Education gradient in children's health care use: health needs and preventive care

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VERY PRELIMINAR DRAFT

Abstract

We specifically address the question of whether, for equal needs, parental education has an influence on their children's public health care use? We explore a subpopulation in Catalonia (Spain) by means of longitudinal administrative data. We use panel data models for count data. Our findings show that the greater the educational level attained by their father, conditional on household income, the lower the number of visits to GPs whereas no effect is found on the visits to specialists or emergency room use. To provide causal evidence, we decided to instrument schooling years by means of a natural experiment provided by parental month of birth. We have also examined parental education effects in preventive care using data from the "Health Children Program" (preventive medicine) and vaccinations registers. We only evidence the presence of an education gradient for specific preventive care (optional vaccinations) through the public health system.

Key words: income gradient, preventive care, children's health

JEL codes: I14, I18

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1. Introduction

Children's health status has been evidenced to be strongly relevant in adult life[1]. One way to remediate children's health is to make use of health care resources. Obviously, children's health care use (HCU) is driven by parental decisions. Thus, parental background characteristics play a role in children's health care utilization. In this paper, we specifically address the question of whether, for equal needs, parental education has an influence on their children's public health care use? Do more educated parents use more frequently public health resources? On the one hand, a greater health care use can arise mainly because the greater the parental education the more able parents are to identify a severe ill health, and thus, the more conscious of their need to visit a doctor. Likewise, conditional on visiting a GP, the more educated parents might be more likely to arrange a second visit or to insist in visiting a specialist. On the other hand, a negative answer is expected a priori given that more educated mothers are more likely to be enrolled in the labour market, and, as a consequence, experience more time constraints although could experience lower differential penalties for missing work. A second reason would consist on the expected negative effect raised from greater educated parents being more conscious to discriminate what really implies a new visit to GP or specialists. Furthermore, greater educated parents, given its association with household income, are more prone to contract supplemental private health coverage which would consequently reduce their use of public health care resources. To our knowledge, no previous literature explaining counts of visits has tackled children's health care use conditioned on parental socioeconomic status (SES).

However, in our opinion, in exploring that research question we should differentiate preventive health care use from the one specifically related to cover health needs. That is, do parents make use of public health care resources in the same way when it refers to preventive health care use compared to when it is related to visits because of a disease?

[1] Literature has evidenced the effects of childhood health status on trajectories of the most central measures of socioeconomic status during individual's adult years (Case, Fertig and Paxson, 2005; Oreopoulos, Stabile, Walld and Roos, 2008; Currie, Stabile, Manivong and Roos, 2010; Smith, 2009; and Almond and Currie, 2011; for an extensive review).

Our dataset allows us to distinguish between those visits for advice to confirm that their children show a healthy status from those because of the presence of health care needs.

Additionally, we have information of the Healthy Child Program. This public health program is addressed to children at the paediatric age containing protocols of preventive medicine that proposes actions to promote health and disease prevention in childhood. We expect to evidence a higher probability of health care use of less educated parents given that the implementation of the program promoted calls to increase attendance of *riskier* children. However, these registers in the protocols contain detailed information that allows us to detect those visits related to advice for some vaccinations that were controversial, due to their effectiveness, instead of referring to regular screenings.[2] Furthermore, we also have access to further administrative registers containing provided vaccinations. Free immunizations are amongst the highest priorities of preventive health-care services for children. At this stage, we can distinguish those systematic vaccinations to those which are voluntary, and especially we can check the provision of those vaccinations which were controversial.

Apart from the novelty of our analysis, we contribute to literature of inequities in health because the used dataset. We explore a subpopulation in Catalonia (Spain) by means of longitudinal administrative data. Thus, we analyse the education gradient in a publicly funded health care system with universal coverage for children. In principle, the association might be weaker than in privately financed systems although income and education have an impact on children health status.

The paper is structured as follows. The next section reviews related literature whilst the third section describes the data and the econometric procedures used. The fourth section contains our empirical results, and the final section concludes.

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[2] In fact, the only analysis addressing SES associations with provided preventive screenings can be found in Navarro-Rubio, Jovell and Schor (1995). However, these authors do not dispose enough variation in immunization provision and very limited information on preventive measures.

2. Related literature

Although we specifically address the question of the impact of parental education on children's health care use, it is relevant to know the role of education in explaining the number of visits to GP or specialists conditional on needs and income for adult individuals. In the European context, Bago d'Uva and Jones (2009) found evidence of a positive education gradient in the probability of being a high user, for specialists in all countries, except Italy and Portugal, for which the association between more education and being a high user is evident only at a minor level of education. Thus, adult individuals who attain a higher educational level are more likely to be heavy users of specialists. However, a different pattern is observed when analysing GP visits. That is, the higher the educational attainment level the lower the number of visits to GP. However, this effect becomes statistically insignificant when health is instrumented and then corrected for reporting heterogeneity although it remains for the visits to specialists (Bago d'Uva, Lindeboom, O'Donnell and van Doorslaer, 2011). Then, do we expect the same behaviour when exploring children's health care use? Do more educated parents will more often visit specialists but not GPs such they behave with regards to their own needs? Or on the contrary given their higher knowledge of illness consequences will they need to clarify more often their queries on their children's health? We answer all these questions throughout the paper.

Importantly, it is needed to separate education's role from income gradient effects. The better educated are less likely to experience risky behaviours (smoking, drink heavily, overweight, or use illegal drugs) due to heterogeneity in preferences or in discount rates. It is expected a more preventive care, greater effectiveness in managing child chronic health conditions, more advantage of new medical technologies and better access or assimilation of health information (Anderberg, Chevalier and Wadsworth, 2011) when a higher level of parental education is attained. In order to find causality, some papers used "natural experiments"[3] exploiting exogenous variation of education induced by school reforms (see for a review Lindeboom, Llena-Nozal and van der Klaauw, 2009) or using adoptees datasets to separate nurturing from nature effects (Chen and Li, 2009).

The existence of a SES gradient in children's health is extensively documented in developed countries. No matters SES dimension is considered (income, wealth or education). On the one hand and specifically for the SES income gradient two pioneering and influential papers evidenced this association. The former, using cross-sectional data for the US, Case, Lubotsky and Paxson (2002) evidenced the influence of parent's income on children's health strengthening as children age. The latter was also found for Canada (Currie and Stabile, 2003). More recently, several papers have corroborated this positive association between household income and children's health for the US (Condliffe and Link, 2008; Murasko, 2008), UK (Currie, Shields and Price, 2007), Germany (Reinhold and Jürges, 2011) and Australia (Khanam, Nghiem and Connelly, 2009) although the latter shows the smaller income gradient compared to the other two countries having universal health care financing insurance. Notwithstanding, Propper, Rigg and Burgess (2007) conclude that after including parental behaviours that may affect child health and parental health in particular mother's mental health, there is almost no direct impact of income.

On the other hand, differences in health by education are also well documented (Cutler and Lleras-Muney, 2010). With regards parental education effects on children's health, the common is that after including parental education into regression analyses, income effects considerably decrease in magnitude (Case, Lubotsky and Paxson, 2002; Murasko, 2008). However, two exceptions are worthy of mention. Propper, Rigg and Burgess (2007) evidence for the UK that neither maternal nor paternal education have any association with child health whereas Reinhold and Jürges (2011) found income having a strong independent effect after controlling by educational attainment levels and unemployment.

