

ASSOCIATION OF EDUCATION AND HOUSING QUALITY WITH PUBLIC HEALTH EVENTS OF NATIONAL SIGNIFICANCE IN EIGHT MUNICIPALITIES OF CALDAS - COLOMBIA



Ricardo Gonzalez ¹  , Gerson Bermont ², Pedro Pablo Cárdenas Alzate ³ 

¹ Dirección Territorial de Salud de Caldas, Colombia

² Ministerio de Salud y de la Protección Social, Colombia

³ Universidad Tecnológica de Pereira and GEDNOL, Colombia



ABSTRACT

Background: A questionnaire called “Family sheet” was created to collect information about the population of the Department of Caldas – Colombia.

Method: Analytical cross-sectional study using information from these questionnaires and the Colombian National System of Public Health Surveillance

Results: A total of 1735 public health events of national significance were found. The most common levels of education were “secondary education” and “Pre-school or primary education”. Most of the dwellings had “safe and adequate water supply”, “sanitary disposal of excreta”, adequate “structural features and furnishing”, and “appropriate “lighting”. Their “disposal of solid wastes, and personal and domestic hygiene” was fair and they did not have “indoor air pollution” or “Overcrowding”. Statistically significant associations were found of some levels of education with chickenpox, zika virus disease, foodborne diseases, external causes of injuries and fluoride exposure. They were also identified between “safe and adequate water supply” and/or “sanitary disposal of excreta” and dengue, chikungunya y leishmaniasis; “structural features and furnishing” and fluoride exposure, and “Overcrowding” and Violence against women, domestic and sexual violence/gender-based violence. However, the predictive value of these variables was weak.

Conclusions: The distribution of studied variables was similar to previous studies and some statistically significant associations were found; however, their predictive value was weak.

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Corresponding Author

Ricardo Gonzalez,
citologialsp@saluddecaldas.gov.co

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1. INTRODUCTION

Although the influence of social and environmental factors on health has been described since ancient times (Berlinguer (2013)), it is only in recent years that their study has become a frame of reference for public health research (Álvarez (2009)).

In Colombia, according to Decree 780 of 2016, "events of public health interest" are those that are considered (Colombia (2006)): "Important or transcendent for collective health by the Ministry of Social Protection, taking into account criteria of frequency, severity, epidemiological behavior, prevention possibilities, cost-effectiveness of interventions, and public interest; which also require to be faced with public health measures" (p2). And all members of the Public Health Surveillance System (Sivigila) that



generate information of public health interest must notify the mandatory reporting events that are established (Colombia (2006)). Although several authors have described associations between some social determinants and health events in the Colombian population (Álvarez (2009), Ministerio (2010)), the effect that education and housing conditions may have on the events that have been considered by the Colombian Ministry of Health and Social Protection as "of public health interest" and "individually notifiable" is unknown to date.

In order to record, progressively and in each of the municipalities of the department of Caldas, social, economic and health information of its population, the Territorial Directorate of Health began to use since 2013 an instrument called "Ficha familiar" (Londoño et al. (2014)). In each of these cards, in addition to obtaining data on the education of its inhabitants, it collected information regarding the state of housing. By February 19, 2017 (Date on which this study began), the municipalities in which more than two thirds of their population (>66.6%) had the cards filled out were Aguadas, La Merced, Marulanda, Norcasia, San José, Supía, Victoria and Viterbo (Pineda (2017)).

Using the information obtained in the municipalities of Caldas in which more than two thirds of their population had completed family records, the present study attempted to answer the questions: What associations exist between the educational level and housing conditions of the inhabitants of the municipalities under study and the events of public health interest of individual notification reported in 2015 and 2016? and What is the probability of the occurrence of events of public health interest of individual notification as dependent variables of educational level and housing conditions?

2. MATERIALS AND METHODS

This was a cross-sectional analytical study carried out with information extracted from the Sivigila databases and the Family Files available at the Social Observatory of Public Health of the Territorial Health Directorate of Caldas. The study population corresponded to the inhabitants of the municipalities of Aguadas, La Merced, Marulanda, Norcasia, San José, Supía, Victoria and Viterbo who had an event of public health interest of mandatory individual notification reported to SIVIGILA in 2015 or 2016 and a family record filled out at the time the study began.

