alcañiz, M.** (RFA-IREA)

“A logistic regression approach to estimating customer profit loss due to lapses in insurance”
(Octubre 2011)

XREAP2011-14

Jiménez, J. L., Perdiguero, J. (GiM-IREA), **García, C.**

“Evaluation of subsidies programs to sell green cars: Impact on prices, quantities and efficiency”
(Octubre 2011)

XREAP2011-15

Arespa, M. (CREB)

“A New Open Economy Macroeconomic Model with Endogenous Portfolio Diversification and Firms Entry”
(Octubre 2011)

XREAP2011-16

Matas, A. (GEAP), **Raymond, J. L.** (GEAP), **Roig, J.L.** (GEAP)

“The impact of agglomeration effects and accessibility on wages”
(Novembre 2011)

XREAP2011-17

Segarra, A. (GRIT)

“R&D cooperation between Spanish firms and scientific partners: what is the role of tertiary education?”
(Novembre 2011)

XREAP2011-18

García-Pérez, J. I.; Hidalgo-Hidalgo, M.; Robles-Zurita, J. A.

“Does grade retention affect achievement? Some evidence from PISA”
(Novembre 2011)

XREAP2011-19

Arespa, M. (CREB)

“Macroeconomics of extensive margins: a simple model”
(Novembre 2011)



XREAP2011-20

García-Quevedo, J. (IEB), **Pellegrino, G.** (IEB), **Vivarelli, M.**

“The determinants of YICs’ R&D activity”

(Desembre 2011)

XREAP2011-21

González-Val, R. (IEB), **Olmo, J.**

“Growth in a Cross-Section of Cities: Location, Increasing Returns or Random Growth?”

(Desembre 2011)

XREAP2011-22

Gombau, V. (GRIT), **Segarra, A.** (GRIT)

“The Innovation and Imitation Dichotomy in Spanish firms: do absorptive capacity and the technological frontier matter?”

(Desembre 2011)



2012

XREAP2012-01

Borrell, J. R. (GiM-IREA), **Jiménez, J. L.**, **García, C.**
“Evaluating Antitrust Leniency Programs”
(Gener 2012)

XREAP2012-02

Ferri, A. (RFA-IREA), **Guillén, M.** (RFA-IREA), **Bermúdez, Ll.** (RFA-IREA)
“Solvency capital estimation and risk measures”
(Gener 2012)

XREAP2012-03

Ferri, A. (RFA-IREA), **Bermúdez, Ll.** (RFA-IREA), **Guillén, M.** (RFA-IREA)
“How to use the standard model with own data”
(Febrer 2012)

XREAP2012-04

Perdiguero, J. (GiM-IREA), **Borrell, J.R.** (GiM-IREA)
“Driving competition in local gasoline markets”
(Març 2012)

XREAP2012-05

D’Amico, G., **Guillen, M.** (RFA-IREA), Manca, R.
“Discrete time Non-homogeneous Semi-Markov Processes applied to Models for Disability Insurance”
(Març 2012)

XREAP2012-06

Bové-Sans, M. A. (GRIT), Laguado-Ramírez, R.
“Quantitative analysis of image factors in a cultural heritage tourist destination”
(Abril 2012)

XREAP2012-07

Tello, C. (AQR-IREA), **Ramos, R.** (AQR-IREA), **Artís, M.** (AQR-IREA)
“Changes in wage structure in Mexico going beyond the mean: An analysis of differences in distribution, 1987-2008”
(Maig 2012)

XREAP2012-08

Jofre-Monseny, J. (IEB), **Marín-López, R.** (IEB), **Viladecans-Marsal, E.** (IEB)
“What underlies localization and urbanization economies? Evidence from the location of new firms”
(Maig 2012)

XREAP2012-09

Muñiz, I. (GEAP), **Calatayud, D.**, **Dobaño, R.**
“Los límites de la compacidad urbana como instrumento a favor de la sostenibilidad. La hipótesis de la compensación en Barcelona medida a través de la huella ecológica de la movilidad y la vivienda”
(Maig 2012)



XREAP2012-10

Arqué-Castells, P. (GEAP), **Mohnen, P.**

“Sunk costs, extensive R&D subsidies and permanent inducement effects”

(Maig 2012)

XREAP2012-11

Boj, E. (CREB), **Delicado, P.**, **Fortiana, J.**, **Esteve, A.**, **Caballé, A.**

“Local Distance-Based Generalized Linear Models using the dbstats package for R”

(Maig 2012)

XREAP2012-12

Royuela, V. (AQR-IREA)

“What about people in European Regional Science?”

(Maig 2012)

XREAP2012-13

Osorio A. M. (RFA-IREA), **Bolancé, C.** (RFA-IREA), **Madise, N.**

“Intermediary and structural determinants of early childhood health in Colombia: exploring the role of communities”

(Juny 2012)



xreap@pcb.ub.es