[3] Given that assign individuals randomly to different levels of education is unethical.

As far as we know, literature mainly has addressed the presence of this gradient in children's health and explored marginally this gradient in utilization. Thus, little research has been conducted in the past with regards to the presence of an education gradient in children health care use. Oreopoulos, Stabile, Walld and Roos (2008), in exploring the role of children's health at birth on health status, address linearly the number of visits to physicians between the ages of 12 and 17 but the coefficients referring to education are not displayed. Then, Reinhold and Jürges (2011) explored higher participation in free screening examinations were induced by parental income effects which might bias chronic conditions detections ("diagnosis bias" effect). However, they use a self-reported measure by parents and they do not estimate by counts but an ordered logit. Specifically for the Spanish case, the only reference constitutes Navarro-Rubio, Jovell and Schor (1995) who evidenced the presence of an association between SES and some preventive visits (visual, hearing and dental exams). However, these authors use very limited cross-sectional information at the national level.

3. Data and econometric methodology

The data used are observational and longitudinal data based on administrative and medical records of patients followed-up during seven consecutive years in six primary care centres (Apenins-Montigalà, Morera-Pomar, Montgat-Tiana, Nova Lloreda, Progrés-Raval and Marti i Julià) and two reference hospitals (Hospital Municipal de Badalona and Hospital Universitari Germans Trias i Pujol), serving to more than 110,000 inhabitants in the north-eastern area of Barcelona. This population is mostly urban, of lower-middle socioeconomic status and from a predominantly industrial context. Our sample includes patients aged below 18 who had at least one contact with the system from 1st January 2004 to 31st December 2010, and who belong to the above-mentioned healthcare centres during the study period. The study also considers those who deceased during the analysed period.

This dataset incorporates a rich set of information regarding utilization of healthcare resources (number of visits to the GP, specialist and emergency care; hospitalizations and bed days; laboratory, radiology and other diagnostic tests; or consumption of medicines), clinical measurements of weight and height[4], chronic conditions and other diseases associated with each patient (according to the ICPC-2), functional limitations, date of admission and discharge, type of healthcare professional(s) contacted and motive of the visit. Moreover, the dataset informs on each patient's age, gender, employment status (active/retired), place of birth and habitual residence. Owing to a unique identifier, the register data is additionally merged with the Population Census allowing us to incorporate new variables for each patient (e.g., education, marital status or employment status) that were not available in the original sample although the last Spanish Census was conducted in 2001. Given this, the information we matched corresponds to this specific year. EVOLUTION of labour: need to wait till January 2013.

The use of administrative data[5] for counts constitutes per se a contribution in this literature[6] since most of studies rely on health status by means of self-assessed measures (health status and chronic conditions). These measures are considered powerful predictors of mortality (Burström and Fredlund, 2001) and good predictors of subsequent use of medical care (van Doorslaer et al., 2000). However, the reliability of this subjective measure of health has been questioned (Crossley and Kennedy, 2002; Baker, Stabile and Deri, 2004). Indeed, Baker, Stabile and Deri (2004) found that false negative reporting (users but not reporting in the survey) was around 50% for most chronic conditions examined. Individual misreport basically because misremember visits to clinicians or simply because do not give relevance to some actions in the past.

[4] The body mass index (BMI) of each patient was calculated as weight (in kilograms) divided by the square of height (in metres) using clinical or measured information. The traditional problems found in reporting this information are not an issue here. Notice that in our sample not all patients are measured when they visit the physician, however there are other individuals with several measurements along the observed period.

[5] A caveat constitutes that registers contain administrative errors that need to be accurately cleaned.

[6] A few exceptions can be found in: Oreopoulos, Stabile, Walld and Roos (2008) and Currie, Stabile, Manivong and Roos (2010) using administrative data from Manitoba (Canada). On the other hand, Currie, Shields and Price (2007) and Reinhold and Jürges (2011) included some medical examinations.

Then, if misreporting children's health status is income or educational graded, the use of self-reported measures will produce biased estimates of the SES gradient (Bago d'Uva, Lindeboom, O'Donnell and van Doorslaer, 2011).[7] So far, after the use of more objective measure, the income gradient is not evidenced (Currie, Shields and Price, 2007). To our knowledge, no previous literature has addressed the specific question to what extent children's health parental misreporting is driven by their socioeconomic status but, a priori, we expect a similar education gradient. In this regard, Propper, Rigg and Burgess (2007) evidenced maternal misreporting by comparing her assessments with that of their partners although they did not show the underpinning reasons.

Descriptive statistics are given in Table 1. We restricted the sample to those who were below 18 years old during the whole analysed period and there was available parental background information from the Census. Thus, our balanced panel dataset contains information of 11,415 children during the period 2004-2010 (79,905 observations). Seven health sanitary districts were considered. The average number of visits to GP and specialists were 6.95 and 0.39, respectively. We also report descriptives for average number of hospitalization days and urgency visits as well as some other information with regards to laboratory, radiology and diagnostic tests. The average age of children is 6.27 years, 48.4% of children are female and 0.01% had the status of immigrant.[8] Average distance to GP and hospital were 4.02 and 7.34 minutes, respectively. We also report average lifestyle behaviours (BMI, smoking and alcoholism). Next, we report some descriptives for needs. On average, it is worthy to mention that children visited GPs almost 7 times because 2.1 different health issues. We also computed the Charlson

[7] It is known the influence of education on biases in several self-reported health outcomes. For instance, Johnston, Propper and Shields (2009) evidenced a sizeable gradient when using objectively measured hypertension but not when using self-reported measure and a false negative reporting significantly income graded. Specifically for the bias in self-reported BMI, Etilé (2007) and Gil and Mora (2011) found significant effects for social norms (accounting mainly for education and age cohorts).

[8] We are not focussing on this issue given that our dataset is linked with the 2001 Census. Note that the more intensive immigration period was 2001-2008. The percentage of immigrants in Spain in 2001 was 2.28% of the total population whereas this figure rose to a 12.17%. Strictly speaking about the Badalona city, immigrants were 14.8% of the population in 2010. However, it is very easy to get coverage from the public health system through obtaining the health identity card simply registering at their municipality (obviously, these are not identified from the Census). In our sample the initial percentage of immigrant children was 11%. Thus, we suffer a significant lose in the sample of immigrants in our estimations after including parental information from the Census.

co-morbidity index[9] given that diagnoses codes were available for the visits to GP. Finally, a list of dummies collect the presence of severe diseases in which mental and cardio related diseases were grouped.

Next, we included parental background with some information linked via Census data. Parents' descriptives show a greater average number of visits either to GP or specialists compared to their children. Average ages were 45.04 and 43.07 years for fathers and mothers, respectively. Mothers attained slightly greater schooling years.[10] With regards to labour market maternal employment levels were almost identical to those in average in Catalonia.[11] Lifestyle behaviours are similar to population ones (BMI or smoking, for example). We finally report some descriptives about specific diseases such those related to mental health (depression, neurological diseases, dementia and psychosis).