For the statistical analysis, the variables of the family records corresponding to educational level were grouped according to the levels of the Colombian educational system (Nacional (n.d.)) and some variables related to housing conditions, based on what is described in the WHO "Principles related to sanitary needs" (OMS (1990)). For the latter variables, it was considered that the "supply of safe water in sufficient quantity" was good if the family records showed that the dwelling had treated water from the urban aqueduct; that the "drainage and hygienic excreta disposal system" was good if it had a sewage system and toilet; that "solid waste disposal and personal and domestic hygiene" was good if they had a garbage collection system, household garbage with a lid, did not live with animals (as recorded in the "number of dogs", "number of cats" or "other animals" boxes of the family files) and there was good hygiene in the dwellings and in the people and that there was no "indoor air pollution" if the dwelling was well ventilated and they cooked with gas or electricity.

Based also on what is described in the "Principles on health needs" (OMS (1990)), for the events dengue, varicella, zika, chikungunya, foodborne disease and leishmaniasis, statistical associations were sought with the characteristics of the

dwellings related to "protection against communicable diseases" (i.e., with the variables "safe water supply in sufficient quantity", "drainage system and hygienic excreta disposal", "solid waste disposal and personal and domestic hygiene", "indoor air pollution", "housing conditions", "lighting" and "overcrowding"), for the events external cause injuries, poisoning/pesticide poisoning and fluoride exposure, statistical associations were sought with the variables related to "protection against trauma, poisoning and chronic diseases" (i.e., housing conditions, lighting and indoor air pollution) and, for the events violence against women, domestic violence and sexual violence/public health surveillance of gender-based violence and attempted suicide, statistical associations were sought with housing characteristics related to "minimization of psychological and social stressors" (i.e., housing condition, lighting and overcrowding).

The variables related to housing characteristics that had three values were dichotomized (into "good[a]" vs "fair" and "bad[a]") at the time of constructing the 2x2 tables. To determine an association as statistically significant in the bivariate analysis, the Chi-square test was used, a p-value of less than 0.05 and that when constructing the 2x2 table none of its cells had less than 5 observations. To establish the probability of occurrence of events of public health interest of obligatory individual notification (dependent variables) based on the variables corresponding to educational level and housing conditions (independent variables) with which statistically significant associations were found, the logistic regression method was used and both the dependent and independent variables were dichotomized. The logistic regression was constructed with the following equation:

$$P = \frac{1}{1 + e^{-(\beta_0 + \beta_1 x_1)}}$$

Where: P is the probability of occurrence of the event. E is the exponential function (exp). β_0 is a constant of the model. β_1 is the coefficient of variable 1 and x_1 is the value of variable 1.

3. RESULTS AND DISCUSSIONS

3.1. RESULTS

A total of 1,735 records were included with information on the study population. The most common educational levels were "middle and/or basic secondary" education (30%), "basic primary and/or preschool" (26%), "initial or no education" (5%) and "higher" (4%). No information was obtained for 36% of the population. In most of the homes of the individuals studied, it was found that there was a good "Supply of clean water in sufficient quantity" (56%), a good "Drainage system and hygienic excreta disposal" (65%), a good "Condition of the home" (77%), good "Lighting" (94%), regular "Disposal of solid waste and personal and home hygiene" (78%) and that there was no "Indoor air pollution" (94%) or "Overcrowding" (96%).

Statistically significant associations were identified for some educational levels with varicella, Zika, foodborne disease, external cause injuries and exposure to fluoride; for "supply of safe water in sufficient quantity" and/or "drainage system and hygienic excreta disposal" with dengue, chikungunya and leishmaniasis; for "housing conditions" with exposure to fluoride and for "overcrowding" with violence against women, domestic and sexual violence/gender violence (Table 1).

Table 1. Statistically significant associations between events of public health concern and educational levels and housing conditions in the study population.

