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Title of the contribution
Citizenship and mother's educational level effects on pregnancy assistance, perinatal outcomes and hospital access in the first year of age in Emilia-Romagna region

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Related area of interest
Epidemiology

Subject of the contribution
The number of immigrants in Italy has risen rapidly during the last few years reaching 7% of the total population in 2009. The Emilia-Romagna region has the highest prevalence of foreigners, 10,5% in 2009. Antenatal and infant health is one of the main issues; the number of deliveries by immigrant women has more than doubled from 2002 to 2009 and has exceeded a quarter of total deliveries; moreover the socio-economic conditions of immigrant mothers are generally the worst[i].
Pregnancy care and the health of newborns can be influenced by both the mother's educational level and country of origin. During pregnancy adverse socio-demographic conditions tend to reduce visits to health providers and is more likely to delay the first visit; moreover the duration of the pregnancy may be adversely affected as well as the health of the newborns[ii].

Although the disparity in visits between immigrants and the rest of the populations decreased from 2005 to 2009, immigrants have a more irregular pregnancy care pathway. Moreover those from particular areas are at greater risk of preterm birth[iii,iv], the reasons for which are complex but include the

culture and prenatal care system of the country of origin, genetic factors, the length of stay in Italy and prospects of social integration[v,vi].

As mentioned, immigrant conditions are not the only factor reducing health care visits and adversely affecting newborns: lower educational levels increase risks, in particular among Italians[vii]. The causal pathways are complex and can be over-simplified in some study approaches, for instance, by overlooking the interaction effects; the effect on some pregnancy and perinatal outcomes, of the country of origin, can be modified by educational level and *vice versa*.
In addition it is useful to deepen our understanding of the influence of socio-demographic conditions on perinatal and infant health status, consider their interactions and keep in mind that pregnancy and health in the foetal period and in the first years of life is a relevant determinant of adult pathologies[viii].

Methods and procedures utilised in the study

Factors analyzed in this study are where the mothers are from and their level of education. Immigrant status was identified on the basis of their citizenship (considered in Italy as a good proxy of country of origin) in High Migration Countries (HMC), *i.e.* with a low or medium income, considered quite homogeneous in terms of health status and needs. As reference population we considered Italian citizens and immigrants from Highly Developed Countries (HDC), *i.e.* with a high income[ix].
Educational level is frequently used as a socio-economic position indicator, since it is strongly correlated with health status[x], particularly when a study population comprised mostly women and when pregnancy pathway outcomes are investigated[xi]. Here the educational level was classified into three groups: high (university degree; schooling years: SY≥17), medium (schooling years: 13≤SY<17), low (SY<13).
The record-linkage between data bases allowed us to put together the information on the mothers' conditions mentioned below, pregnancy assistance, preterm birth (gestational age < 37 weeks), possible hospital access at birth (meaning access to a non-nursery unit) and those that occurred during the first year of life (age > 2 days). Pregnancy assistance was evaluated with two indicators: number of visits less than 4 and having received the first visit in a late period, that is after the eleventh week of gestation, according to WHO standards for a physiological pregnancy[xii].
The newborn cohort was obtained from Delivery Assistance Certificates (DACs) by selecting the singletons born alive in the Emilia-Romagna Region. Any hospital access following birth was studied except those with ICD-IX code in V30-31 and 764-765.
The associations was analyzed by means of frequency distributions and multivariate regression models; estimates of relative risks (RRs) and their 95% confidence interval are obtained applying Poisson models with robust method for the variance estimation[xiii]. Incidence rate ratios (IRRs, estimate of RRs) are adjusted for: maternal age (up to 24, 25-34 years, 35 and over), parity, and only for hospital access, preterm births (32-36 weeks) and very preterm births ($\leq$ 31 weeks). Interaction between educational level and citizenship was evaluated by Wald test and effect modification was measured by stratification on citizenship
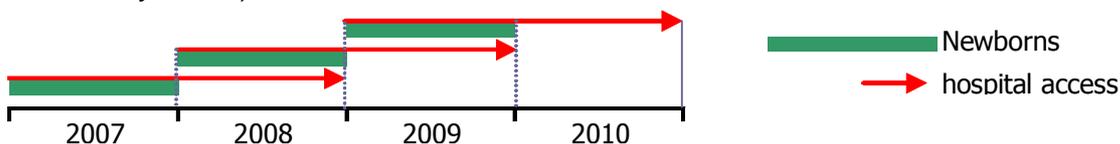
(and in one case by educational level). All analyses were conducted by the means of STATA 10 software[xiv].