[Insert Tables 1 & 2 here]

The overall proportion of zero GP visits was 30.97%, whereas this figure is obviously greater for either the visits to specialists or urgencies (82.6% and 93.2%, respectively). Then, Table 3 displays the average number of visits conditioned on parental educational attainment levels. It can be appreciated that the higher the educational level is attained by parents the lower the number of visits to GP for their children. This pattern is evidenced both for fathers or mothers and it is corroborated for the visits to specialists. The latter is marginally found, as expected, for urgencies use.

[9] This index predicts the ten-year mortality for a patient who may have a range of co-morbid conditions such as heart disease, AIDS, or cancer (a total of 22 conditions). Each condition is assigned with a score of 1, 2, 3 or 6 depending on the risk of dying associated with this condition.

[10] One caveat constitutes the fact that, strictly speaking about the Badalona city, it is a low-middle class area compared to the whole Catalan region (83 index number for the Gross disposable household income; Catalonia=100). Likewise, in 2007, the percentage of individuals not attaining any degree was 12.9 percentage points being significantly lower compared to Catalonia. The greatest difference was observed for those attaining a university degree (8.3% vs. 15.7%, respectively).

[11] The Catalan participation rate in 2004 was 71.3% and 50.8% for men and women, respectively. These figures were 70.4% and 55.5% in 2010. Likewise, strong differences rise by educational attainment and gender. Thus, in 2007, for those Catalan women attaining primary studies or below this level, their participation was 33 percentage points lower compared to men whereas for those attaining the highest educational this difference was only 7.1%. For the younger cohort (25-34 years old) these figures were slightly different, 35.4% and 6.7%, respectively.

[Insert Table 3 here]

We model children's health care use (HCU) by means of individual determinants (such differences in preferences and discount rates) and the health care system characteristics (organizational framework to provide health care) and. Relevant influences are summarized by the following reduced form equation:

$$HCU_{c,t} = \alpha_0 + \alpha_1 H_{c,t} + \alpha_3 H_{p,t} + \alpha_4 SES_{p,t} + \alpha_5 B_{c,t} + \alpha_6 B_{p,t} + \alpha_7 X_{c,t} + \alpha_8 X_{p,t} + \alpha_9 D_c + \alpha_{10} HD_c + error \quad (1)$$

where *H* denotes health status and *B* represents individual behaviour whereas subscripts *c* means children, *p* denotes parental and *t* indicates the analysed time period *t*=2004…2010. The most important reason for health service utilization is a person's need. Thus, health status degree is proxied through a list of dummy variables representing children experiencing severe diseases (hypertension, lipids and cholesterol problems, cardio problems, bronchial asthma and chronic obstructive pulmonary disease, the presence of any mental disorder and malignant neoplasms). With regards to health care provision, we computed the distance (D) between children's residence and the closest GP that is the one they belong to (also for both hospitals). Note that specialists are located in the same building as GP. Then, HD_c controls for the health district children belong to. Alternatively, we also estimated conditional on specific GPs FE (doctors attending at first consult and deciding whether the need for a referral or a second consultancy in GP). The latter will pick up 'supplier-induced demand', that is GPs influencing patient demand for care.

Parental information was linked by means of the use of household identifiers provided by Census Statistics (2011) and municipality administrative records containing information on population evolution.[12] With regards SES it is separately proxied by means of educational attainment levels and inferred salaries records through the use of average earnings based on occupational codes[13]. Mother's education and father's education have been considered usually separately because mostly it is the mother who takes more care of children's health, especially at younger ages (Contoyannis and Li, 2011). We also included maternal employment status. Parental behaviour (B_p) is captured through lifestyle habits (BMI and dummies representing smoking, alcohol heavy-drinkers) whereas *X* contains a list of covariates denoting differences in preferences (age, female, status of immigrant).

Given the nature of our endogenous variable, we proceed to estimate by means of TERESA writing

LAGGED HCU? Lagged visits for state dependence: motivate but problematic (GMM but need an instrument). State dependence will be taken into account by controlling for the lag of the number of visits of the child, while unobserved heterogeneity will be controlled for by using random effects models.

4. Empirical results

4.1.Main findings

Table 4 shows our main primary results. The first two columns display evidence for visits to GP, columns (3) and (4) refers to visits to specialists whilst the last two columns show results for urgencies use. Columns (1), (3) and (5) do not include parental information whereas the rest do. As it can be appreciated, the only variable that is statistically significant regarding parental education is the one for the fathers when explaining visits to GPs, after controlling for parental information. In fact, the greater the educational level is attained by their father, the lower the children visits to GP. We

[12] Household identifiers were provided by the Catalan Institute of Statistics (IDESCAT).
[13] Average salary records in 2002 by occupational category were also provided by IDESCAT.

found no effect on the visits to specialists or urgencies use. Note that these results are conditioned on household income. All results were robust to the exclusion of some parental information such either parental health care use or health status proxied through the number of diseases in a year. Furthermore, results showed also robustness to the use of educational categories instead of schooling years (we do not show for redundancy reasons).

[Insert Table 4 here]

4.2. *Do parents differ in their behaviour based on gender or age-cohort?*

At this stage, we wondered about the presence of heterogeneous effects for different subpopulations. For this reason, we disentangled individuals from the sample based on gender and age-cohorts. Table 5 displays these results. Interestingly, the education gradient is not present for the population of girls (column 1) but holds for boys (column 2). The reasoning may underlie in the fact that parents makes a difference in taking a decision to visit a physician based on children' gender. Note that irrespectively to parental education levels, parents take more care when the children is a girl, Table 5, columns 3 to 5, explores education gradient distinguishing three age cohorts. There still statistically significant effects of parental education for children who are from 6 years old to 18 although for the group of children who are 6 to 12 years old the parameter is only statistically significant at 10%. However, visits of children with a lower age are not influenced by the educational levels of their parents. This finding is in line with the existence of an age profile has been also found for Canada (Currie and Stabile, 2003) and more recently corroborated for the US (Murasko, 2008).[14]

[14] Improvements by using a panel data framework accounting for unobserved heterogeneity and modelling the evolution process of health outcomes from childhood to adolescence have been recently carried out (Contoyannis and Li, 2011). However, Currie, Shields and Price (2007) and Propper, Rigg and Burgess (2007) found no evidence that the income-health gradient increased with age in their sample of British children and Reinhold and Jürges (2011) for Germany. Chen, Martin and Matthew (2006) found the same no evidence by age profile for the US, although for specific conditions the gradient appeared at adolescence. In a reply, Case, Lee and Paxson (2008) re-examined Currie, Shields and Price (2007) findings, evidencing income-health gradient for children increases with age in both the US and the UK although smaller in magnitude for the English sample.

[Insert Table 5 here]

4.3. *Results sensitivity to lifestyle behaviours*

Notwithstanding, in our opinion, a heterogeneous impact might appear given a specific parental educational attainment level because the presence of dissimilarities in their lifestyle behaviour differences in tastes. Apart from this, although the more educated are less likely to become overweight or obese, maternal employment might affect children's health status (Gennetian, Hill, London and Lopoo, 2010). This might occur, for instance, through engaging their children to more sedentary activities. Note that employed mothers will have less time to supervise children's activities and to prepare meals or stop breastfeeding earlier. On reverse, labour market participation raises income which produces better health (children enrolled in extracurricular activities or provide better quality of food) although selection might be present.