EVENT/VARIABLE	X ²	Value p
VARICELA		
Initial education or no education	11.04	0.0008893
Basic primary and/or preschool education	5.07	0.0243378
Secondary education and/or basic secondary education	13.53	0.0002348
ZIKA		
Basic primary and/or preschool education	5.46	0.0194751
FOODBORNE DISEASE		
Middle and/or high school education	10.14	0.0014529
INJURIES FROM EXTERNAL CAUSES		
Basic primary and/or preschool education	6.58	0.0103153
Middle and/or basic secondary education	6.06	0.0138579
FLUORIDE EXPOSURE		
Middle and/or high school education	21.27	0.0000004
DENGUE		
Supply of safe water in sufficient quantity	31,13	0,0000001
Drainage and hygienic excreta disposal system	36,14	0,0000001
CHIKUNGUNYA		
Sufficient supply of safe water supply	7,43	0,0063998
Drainage and hygienic excreta disposal system	5,73	0,0166933
LEISHMANIASIS		
Drainage and hygienic excreta disposal system	23,97	0,0000001
EXPOSURE TO FLUORIDE		
Condition of housing	13,6	0,0002256
VIOLENCE AGAINST WOMEN, DOMESTIC VIOLENCE AND SEXUAL VIOLENCE/ GENDER VIOLENCE		
Overcrowding	19,02	0,000013

Logistic regression found that the predictive power of most variables was predominantly low. Within the educational levels, the presence of a lower educational level increases the probability of occurrence of chickenpox. At the same time, these modify the probability of occurrence of Zika, ATE, external cause lesions and exposure to fluoride, but to a lesser extent (less than 15%). Regarding housing characteristics, it was found that while the probability of occurrence of dengue is 15.66% when the "Supply of safe water in sufficient quantity" and the "Drainage system and hygienic excreta disposal" are good, this probability increases when only one of these conditions is present. The probabilities of occurrence of the other events based on the characteristics of the dwellings with which statistically significant associations were found were also less than 15% (see Table 2).

Dependent variable	Independent variables	Probability	%
Varicela	Initial education or no education	0,211153107	21,11
	Basic primary and/or preschool education	0,134703719	13,47
	Secondary education and/or basic secondary education	0,064706491	6,47
Zika	Basic primary and/or preschool education	0,022291623	2,23
Foodborne illness	Middle and/or basic secondary education	0,034589629	3,36
Injuries from external causes	Basic primary and/or pre-school education	0,059412411	5,94
	Middle and/or basic secondary education	0,06315045	6,31
Fluoride exposure	Middle and/or basic secondary education	0,017073616	1,71
Dengue	"Safe water supply in sufficient quantity" and "Drainage and hygienic excreta disposal system".	0,15656558	15,66
	"Drainage system and hygienic excreta disposal".	0,24434345	24,43
	"Supply of safe water in sufficient quantity".	0,47826295	47,83
Chikungunya	"Safe water supply in sufficient quantity" and "Drainage and hygienic excreta disposal system".	0,00817878	0,82
	"Drainage system and hygienic excreta disposal".	0,01896526	1,90
	"Supply of safe water in sufficient quantity".	0,01843315	1,84
Leishmaniasis	"Drainage system and hygienic excreta disposal".	0,03842002	3,84
Fluoride Exposure	"Condition of housing"	0,054578	5,46
Violence against women, domestic violence and sexual violence/Public health surveillance of gender-based violence.	Overcrowding	0,13967403	13,97

4. DISCUSSIONS

A total of 1735 events of public health interest of individual notification were found in people who had been characterized through family records in the municipalities under study. Considering that in 2015 and 2016 a total of 2776 events were notified in these municipalities; the events analyzed in the present study corresponded to 63% of all those notified (INS. (2015), INS. (2016)).

Although the educational level of most of the individuals in the study population was lower than that reported for the inhabitants of 36 member countries of the Organization for Economic Cooperation and Development (OECD) and 10 non-member countries (OECD (2018)), the most common educational levels were the same as those found at the departmental and national levels in the last population census of 2005 (DANE (2005)); the most common educational levels

were the same as those found at the departmental and national levels in the last population census of 2005 (DANE (2005)) and similar to those reported by Profamilia in the "Encuesta Nacional de Demografía y Salud (ENDS)" of 2015 (Profamilia (2015)) (Although in this last survey they used different categories than those used in the Colombian educational system) (Nacional (n.d.)).

