

Vulnerability Level of Spatial Units and Adolescent Fertility in Colombia

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Abstract

In Colombia, adolescents from the most vulnerable contexts are the most likely to become mothers. Despite the efforts to reduce adolescent fertility, accurate targeting is required for public policy and preventive interventions planning and implementation. This study aims to identify spatial units with the highest levels of vulnerability to child and adolescent pregnancies, to facilitate prevention decision-making. We conducted an ecological study using housing census and CRVS data. We build a classification of vulnerability to adolescent fertility (aged 10-19) using a k-means algorithm that clusters residential blocks according to vulnerability indicators. We fit three analysis scenarios to assign the vulnerability level: univariate, including adolescent births; multivariate, including vulnerability indicators; multivariate, including both births and vulnerability indicators. The study showed a significant association between vulnerability indicators and births. Previous births in a residential block were associated with a higher vulnerability level to adolescent fertility. The study provides a tool for decision-makers to reduce the vulnerability level and adolescent fertility, as it allows for identifying hotspots of vulnerability where attention should be focused. This mapping will be available on the NSO website for stakeholders to consult as a friendly way to improve self-care and interventions regarding this public health and rights matter.

key words: Adolescent fertility, Sexual and Reproductive Health and Rights, Census, CRVS, linked data sets, k-means algorithm, GIS, statistics for advocacy and policy impact.

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Background

In Colombia, adolescents who become mothers usually belong to the most vulnerable populations: living in the poorest contexts, with the lowest educational levels, as part of an ethnic minority group (indigenous or afro-descendant), or as persons with disabilities. For these adolescents, getting pregnant and having a child worsens their vulnerability as they face much fewer opportunities to overcome the poverty and inequity trap. Reducing pregnancies among children and adolescents (aged 10-19) is one of the principal goals of countries to improve the quality of life of their population, as part of the Sustainable Development Goals (SDG)—SDG 3.7.2—and the global 2030 Agenda. Like many countries in the Latin American and Caribbean region and globally, Colombia has focused its efforts—from multiple stakeholders—on preventing adolescent pregnancies since it improves conditions for women, families, and the entire society. However, accurate targeting is still required to plan and implement public policies and preventive interventions to reach the most vulnerable contexts and efficiently address the vulnerability.

This study aims to identify spatial units (residential blocks) with the highest levels of vulnerability to the occurrence of child and adolescent pregnancies. The study is based on the current knowledge that the combination of multiple associated factors present in the adolescents' environment puts them in a higher vulnerability, at the risk of becoming mothers at an earlier age. Hence, girls and adolescents living in a lower-income (Maness and Buhi, 2016; Yee et al., 2019), in a single-parent household (Maness et al., 2016), and where lower levels of education are attained (Jiménez-Peña et al., 2019; Favara et al., 2020), among other conditions, have a higher risk of getting pregnant than those who do not. In this way, exposing the areas where girls and adolescents are most likely to have children will facilitate decision-making of stakeholders on prevention policies and interventions.

Data

We used the 2018 Housing Census data and civil registration and vital statistics (CRVS) data between 2017 and 2019 from the National Statistics Office—NSO (DANE, by its Spanish acronym). The sources of data were linked through a deterministic linkage using the ID personal number; this procedure was performed in compliance with the DANE confidentiality standards. The unit of analysis was “residential block” from the Colombian National Geostatistical Framework MGN (by its Spanish acronym). A residential block is the smallest spatial unit of division for aggregated census data; they are not uniformly defined but delimited by geographical, cultural, and natural conditions (DANE, 2018a). Out of the 504.738 residential blocks in the 1122 municipalities of Colombia, we included 431.131 in the analysis based on the completeness of the information, geographical precision, and variability.

From the Housing Census, we obtained data on the characteristics of homes and sociodemographic variables of women by residential blocks. We selected the variables based on the current knowledge about the association of adolescent

pregnancy with socioeconomic (education and poverty), cultural (ethnicity), and interpersonal factors (family history of adolescent pregnancies, single-parent household, and early unions). We calculated eight vulnerability indicators: i) % of girls aged 10-14; ii) % of adolescent girls aged 15-19; iii) % of girls aged 5-19 not attending school; iv) % of girls under 19 years of age who are mothers; v) % of women who were adolescent mothers according to the age of their last child; vi) % of homes with early unions from girls under 14 (girls who stated their civil status as being in a union or having been united); vii) % of homes with early unions from girls under 14; viii) % of single-parent homes. From the CRVS, we obtained data on the live births of mothers aged 10-14 and 15-19 at the residential block level.