Thus, lifestyle behaviours effects, such inactivity, conditioned on educational attainment levels need to be tested. With regards this sedentary behaviour, it can be partially controlled by means of parental anthropometric measures such as the Body Mass Index (BMI) constituting one of the intergenerational transmissions of health and being heavily influenced by the role of social norms. Intergenerational correlations in health have mainly focussed on mother-child strong associations in birth weight (Currie and Moretti, 2007) and self-assessed health or parental anthropometric measures (Coneus and Spiess, 2012). These findings rely on the skill formation model developed in Heckman (2007) in which children's health status depends on endowments at birth (genetic transmission), environmental conditions (lifestyle behaviours) and parents' investments (good nutrition and medical health care) during childhood and adolescence. Note that both environment and investments could vary depending on children's age profile. Obviously, environmental characteristics and parental investments are strongly conditioned to parental educational attainment levels and their income.

For this purpose, we make use of including BMI measurements either for the children or their parents. Given that not all individuals were measured at least once during the analysed period our estimates will suffer sample selection. In this sense, 15.37% of children were not measured whilst fathers and mothers show a greater number of missings observations (32% and 24.82%, respectively). In any case, and for robustness reasons, we run again our main specification including this lifestyle information. Table 6 shows these results. As it can be seen, the negative association remains after including both BMI variables (children and parents) although the statistical significance diminishes. However, note that this would confirm our previous results given that both parents evidence statistical significant differences when information is not available for BMI. Thus, average schooling years for parents with BMI info is 9.45 whilst this figure rose to 10.59 for those without any BMI measurement during the analysed period. This difference is even greater for the mothers (9.62 and 11.11 schooling years, respectively).

[Insert Table 6 here]

4.4. *Schooling years at the household level*

Complementarily, we used the sum of mother's and father's schooling years since we are not interested in gender-specific programs that aim to raise children's health and separate coefficients might be influenced by assortative mating (Holmlund, Lindahl and Plug, 2011) although this restriction should be tested. It is likely that mothers' effects might be cancelled out by already captured fathers' influence. Table 7 shows these results. As it can be appreciated, the education gradient is not statistically significant for any of the counts.

[Insert Table 7 here]

4.5. *Non-linear relationship between schooling years and HCU*

However, we wondered about the presence of a non-linear relationship between socioeconomic status, proxied by parental educational attainment levels and the counts of visits. For this purpose, we made use of fractional polynomials. The same argument can be made for inferred salaries but after running the same procedure a linear relationship was evidenced. Table 8 displays these new results. Our results indicate that parental schooling has a non-linear effect on visits to GP. Contrary to our previous findings, mother schooling years had an influence on the number of visits to GP when non-linearities are taken into account. All polynomial functions show a decreasing influence of parental schooling years on the number of visits to GP or specialists and urgencies use. That is, we confirm the greater the educational level the lower number of visits for any of the counts.

[Insert Table 8]

4.6. *Instrumenting schooling years*

However, two caveats appear in interpreting all these results. On the one hand, diagnosis bias can arise because more educated parents would condition GP to identify ill health or persuade the doctor to diagnose a minor disease (Reinhold and Jürges, 2011). On the other hand, more educated are more likely to bring their children to private paediatrics private visits. Although we strictly focus on health care use of public resources, it is very likely that vaccinations and regular visits were undertaken by private doctors when parents hold a supplemental coverage. Although we lack this information, those attaining a duplicate coverage in Catalonia were 21.14% (1994), 24.56% (2002) and 18.58% (2006) based on information from the Catalan Health Survey. Notwithstanding, these figures were consistently lower for the analysed health sanitary region: 12.09%, 20.10% and 16.43% (respectively in 1994; 2002; 2006). Given that the analysed cities are the ones with greater low-middle class population within the health sanitary region, this effect would be consistently smaller.

Next, although we have accounted for unobserved heterogeneity using the random effects model through sections 4.1 to 4.5, the latter is questionable. To provide causal evidence, we decided to instrument schooling years by means of a natural experiment. Previous literature addressing this issue has mainly used changes in compulsory education as an exogenous variation of education (see Cutler and Lleras-Muney, 2012 for a review of this literature). In this sense and, for identification purposes, we make use of a natural experiment provided by parental month of birth.[15] The intuition for this approach is very simple given that some individuals are more likely to dropout once they reached the age of 16 before ending the last compulsory academic year.[16] Consequently, children born in the first quarter of a calendar year will have received less schooling. Therefore, graduation from compulsory school occurs when children are 15.5 to 16.5 years old. The latter is especially relevant for our sample given that individuals are low-middle class and show less schooling years compared to the whole Catalan population.

To proceed, we need to validate the instrument which are dummy variables representing the quarter of birth on parental schooling years. Note that we are introducing non-linearities in the instrument. Our regression results indicate that those born in the third quarter are more educated compared to those born in the first and second quarters, irrespectively to their gender. Obviously, the effect was greater for those below compulsory education who are those to be more treated by the instrument. In a second step and, following Braakman (2011), we validated that there were no statistically significant differences between children born in adjacent months within the same quarter. Results are shown in Table 9. As expected, standard errors are greater for our estimates by means of instrumental variables. In Table 9, column (1) displays a greater and statistically significant effect for mothers' schooling years on the number of visits

[15] This kind of procedure was pioneered by Angrist and Krueger (1991).
[16] For our study, it is not feasible to compare our results to those using exogenous variation as a consequence of a change in the compulsory education law, such in Holmlund, Lindahl and Plug (2011), since it happened during the academic year 1993-1994 (increasing compulsory education from 14 to 16 years old). Thus, first graduated after this change (2000) were 20 years old in 2004 (26 in 2010). Hence, it is very unlikely that they become parents during the analysed period given that mean age motherhood is around 31 years old during the whole analysed period.

to GP compared to our previous findings. But, fathers' effect turns out to be not statistically significant although it holds the same magnitude. Mothers' impact is again statistically significant for the visits to specialists and urgencies use (Table 9, columns 2 and 3) although for the later is only at 10%.

[Insert Table 9 here]

A caveat for this approach consists on the fact this procedure estimate average causal treatment effects for those who change treatment status (i.e. local average treatment effects). Thus, our instrumental variable estimates a unique causal parameter that is specific to the subpopulation of 'compliers' for that instrument, that is, those born in the first quarter. Another criticism to this approach constitutes the fact that month of birth seems to be associated to different parental background characteristics such their health status (Buckles and Hungerman, 2008). However, month of birth has nothing to do with how preventive parents are. Likewise, and following Buckles and Hungerman (2008), regressions that add controls for family background would likely decrease systematic differences in the error terms. We should note that in our approach we control for a large list of parental information: health status, age, income and even we might control for how preventive they are for themselves (health care use of parents).

4.7. *Latent class models: does it make a difference?*

At this juncture, we wondered about explaining either the fact of the visit or the intensity through the number of visits by means of a latent class model. NEED TO RUN TERESA CODE YET

[Insert Table 10]

WE DO SOMETHING WITH SPELLS FOR VISITS TO SPECIALISTS?

4.8. Visits to GP for preventive care

Next, we explored the more frequent diagnosed diseases through recorded information in GP visits categorized by International Classification of Primary Care (ICPC). In this regard, literature has mostly included chronic conditions as further covariates (Murasko, 2008) or regressed separately for each condition (Chen, Martin and Matthews, 2006).[17] In our dataset, the more frequent diagnoses in descendent order were related to: acute respiratory infection, fever, preventive medicine, otitis media, bronchitis, cough, pharyngitis and intestinal infection. Most of these codes were also the more frequent for adolescents' sample.