Regarding the first housing characteristic evaluated, "supply of safe water in sufficient quantity", it was found that this was similar to the drinking water coverage reported in the 2016 "Informe Nacional de Calidad del Agua para Consumo Humano (INCA)" (Social (2016)) but lower than that found in the 2015 ENDS (Considering for this comparison the projections of the National Administrative Department of Statistics - DANE for the population residing in urban areas in Caldas in 2015 and 2016) (Profamilia (2015)).

Regarding the "drainage and hygienic excreta disposal system", although the indicators are not entirely comparable, the situation in the population studied appears to be similar to that reported worldwide by the "WHO/UNICEF Joint Monitoring Program (JMP)" (WHO/UNICEF (2015)) but worse than that found in the 2015 ENDS (Profamilia (2015)), in the "National Quality of Life Survey (ECV)" conducted by the DANE of 2016 (Borg (2012)) and in the 2005 Census (DANE (2005)). Although the authors do not know the reasons for these differences, it is important to remember that the individuals evaluated in this study were chosen for convenience and do not constitute a representative sample of the population of the country or the department.

Although in the "principles related to sanitary needs" they are mentioned together (OMS (1990)), the authors are unaware of other population studies in which, in addition to garbage disposal, they report the "hygiene of homes and people", the "use of lids on household garbage" and "coexistence with animals" in order to compare their results with those obtained with the variable "solid waste disposal and personal and domestic hygiene" in the population under study.

In order to compare the information collected with the family files on "condition of the dwelling", "lighting" and "overcrowding", the authors reviewed the instructions given to the interviewers for filling in these boxes and found that they had to consider the condition of a dwelling as "good" if it was "habitable, comfortable and with good quality of the roof, floor, bathroom, etc."; "fair" if it had regular "safety and comfort conditions" and "bad" if these conditions were not adequate and had "cracks, holes in the roof, etc.". "The "regular" if it had regular "safety and comfort conditions" and "bad" if these conditions were not adequate and presented "cracks, perforations in the ceiling, etc.". As for the "lighting of the dwelling" they had to qualify it as "good" if they had "sufficient windows, skylights or lattices" that allowed "natural lighting of the dwelling during the day", "regular" if these structures were not sufficient and "bad" when they did not have them and there was an "appearance of darkness", being necessary to "use artificial light". The presence of overcrowding was established if "more than three people" slept in "a small room with poor ventilation and lighting" (Londoño et al. (2014)). Taking this into account, no other population-based studies were found where they assessed "Housing condition" following the same criteria; the proportion of dwellings with good "lighting" was similar to that reported in European Union countries in 2007 (WHO (2014)) and "Indoor air pollution" was similar to that which relied on solid fuels (wood, dung, crop waste, coal, etc.) for cooking and heating their dwellings.) for cooking and heating their homes in Colombia in 2012 according to WHO estimates (EUROSTAT (2015)) and to that found in the 2015 ENDS (Profamilia (2015)) and 2016 LCS (Borg (2012)). Finally, although the proportion of

overcrowded housing in the study population was lower than that described in European Union countries in 2013 ([Inmunoprevenibles \(2014\)](#)) and that reported in the 2015 ENDS for Colombia and for its central region ([Profamilia \(2015\)](#)); this was higher than that reported in the 2005 Census ([DANE \(2005\)](#)). However, it is important to keep in mind that the criteria used for the qualification of this variable in the other studies were different from those used by the enumerators of the family files, thus limiting the comparison of these results.

When reviewing the results of the bivariate analysis, it is striking that statistically significant associations were only found between some levels of education and some events belonging to the group of "communicable diseases" ("varicella", "zika", "foodborne disease") and to the group of events related to "trauma, poisoning and chronic diseases" ("external cause injuries" and "exposure to fluoride") and not with the events related to "psychological and social stress". Additionally, the low number of individuals belonging to the educational levels "initial education or no education" and/or "higher education" prevented the evaluation of statistical associations between these levels and most of the events. With regard to housing characteristics, of the seven characteristics evaluated, only four had statistically significant associations with the events ("supply of safe water in sufficient quantity", "sewage system and hygienic excreta disposal", "condition of the dwelling" and "overcrowding").