Research methods

We conducted a multivariate analysis using k-means algorithms to measure the association between vulnerability and adolescent and childhood fertility. The k-means assigns each observation to a number of clusters predefined, optimizing the cohesion within the clusters; it gets tighter groups by assigning the most similar observations to the same group, where similarity is usually measured with a distance (Hartigan and Wong, 1979). In this study, the k-means algorithm grouped similar residential blocks based on the values of the vulnerability indicators. Thus, residential blocks with similar values belong to the same cluster; by analyzing the cluster centroids (indicators average values), the level of vulnerability was assigned to each cluster. Three analysis scenarios were fit to assign the vulnerability level: a) a univariate analysis with live births of adolescent mothers; b) a multivariate analysis including the eight indicators of vulnerability; c) a multivariate analysis including both the vulnerability indicators and live births of adolescent mothers. We performed a multinomial regression model to test whether the suggested classification level was significantly associated with adolescent fertility. In this way, we were able to validate the proposed methodology and its accuracy in assigning levels of vulnerability.

Expected results

Having a class that combines and summarizes different information gives more confidence in identifying hot spots on the territory. In addition, most of the indicators used have, in the majority of cases, very low or close to zero values that do not allow to differentiate between the analysis units. The classification sets an order between the residential blocks that identify the places where most urgent actions should be taken regarding child and adolescent fertility. The specific analysis at the residential level allows for a more general overview at the municipality and department (like State) level identifying that the outer parts of the country have the greater percentage of blocks in the higher levels of vulnerability.

As an example, Figure 1 shows 1 of the 1122 municipalities in the country, which contains 45 residential blocks, representing 0,01%, of the total number of blocks (431.131) in the country to be analyzed; with at least one person effectively censused. The interpretation of these hot-spots, reflects how in the darker red

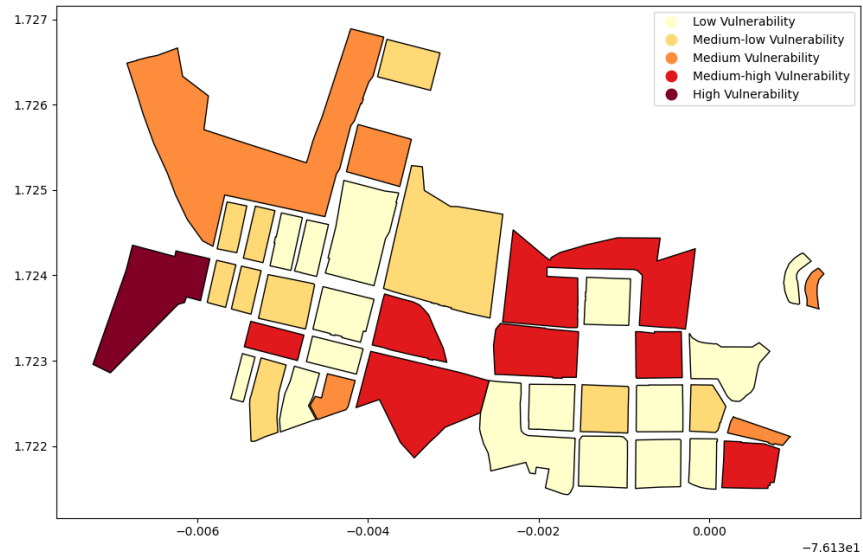


Figure 1: Vulnerability map levels for the municipality of Palestina, Huila

areas adolescents have a higher vulnerability to become mothers before planned. Usually these areas have higher observed values of teenage motherhood, single-parent households and/or early unions, compared to the light yellow blocks.

As a result, the study will provide tools for decision-makers at different levels (national, regional, local) to plan and propose actions to reduce the vulnerability of girls and adolescents by ensuring access to sexual and reproductive healthcare services even in the most remote and inaccessible places in the country. This will have a significant impact not only on the lives of women but also in the social and economic situation of their families and communities; women who delay their pregnancies until young adulthood achieve higher levels of education which also impacts their incomes, in Colombia women with masters or doctoral degrees earn 7.3 times more than those with primary education (UNFPA, 2020).

Preliminary progress in carrying out this work has shown that, even though poverty indicators are not included in the analysis, the vulnerability map of the country shows a strong spatial correlation with poverty measures (DANE, 2018b). This reinforces the theory that the most vulnerable girls and young women living in the most impoverished environments are also most likely to become mothers before planned. This result raises the possibility of identifying a significant association between poverty measurements and the proposed vulnerability level and test this association with other factors such as the educational level attained, how close the schools are from the most vulnerable blocks, or women inactivity/unemployment.

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