Given that we dispose data on visits to GP without the presence of any specific disease (preventive medicine), these records would indicate us the presence of more care preventive parents. Then, our intention was to examine parental educational level effects on either the number of visits or the likelihood to attend this kind of visits. In this sense, we focussed on the fact of taking their children preventively rather than explaining the number of times. For this purpose, then, we run a logit panel procedure given that only 1.34% of children went two or more times to their assigned GP because of a preventive visit. Note that 89.7% of observations are zero visits. Table 11 shows the influence of parental schooling on preventive care visits. Either columns, considering separately or jointly both parental educational attainment levels, indicate a positive effect. Hence, the more educated parents are the more care preventive are. Given this result, in the next section we explore a specific program for preventive care run by the Catalan public health system.

[Insert Table 11 here]

[17] Note that lower chronic condition records are observed when administrative dataset is used (Currie, Stabile and Roos, 2010; Almond and Currie, 2011). Likewise, measurement errors in ICPC codes were handled by grouping into major disease categories following Baker, Stabile and Deri (2004).

4.9. Preventive visits to GP from the Healthy Child Program

As mentioned before, we have access to another dataset related to a specific public health program for preventive care. The program is called “Health Children Program”. We obtained detailed information of all screenings made at each visit for the period 2004-2012 (mid-year of the ending period). This dataset contains information until individuals are 16 years old. The program promotes actions to promote health and prevention at the paediatric age. These visits are coded and consist in: screening, health advice, immunization and orientation versus risks. The proposed monitoring of children is within one of the following risk groups: prematurity and low birth weight, dystonia families and obesity. Instead of collapsing annually these visits by individual, we preferred to explain by means of a logistic estimation procedure those individuals that had a visit during the analysed period. We should note that the same results were obtained when using a negative binomial regression procedure (we do not report for redundancy reasons). However, in doing so, we need to disentangle children from the sample by age boundaries. The later relies on the fact that for each age boundary there are assigned specific screenings (0-1, 1-2, 2-3, 3-6, 6-8, 8-12 and 12-16 years old). Note that some individuals might appear at different boundaries given their age at the initial period because the analysed period covers seven and a half years. Table 12 displays these results. As it can be seen the greater the educational attainment level of their parents the lower number of visits for this public health program. This was an expected finding given that the program is addressed to riskier children and calls were made to assure their attendance. Notwithstanding, for the three latest age boundaries (columns 5 to 7) no statistical significance was found. This finding is contrary to the above mentioned age profile for the whole number of visits but it might be related to the fact that calls were made for attendance more frequently for attendance at initial ages.

[Insert Table 12 here]

At this juncture, we explored only those visits because of specific advice with regards to vaccinations. Given that vaccinations should be paid supplementary when parents bring their children to private consultations, some of them might attend the public health system to obtain freely this preventive care. In this regard, we should distinguish those vaccinations which are systematic from those which are voluntary. In fact, some of these voluntary vaccinations have been controversial regarding their effectiveness. Concretely, we are referring to the pneumococcal and human papillomavirus vaccinations given that intense debates appeared at media and among physicians. Table 13 shows these results. Irrespectively to the character of the provided vaccinations we evidence a positive association between parental schooling years and the likelihood of these visits for advice with regards to vaccinations. Thus, in this regard, we are evidencing the presence of an education gradient for preventive care through the public health system.

[Insert Table 13 here]

4.10. Vaccinations registers

Concentrating on preventive care we then examined vaccinations registers. This dataset covers all individuals during the period 2004-mid 2012. Although parents might bring their children to doctors in the private health system because they can afford a supplemental coverage, vaccinations should be paid additionally. That is, supplemental coverage covers the visits but not the price of immunizations. For this reason, we explore the presence of an education gradient either in the number of visits for vaccinations or the provided number of immunizations. Table 14 shows these results in columns 1 and 2. We evidence the same finding, i.e. the greater the parental education the lower number of visits and vaccinations. However, running a logistic estimation there was no statistical significance for the likelihood of being vaccinated (Table 14, column 3). Besides this point, we decided to run some estimates for specific vaccinations. Specifically, we decided to examine the likelihood of being vaccinated for above mentioned controversial immunizations. Concretely, we explore the fact of being immunized against the human papillomavirus. This vaccine costs 312 € when it is provided through the private health system. Therefore, it is very likely that the more educated parents take profit of the public health system to get freely this kind of vaccinations. Table 14, column 4, shows that the greater the mothers' educational attainment level, the higher probability of being vaccinated for this specific immunization. Finally, columns 5 and 6 display the presence of an age profile for vaccinations. In fact, we find that less educated parents visit more frequently GPs for immunizations when children are below six years old but that pattern is completely the opposite after that age. Hence, for children between 6 and 16 years old the more educated parents are more likely to provide immunizations to their children.

[Insert Table 14 here]

5. Conclusion

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Table 1 Descriptive statistics for children

Health care use		*Lifestyle behaviour*	
Number of visits to GP	6.954 (8.68)		
Number of visits to specialists	0.394 (1.17)		
Number of hospitalized days	0.003 (0.07)	Median BMI	17.302 (3.22)
Number of urgency visits	0.087 (0.36)	Mean BMI	17.417 (3.12)
Number of laboratory tests	0.117 (0.44)	Smoker	0.000 (0.02)
Number of radiology tests	0.142 (0.49)	Alcoholism	0.000 (0.01)
Number of diagnostic tests	0.021 (0.17)		
Annual pharmaceutical costs	28.369 (169.56)		
Personal characteristics		*Health status*	
Being female	0.484 (0.50)		
Patient's age	6.270 (4.93)	No. different diseases in a year	2.095 (2.39)
Immigrant status	0.006 (0.08)	Charlson index	0.018 (0.15)
Minimum distance to GP	4.020 (4.51)	Hypertension	0.001 (0.03)
Minimum time distance to hospital	7.336 (4.81)	Lipids & cholesterol problems	0.006 (0.07)
Health district ABS01	0.105 (0.31)	Children with any cardio problem	0.006 (0.08)
Health district ABS03	0.147 (0.35)	Stroke/cerebrovascular accident	0.000 (0.01)
Health district ABS08	0.132 (0.34)	Bronchial asthma & obstructive pulmonary	0.070 (0.26)
Health district ABS09	0.181 (0.39)	Children with any mental disorder	0.002 (0.04)
Health district ABS10	0.125 (0.33)	Malignant neoplasms	0.002 (0.04)
Health district ABS12	0.119 (0.32)		
Health district ABS15	0.192 (0.39)		

Note: average values and standard errors in brackets are reported. Time distances (in minutes) were computed accounting for children’s residence and GP or hospital location by means of *geocode* and *traveltime* commands in Stata.