Regarding "varicella", this disease mainly affects children under 10 years of age worldwide and its higher incidence at this age is associated with the beginning of elementary school or daycare attendance ([Nardone et al. \(2007\)](#), [Idrovo et al. \(2011\)](#)). In Colombia, a study conducted in Valle del Cauca between 2003 and 2007 found a higher incidence of the disease in municipalities with lower quality education; however, this quality was estimated by the average results of the inhabitants of the municipality in an exam conducted by the Colombian Institute of Higher Education (ICFES) and not by the maximum levels of schooling of its population ([Loureiro et al. \(2016\)](#)). Although further studies are required, as described in other countries, it is likely that in our population lower educational levels are associated with a higher incidence of the disease and this could be due to the effect of age as a confounding variable.

Regarding "zika", a study conducted with all women with zika who were notified to the Brazilian Ministry of Health between epidemiological weeks 1 and 32 of 2016 found that, of the 42995 affected women with known schooling, the majority (87%) had an educational level higher than 4th grade of primary school ([Tolosa and Pinilla \(2017\)](#)). In Colombia, active, autochthonous, vector-borne transmission of Zika virus was confirmed in October 2015 and routine epidemiological surveillance began in early 2016. Although the total number of reported cases, from the start of its surveillance until the close of the 2016 epidemiological year was 106659 cases (of which 9799 were laboratory confirmed and 96860 clinically suspected), the authors found no information on the educational levels of affected individuals ([OMS \(2015\)](#)). New studies are therefore needed to assess the possible influence of educational levels on the incidence of Zika in the country, including, if possible, only confirmed cases.

Although in developing countries, according to WHO, there is a higher risk of developing "foodborne illness (FBD)" and this risk is linked, among other factors, to a low level of education ([Newman et al. \(2015\)](#)), some reports on the subject have contradictory results. For example, studies conducted in the United States, Denmark, and Finland found that a higher level of education was associated with FBD caused by *Campylobacter*, *E. coli*, and *Salmonella*. However, while in two

studies this level of education was a risk factor for TAD caused by *Campylobacter*, in another it was shown to be a protective factor. The same was true for TAD caused by *E. coli* and *Salmonella*, with the aggravating factor that there is also an additional study in these populations that found no statistical association between educational level and the latter pathogen (Kalediene et al. (2006)). Therefore, new research projects are required to assess the association between educational levels and the incidence of ATE in our population. Regarding external cause injuries, a study in Lithuania found that low educational level was strongly associated with higher mortality from all external causes (including those from traffic accidents, suicides and homicides) (Sami et al. (2013)). Something similar was found with traffic accidents specifically in a population from Iran (Borrell et al. (2005)) and in men belonging to nine European countries (but not in women in this population) (Dalala et al. (2015)). Regarding occupational exposure injuries in children under 18 years of age, a study conducted in Bangladesh found that while external injuries were more frequent between 6 and 9 years of age, mortality was higher in children between 10 and 14 years of age. Although the authors did not discriminate their results according to the educational level of these minors, the proportion of children with primary education (35.5%) was slightly higher than those who were illiterate and those with secondary education (31.5% and 31.4%, respectively) (Fetuga et al. (2005)). Another study in Nigeria with minors linked to educational institutions found that 78% had a primary education and the remaining 22% had a secondary education. Although the authors describe that some were engaged in potentially hazardous activities, they did not report the frequency of external cause injuries in that population (Javo and Sørliie (2010)). With regard to injuries due to cosmetic procedures, although some studies have associated educational levels with interest in having plastic surgery (Brinton et al. (2000), Hartmann and Klaschka (2017)) or in knowing the health risks of the products they consume (Beltrán-Valladares et al. (2005)); the authors are unaware of any associations that have been described between educational level and the incidence of injuries associated with cosmetic procedures or the consumption of products.

In "exposure to fluoride", the surveillance event in Colombia corresponds to dental fluorosis in patients up to 18 years of age. Although the authors did not find studies reporting associations between the educational level of the patients and the incidence of dental fluorosis, associations have been found between this event and the educational levels of the parents with dissimilar results. Thus, while in a city in Mexico a higher incidence of dental fluorosis was found in children of mothers with a low level of education (Maupoméa et al. (2003)), in a Canadian population it was more frequent in children of parents with a high level of education (Maupoméa et al. (2003)) and in a Brazilian population there were no significant differences (Lima et al. (2014)). With regard to the association found between this event and the "state of housing", although in several countries dental fluorosis has been found to be associated with different socioeconomic levels (Pontigo-Loyola et al. (2014)), the authors did not find studies that report associations with the "state of housing" specifically.