Sources of reference

Data source include Delivery Assistance Certificates (DACs), from which mothers conditions, pregnancy assistance and preterm birth were taken, and patient lists of the Emilia-Romagna Region together with Hospital Discharge Records (HDRs) to identify possible births transferred to extra-nursery unit and access to hospital in the first year of life.

Data used with particular regard to their quality

The main data base derives from Delivery Assistance Certificates (DACs) registered in Emilia-Romagna Region from 2007 to 2009 for all singleton births (N=121.073). The linkage between archives was obtained by a table containing a newborn code that allowed us to find HDRs of newborns in the 97.7% of cases (**N=118.317**). The study is a closed cohort followed up to one year (from the 3° day of life), so that the HDRs occurred from 2007 to 2010 are included:
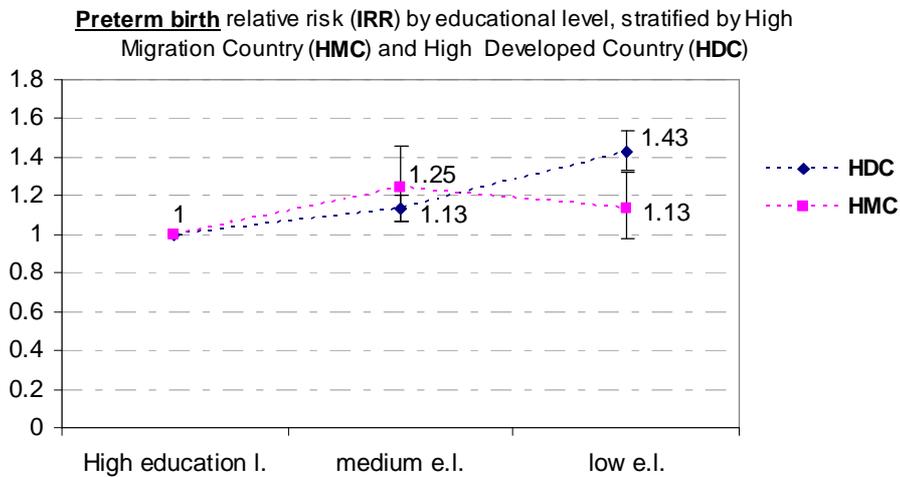

The hospital accesses at birth in an extra-nursery unit were 13,440 (11.4%), while accesses after the 2° day of life were 19.596. Accesses by immigrants mothers were 6,055 (equal to 30.9%).

Results obtained

In the Emilia-Romagna Region during the period from 2007 to 2009 the frequency of pregnancy with an insufficient number of visits was greater among immigrants (citizenship in HMC; 9.4% Vs. 2.1%) and for medium and low educational level (2.9 and 7.0% Vs. 1.9% of high e.l.). Between the two factors we registered an interaction on a multiplicative scale; immigrant status mitigates the effect of education if compared to what is observed for Italians (low Vs. high educational level IRRs: 1.76; CI 95%: 1.51-2.06 Vs.: 2.01; 95% CI: 1.76-2.29).
The frequency of pregnancies with a late first visit was greater among immigrants (27.6% Vs. 9.3%) and in women with a medium or low educational level (11.9 and 20.3% Vs. 9.3% of high e.l.). Between the two factors an interaction subsists; the low educational level effect is mitigated by HMC provenance, as the HMC provenance effect is mitigated going from high to medium and low instruction (HMC Vs. HDC IRRs: 2.78; 95% CI: 2.54-3.05. 2.51; 95% CI: 2.38-2.56. 2.30; 95% CI: 2.19-2.42).

The frequency of preterm births was slightly higher among immigrants (6.8% Vs. 6.3%), and among women with medium and low e.l. (6.3 and 7.1% Vs. 5.6% of high e.l.). Between the two factors an interaction was observed; less educated Italian women (see next graph), as well as immigrant women with medium educational level, were at greater risk (data from additional analysis, not reported).