Table 2 Descriptive statistics of parental information

Health care use		*Lifestyle behaviour*	
Fathers' visits to GP	8.188 (8.38)		
Mothers' visits to GP	10.261 (9.19)	Fathers' average BMI	27.693 (4.25)
Fathers' hospitalization days	0.500 (2.24)	Mothers' average BMI	26.253 (5.37)
Mothers' hospitalization days	0.318 (1.50)	Fathers' smoker	0.275 (0.45)
Fathers' urgency visits	0.670 (0.98)	Mothers' smoker	0.236 (0.42)
Mothers' urgency visits	0.667 (0.98)	Fathers' alcoholism	0.027 (0.16)
Fathers' visits to specialist	3.235 (4.42)	Mothers' alcoholism	0.004 (0.06)
Mothers' visits to specialist	3.486 (4.92)		
Personal characteristics		*Health status*	
Fathers' age	45.038 (9.05)	Parental consumption of medicines	0.412 (0.84)
Mothers' age	43.070 (8.79)	Fathers' comorbidity-episodes	2.843 (2.05)
Parents are separated or divorced	0.046 (0.21)	Mothers' comorbidity-episodes	3.661 (2.40)
Fathers' deceased	0.012 (0.11)	Fathers' Charlson index	0.202 (0.60)
Mothers' deceased	0.004 (0.06)	Mothers' Charlson index	0.160 (0.50)
Father's schooling years	9.819 (4.03)	Fathers' mental problems	0.057 (0.23)
Mother's schooling years	9.988 (4.14)	Mothers' mental problems	0.135 (0.34)
Maternal employment	0.669 (0.47)		

Note: average values and standard errors in brackets are reported.

Table 3. Average number of visits by parental educational level

		Visits to GP	Visits to specialists	Urgencies use
Fathers	Illiterate	7.78	0.39	0.10
	Primary	7.38	0.42	0.10
	Secondary	7.40	0.46	0.10
	Vocational	7.45	0.46	0.10
	Upper secondary	6.80	0.36	0.08
	3-year degree	5.86	0.29	0.06
	Higher education	5.23	0.25	0.06
	Post- higher education	4.92	0.16	0.07
Mothers	Illiterate	7.33	0.36	0.10
	Primary	7.50	0.44	0.11
	Secondary	7.55	0.48	0.11
	Vocational	7.31	0.44	0.10
	Upper secondary	6.61	0.35	0.07
	3-year degree	6.21	0.29	0.06
	Higher education	5.55	0.26	0.06
	Post- higher education	5.08	0.18	0.09

Table 4 xtbnreg: marginal effects

	Visits to GP		Visits to specialists		Urgencies use	
	(1) Children covariates	*(2) Parental information*	*(3) Children covariates*	*(4) Parental information*	*(5) Children covariates*	*(6) Parental information*
Being female	0.0008 (0.009)	-0.0008 (0.009)	-0.03 (0.02)	-0.04 (0.02)	-0.2*** (0.04)	-0.2*** (0.04)
Individual's age	0.4*** (0.006)	0.4*** (0.006)	0.9*** (0.03)	0.9*** (0.03)	0.6*** (0.04)	0.6*** (0.04)
Squared age	-0.04*** (0.0008)	-0.04*** (0.0008)	-0.07*** (0.003)	-0.07*** (0.003)	-0.03*** (0.005)	-0.03*** (0.005)
Cubic age	0.001*** (0.00003)	0.001*** (0.00003)	0.002*** (0.0001)	0.002*** (0.0001)	0.0006*** (0.0002)	0.0006*** (0.0002)
Immigrant status	-0.1* (0.06)	-0.07 (0.06)	-0.1 (0.1)	-0.02 (0.1)	-0.6* (0.2)	-0.6* (0.2)
Distance to GP (hospital) in km	-0.005** (0.002)	-0.005** (0.002)	-0.007 (0.004)	-0.006 (0.004)	-0.003 (0.007)	-0.003 (0.007)
Comorbidity index (episodes)	0.3*** (0.001)	0.3*** (0.001)	0.2*** (0.004)	0.2*** (0.004)	0.2*** (0.006)	0.2*** (0.006)
Children chronic conditions	YES	YES	YES	YES	YES	YES
Father's schooling years	-0.008*** (0.001)	-0.004** (0.001)	-0.007 (0.004)	-0.004 (0.004)	-0.02*** (0.006)	-0.01 (0.006)
Mother's schooling years	-0.003* (0.001)	0.002 (0.001)	-0.002 (0.004)	0.003 (0.004)	-0.01 (0.006)	-0.004 (0.006)
Inferred salaries at household level	-0.001*** (0.0003)	-0.0008*** (0.0003)	-0.004*** (0.0007)	-0.003*** (0.0007)	-0.003* (0.001)	-0.002 (0.001)
Parental information	NO	YES	NO	YES	NO	YES
Time FE & HSR FE (GP FE)	YES	YES	YES	YES	YES	YES
Sample size	79,583	79,583	79,583	79,583	79,583	79,583
Log likelihood	-198,415.8	-197,934.4	-50,092.1	-49,822.6	-19,886.3	-19,734.4
χ^2	2,778.9 (0.00)	2,993.3 (0.00)	2,779.4 (0.00)	2,637.2 (0.00)	1,288.2 (0.00)	1,169.9 (0.00)

Note: standard errors are reported in brackets, whereas ***, **, * denote significance levels of 1, 5 and 10%, respectively. Regressions include a dummy variable representing odd minimum distance. Children chronic conditions include the following diseases: hypertension, lipids & cholesterol problems, children with any cardio problem, stroke/cerebrovascular accident, bronchial asthma, chronic obstructive pulmonary disease, children with any mental disorder and malignant neoplasms. We also included unhealthy behaviour which are relevant for adolescents (smoking and heavy drinker). Parental information includes information either with regards to fathers or mothers: age, any parent have passed away, parental consumption of medicines in thousand Euros, comorbidity-episodes, mental problems, maternal employment, unhealthy behaviours (smoker and heavy drinker), health care use (visits to GP, specialists, urgencies and hospitalization). We lack information for the specific attended GP for 46 individuals.

Table 5 subsamples: visits to GP, xtnbreg

	Boys	Girls	Age [0-6]	Age [6-12]	Age [12-18]
Individual children characteristics	YES	YES	YES	YES	YES
Children chronic conditions	YES	YES	YES	YES	YES
Father's schooling years	-0.006** (0.002)	-0.002 (0.002)	-0.003 (0.001)	-0.005* (0.002)	-0.01*** (0.003)
Mother's schooling years	0.002 (0.002)	0.002 (0.002)	-0.0004 (0.001)	-0.003 (0.002)	-0.004 (0.003)
Parental information	YES	YES	YES	YES	YES
Time FE & GP FE	YES	YES	YES	YES	YES
Sample size	41,125	38,458	40,714	26,771	12,420
Log likelihood	-102,257.2	-95,576.3	-90,841.4	-66,701.6	-29,591.2
χ^2	1,475.0 (0.00)	1,463.7 (0.00)	68.9 (0.00)	2,842.0 (0.00)	903.4 (0.00)

Note: standard errors are reported in brackets, whereas ***, **, * denote significance levels of 1, 5 and 10%, respectively. Regressions include a dummy variable representing odd minimum distance. Children chronic conditions include the following diseases: hypertension, lipids & cholesterol problems, children with any cardio problem, stroke/cerebrovascular accident, bronchial asthma, chronic obstructive pulmonary disease, children with any mental disorder and malignant neoplasms. We also included unhealthy behaviour which are relevant for adolescents (smoking and heavy drinker). Parental information includes information either with regards to fathers or mothers: age, any parent have passed away, parental consumption of medicines in thousand Euros, comorbidity-episodes, mental problems, inferred salaries by occupational code, maternal employment, unhealthy behaviours (smoker and heavy drinker), health care use (visits to GP, specialists, urgencies and hospitalization).

Table 6 xtnbreg including BMI

	Visits to GP	Visits to specialists	Urgencies use
Individual children characteristics	YES	YES	YES
Children chronic conditions	YES	YES	YES
Father's schooling years	-0.002 (0.001)	-0.004 (0.005)	-0.01 (0.008)
Mother's schooling years	-0.001 (0.001)	0.006 (0.005)	-0.02* (0.008)
Parental information	YES	YES	YES
Children BMI	0.02*** (0.002)	0.02*** (0.005)	0.02** (0.007)
Fathers' BMI	-0.002 (0.001)	0.002 (0.003)	0.008 (0.006)
Mothers' BMI	-0.0008 (0.0009)	0.002 (0.003)	0.007 (0.005)
Time FE & GP FE	YES	YES	YES
Sample size	40,252	40,252	40,252
Log likelihood	-111,109.4	-31,128.8	-11,174.9
χ^2	749.3 (0.00)	1,484.2 (0.00)	650.5 (0.00)

Note: standard errors are reported in brackets, whereas ***, **, * denote significance levels of 1, 5 and 10%, respectively. Regressions include a dummy variable representing odd minimum distance. Children chronic conditions include the following diseases: hypertension, lipids & cholesterol problems, children with any cardio problem, stroke/cerebrovascular accident, bronchial asthma, chronic obstructive pulmonary disease, children with any mental disorder and malignant neoplasms. We also included unhealthy behaviour which are relevant for adolescents (smoking and heavy drinker). Parental information includes information either with regards to fathers or mothers: age, any parent have passed away, parental consumption of medicines in thousand Euros, comorbidity-episodes, mental problems, inferred salaries by occupational code, maternal employment, unhealthy behaviours (smoker and heavy drinker), health care use (visits to GP, specialists, urgencies and hospitalization).

Table 7 xtbnreg: marginal effects, sum of parental schooling years

	Visits to GP	Visits to specialists	Urgencies use
Individual children characteristics	YES	YES	YES
Children chronic conditions	YES	YES	YES
Parental schooling years	-0.001 (0.0008)	-0.0006 (0.002)	-0.008* (0.003)
Inferred salaries at household level	-0.0009*** (0.0003)	-0.003*** (0.0007)	-0.002 (0.001)
Parental information	YES	YES	YES
Time FE & GP FE	YES	YES	YES
Sample size	79,583	79,583	79,583
Log likelihood	-197,937.5	-49,824.2	-19,732.9
χ^2	2,993.4 (0.00)	2,639.1 (0.00)	1,168.1 (0.00)

Note: standard errors are reported in brackets, whereas ***, **, * denote significance levels of 1, 5 and 10%, respectively. Regressions include a dummy variable representing odd minimum distance. Children chronic conditions include the following diseases: hypertension, lipids & cholesterol problems, children with any cardio problem, stroke/cerebrovascular accident, bronchial asthma, chronic obstructive pulmonary disease, children with any mental disorder and malignant neoplasms. We also included unhealthy behaviour which are relevant for adolescents (smoking and heavy drinker). Parental information includes information either with regards to fathers or mothers: age, any parent have passed away, parental consumption of medicines in thousand Euros, comorbidity-episodes, mental problems, maternal employment, unhealthy behaviours (smoker and heavy drinker), health care use (visits to GP, specialists, urgencies and hospitalization).

Table 8 mfp nbreg with vce(cluster nhc): marginal effects, sum of parental schooling years

	Visits to GP	Visits to GP	Visits to specialists	Urgencies use
Individual children characteristics	YES	YES	YES	YES
Children chronic conditions	YES	YES	YES	YES
Father schooling years non-linear transformation	-0.006 (0.00)***			
Mother schooling years non-linear transformation – 1st term	0.172 (0.05)***			
Mother schooling years non-linear transformation – 2nd term	0.091 (0.02)***			
Sum schooling years non-linear transformation		-0.013 (0.00)***	-0.004 (0.00)**	0.041 (0.02)**
Parental information	YES	YES	YES	YES
Time FE & GP FE	YES	YES	YES	YES
Sample size	79,905	79,905	79,905	79,905
Log likelihood	-207,181.3	-207,189	-50,812.76	-20,218.23
χ^2	18,507.60 (0.00)	18,500.83 (0.00)	6,403.28 (0.00)	3,728.28 (0.00)

Note: standard errors are reported in brackets, whereas ***, **, * denote significance levels of 1, 5 and 10%, respectively. Regressions include a dummy variable representing odd minimum distance. Children chronic conditions include the following diseases: hypertension, lipids & cholesterol problems, children with any cardio problem, stroke/cerebrovascular accident, bronchial asthma, chronic obstructive pulmonary disease, children with any mental disorder and malignant neoplasms. We also included unhealthy behaviour which are relevant for adolescents (smoking and heavy drinker). Parental information includes information either with regards to fathers or mothers: age, any parent have passed away, parental consumption of medicines in thousand Euros, comorbidity-episodes, mental problems, maternal employment, unhealthy behaviours (smoker and heavy drinker), health care use (visits to GP, specialists, urgencies and hospitalization). Non-linear terms were computed following the next transformations: visits to GP [1st term= father_schooling-9.819; 1st term= mother_schooling^-1-0.834 and 2nd term= mother_schooling ^-1*ln(mother_schooling)-.151; 1st term=sum_schooling^2-4.3294]; visits to specialists [1st term= sum_schooling^3-9.008]; urgencies visits [1st term= sum_schooling^-1-0.481].

Table 9 xtnbreg by means of IV

	Visits to GP	*Visits to specialists*	*Urgencies use*
Children characteristics	YES	YES	YES
Children chronic conditions	YES	YES	YES
Predicted father's schooling years	-0.008 (0.02)	-0.035 (0.04)	-0.119 (0.07)*
Predicted mother's schooling years	-0.014 (0.01)**	-0.054 (0.02)***	-0.056 (0.03)*
Inferred salaries at household level	-0.001 (0.00)***	-0.003 (0.00)***	-0.003 (0.00)**
Parental information	YES	YES	YES
Time FE & HSR FE (GP FE)	YES	YES	YES
Sample size	74,724	74,724	74,724
Log likelihood	-185,467.25	-46,614.68	-18,406.69
χ^2	84,310.20 (0.00)	8,602.99 (0.00)	3,446.49 (0.00)

Note: standard errors are reported in brackets, whereas ***, **, * denote significance levels of 1, 5 and 10%, respectively. Regressions include a dummy variable representing odd minimum distance. Children chronic conditions include the following diseases: hypertension, lipids & cholesterol problems, children with any cardio problem, stroke/cerebrovascular accident, bronchial asthma, chronic obstructive pulmonary disease, children with any mental disorder and malignant neoplasms. We also included unhealthy behaviour which are relevant for adolescents (smoking and heavy drinker). Parental information includes information either with regards to fathers or mothers: age, any parent have passed away, parental consumption of medicines in thousand Euros, comorbidity-episodes, mental problems, maternal employment, unhealthy behaviours (smoker and heavy drinker), health care use (visits to GP, specialists, urgencies and hospitalization).