Preterm birth relative risk (**IRR**) by educational level, stratified by High Migration Country (**HMC**) and High Developed Country (**HDC**)
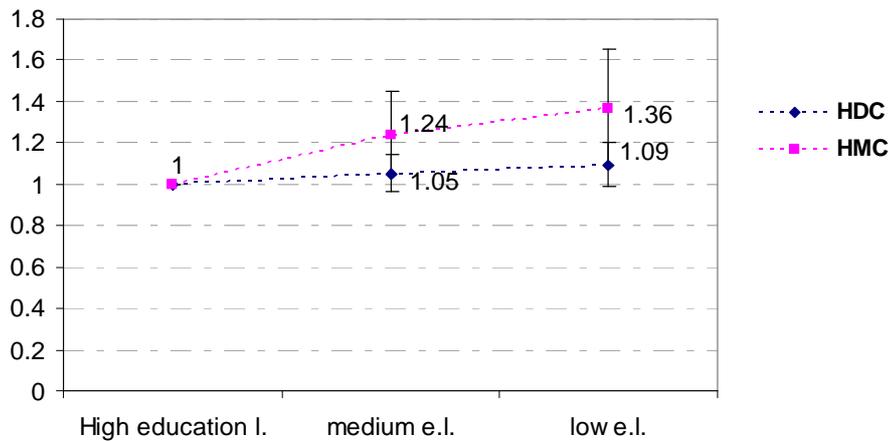

The frequency of births transferred to an extra-nursery unit was slightly influenced by educational level and the mother's immigrant status. We did not observe an effect modification by the two factors. Moreover it strongly influences the probability of hospital accesses during the first year of life (from 3° day; the frequency among newborns without a transfer is equal to 11.3% and to 22.7% among to others); for this reason the analysis of accesses during the first year of life was stratified by birth hospital access (healthy newborns/ newborns with hospital access at birth).

The rates of hospital accesses during the first year of life of healthy newborns were higher in sons of immigrant women (IRRs: 1.22; 95% CI: 1.08-1.38) and in those with low educational level (1.14; 95% CI: 1.06- 1.22). We did not see any interaction.

On the contrary the rates of hospital accesses during the first year of life of newborns transferred to an extra-nursery unit did not show any significant associations with migrant condition or with low educational levels. Furthermore we did not find a significant level of interaction, nevertheless we can observe an indication that lower educational level might have a greater effect among immigrants:

Hospital access relative risk (**IRR**) among non healthy newborns by educational level, stratified by High Migration Country (**HMC**) and High Developed Country (**HDC**)

Conclusion

The results of our analysis seems to confirm that in the Emilia-Romagna region immigrant status played a relevant role in determining pregnancy assistance appropriateness during recent immigration – nevertheless a continuous improvement was observed in the last years particularly concerning timing of the first visit – whereas the association with some perinatal outcomes seems less strong.

Among immigrant pregnant women – who attend public advisory centres more frequently if compared with Italian ones – disadvantage due to lower educational levels in pregnancy assistance and duration seems to be relatively small in comparison with Italian women. This is particularly true as far as preterm birth is concerned, insomuch as Italian women with lower educational levels, together with immigrants with medium educational level, seem to suffer greater disadvantage.

During their first year of life, healthy newborns (not having experienced any hospital access at birth) are significantly more likely to access to hospital if they are born to an immigrant woman or with low educational level, whereas the newborns who have experienced hospitalisation at their birth seems to have similar risks, except for a positive interaction indication.

Thanks to the available, complete and linkable data sets, information about mother's condition and pregnancy assistance, perinatal health outcomes and potential hospital access during the first year of life, can be joined.

This context allows us to better describe and investigate some features of the causal pathways under study along with the opportunity to set up cohort studies with a life-course approach, which are very useful in order to focus on some aspects that are particular influential on newborn health and his future life.

Our results should be interpreted keeping in mind some limitations: the information used to define social-economic status (educational level) could have been less accurate in the case of women coming from foreign countries, where educational qualifications can be differently defined and difficult to translate. A misclassification could have been occurred.

Moreover, take into account that, in the present study, the complexities of causal pathways, in terms of explanatory variable, their levels and outcomes to be investigated may not be described in sufficient detail.

Finally, differences between groups of countries of origin is another issue worthy of further investigation.

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