Table 10 Latent class hurdle panel data: marginal effects

Table 11 xtlogit: marginal effects: preventive care

	Preventive visits to GP	Preventive visits to GP
Individual children characteristics	YES	YES
Children chronic conditions	YES	YES
Father's schooling years	0.009 (0.00)**	
Mother's schooling years	0.000 (0.00)	
Schooling years at household level		0.005 (0.00)**
Parental information	YES	YES
Time FE & GP FE	YES	YES
Sample size	79,583	79,583
Log likelihood	-20,501.661	-20,502.16
χ^2	8,503.67 (0.00)	8,503.88 (0.00)

Note: standard errors are reported in brackets, whereas ***, **, * denote significance levels of 1, 5 and 10%, respectively. Regressions include a dummy variable representing odd minimum distance. Children chronic conditions include the following diseases: hypertension, lipids & cholesterol problems, children with any cardio problem, stroke/cerebrovascular accident, bronchial asthma, chronic obstructive pulmonary disease, children with any mental disorder and malignant neoplasms. We also included unhealthy behaviour which are relevant for adolescents (smoking and heavy drinker). Parental information includes information either with regards to fathers or mothers: age, any parent have passed away, parental consumption of medicines in thousand Euros, comorbidity-episodes, mental problems, inferred salaries by occupational code, maternal employment, unhealthy behaviours (smoker and heavy drinker), health care use (visits to GP, specialists, urgencies and hospitalization).

Table 12 Healthy Child Program: logistic procedure

	Up to 1 years old	*1-2*	*2-3*	*3-6*	*6-8*	*8-12*	*12-16*
Children characteristics	YES	YES	YES	YES	YES	YES	YES
Father's schooling years	-0.04*** (0.009)	-0.03*** (0.008)	-0.03*** (0.008)	-0.02** (0.007)	-0.009 (0.009)	0.004 (0.009)	-0.03* (0.01)
Mother's schooling years	-0.04*** (0.009)	-0.03*** (0.009)	-0.03*** (0.008)	-0.02*** (0.007)	-0.01 (0.009)	0.02 (0.009)	0.009 (0.01)
Inferred salaries at household level	-0.009*** (0.002)	-0.009*** (0.002)	-0.005*** (0.002)	-0.005*** (0.001)	-0.006*** (0.002)	-0.003* (0.002)	-0.002 (0.002)
Maternal employment	0.2* (0.08)	0.2** (0.08)	0.3*** (0.07)	0.5*** (0.06)	0.7*** (0.07)	0.3*** (0.07)	-0.02 (0.09)
Parental information	YES	YES	YES	YES	YES	YES	YES
Sample size	4557	5219	5876	7894	5753	6509	3879
χ^2	369.8 (0.00)	280.4 (0.00)	120 (0.00)	762 (0.00)	949.5 (0.00)	1706.9 (0.00)	664.1 (0.00)
Pseudo-R^2	0.06	0.04	0.02	0.07	0.1	0.2	0.1

Note: standard errors are reported in brackets, whereas ***, **, * denote significance levels of 1, 5 and 10%, respectively. Regressions include a dummy variable representing odd minimum distance. Children chronic conditions include the following diseases: hypertension, lipids & cholesterol problems, children with any cardio problem, stroke/cerebrovascular accident, bronchial asthma, chronic obstructive pulmonary disease, children with any mental disorder and malignant neoplasms. We also included unhealthy behaviour which are relevant for adolescents (smoking and heavy drinker). Parental information includes information either with regards to fathers or mothers: age, any parent have passed away, parental consumption of medicines in thousand Euros, comorbidity-episodes, mental problems, maternal employment, unhealthy behaviours (smoker and heavy drinker), health care use (visits to GP, specialists, urgencies and hospitalization).

Table 13 Visits for vaccinations information: logistic procedure

	Visits for advice about systematic vaccinations	*Visits for advice about controversial vaccinations*
Children characteristics	YES	YES
Father's schooling years	0.03* (0.01)	0.06** (0.02)
Mother's schooling years	-0.008 (0.01)	-0.03 (0.02)
Inferred salaries at household level	0.006** (0.002)	0.004 (0.004)
Maternal employment	0.1 (0.1)	0.2 (0.2)
Parental information	YES	YES
Sample size	50,506	50,397
χ^2	33.9 (0.00)	18.2 (0.00)
Pseudo-R^2	0.005	0.007

Note: standard errors are reported in brackets, whereas ***, **, * denote significance levels of 1, 5 and 10%, respectively. Regressions include a dummy variable representing odd minimum distance. Children chronic conditions include the following diseases: hypertension, lipids & cholesterol problems, children with any cardio problem, stroke/cerebrovascular accident, bronchial asthma, chronic obstructive pulmonary disease, children with any mental disorder and malignant neoplasms. We also included unhealthy behaviour which are relevant for adolescents (smoking and heavy drinker). Parental information includes information either with regards to fathers or mothers: age, any parent have passed away, parental consumption of medicines in thousand Euros, comorbidity-episodes, mental problems, maternal employment, unhealthy behaviours (smoker and heavy drinker), health care use (visits to GP, specialists, urgencies and hospitalization).

Table 14 Vaccinations registers

	Number visits for vaccinations	*Number of vaccinations*	*Likelihood of being vaccinated*	*Likelihood of being vaccinated of human papillomavirus*	*No. of vaccinations age 0-6*	*No. of vaccinations age 6-16*
Children characteristics	YES	YES	YES	YES	YES	YES
Father's schooling years	-0.006 (0.00)***	-0.006 (0.00)***	-0.014 (0.01)	-0.004 (0.01)	-0.012 (0.00)***	0.000 (0.00)
Mother's schooling years	-0.007 (0.00)***	-0.007 (0.00)***	0.000 (0.01)	0.034 (0.01)***	-0.013 (0.00)***	0.010 (0.00)**
Inferred salaries at household level	-0.002 (0.00)***	-0.002 (0.00)***	-0.004 (0.00)**	0.007 (0.00)***	-0.003 (0.00)***	0.001 (0.00)*
Parental information	YES	YES	YES	YES	YES	YES
Sample size	11,415	11,415	11,415	11,415	11,415	11,415
χ^2	943.84 (0.00)	980.15 (0.00)	2,226.52 (0.00)	1,760.64 (0.00)	620.47 (0.00)	1,220.38
Pseudo-R^2	0.0153	0.0164	0.3205	0.2528	0.0074	0.0212

Note: standard errors are reported in brackets, whereas ***, **, * denote significance levels of 1, 5 and 10%, respectively. Regressions include a dummy variable representing odd minimum distance. Children chronic conditions include the following diseases: hypertension, lipids & cholesterol problems, children with any cardio problem, stroke/cerebrovascular accident, bronchial asthma, chronic obstructive pulmonary disease, children with any mental disorder and malignant neoplasms. We also included unhealthy behaviour which are relevant for adolescents (smoking and heavy drinker). Parental information includes information either with regards to fathers or mothers: age, any parent have passed away, parental consumption of medicines in thousand Euros, comorbidity-episodes, mental problems, maternal employment, unhealthy behaviours (smoker and heavy drinker), health care use (visits to GP, specialists, urgencies and hospitalization).