Although dengue can affect any population, according to WHO/PAHO, its burden tends to be greater in communities with inadequate water supplies and lack of good solid waste infrastructure (OPS/OMS (2010)). Similar to what is described in the literature, in the present study the two housing variables that were associated with this event were the "supply of safe water in sufficient quantity" and the "drainage system and hygienic excreta disposal". Considering that these variables are mainly related to vector control and taking into account that, like dengue, Chikungunya and Zika, they are transmitted by the same genus of mosquitoes

(Aedes), the authors expected that these variables would also be associated with the latter two diseases. would also be associated with the latter two events in the population studied, similar to what has been described in the literature (Ali et al. (2017), PAHO (2011)). Although this indeed occurred with Chikungunya, none of the analyzed household variables had statistical associations with Zika. As the number of cases assessed for these two events was similar, the authors consider it unlikely that this difference is simply due to a sampling problem. Further research projects are therefore required to corroborate or counter these findings. In this study, leishmaniasis was associated with "drainage system and hygienic excreta disposal". This is similar to what has been described worldwide, where it mainly affects communities living near water sources and sewage. However, it is noteworthy that no statistical associations were found between this event and the variables "solid waste disposal and personal and domestic hygiene" (since this disease has been more commonly described in people living near garbage dumps and living with animals) and "housing conditions" (taking into account that it is associated with communities that have inadequate housing and the presence of poor quality floors and walls) (Oryan and Akbari (2016)).

Finally, the only variable associated with "violence against women, domestic violence and sexual violence" and "gender violence" was overcrowding. This is similar to that described in the families of workers in a cement company in Colombia (Benavides (2015)) and in studies conducted in populations in other countries such as Mexico (Olaiz et al. (2006)), Cuba (Díaz (2010)), Nigeria (Makinde et al. (2016)) and South Africa (Jewkes et al. (2002)). However, the great diversity of criteria for defining the presence of overcrowding worldwide makes it difficult to compare these results. Further more detailed evaluation in our population is therefore required to try to define possible associations between these variables. Regarding the results of the logistic regression (related to the third specific objective), the education and housing variables that were associated in the present study only allow predicting, with relatively low probabilities, the occurrence of the events of public health interest of mandatory individual notification in the study population. Thus, with the exception of dengue (whose presence in the study population is explained by 48% and 24% by the variables "supply of safe water in sufficient quantity" and "sewage system and hygienic excreta disposal" respectively) and varicella (whose presence is explained by 21% by the variable "initial education or no education"), the predictive capacity of the other variables evaluated was lower than what the authors expected ($\leq 15\%$). Although no other research is known where logistic regressions have been performed to evaluate the variables analyzed in the present study, the authors consider it important to carry out future research projects that include other variables that may be affecting the probability of occurrence of these events.

Before concluding, the authors consider it necessary to make some comments on the limitations of the analysis of the results obtained, which should be taken into account before making decisions based on these findings.

Two databases were used in this study: that of the Epidemiological Surveillance System - Sivigila - and that of the Family Files of the department of Caldas. In the Sivigila database, all individuals who were notified because they presented some event of public health interest in Caldas in the chosen period of time were identified. Once these individuals were identified, only those with a completed family record were selected. Since this study evaluated variables at a given point in time using individuals (and not populations) as units of observation that were characterized individually (and not through aggregate, environmental or global measurements), the design of this study corresponds to an analytical cross-sectional design and not

to an ecological one. Although the analytical cross-sectional design constitutes a valid alternative to examine the associations between an exposure and an outcome (Szklo and Nieto (2003)) and the statistical associations were made based on theoretical assumptions (OMS (1990)) to avoid the establishment of spurious relationships; in the results of this study it was not possible to conclude that the variables of education and housing characteristics acted as "risk factors" or "protective factors" nor to adequately interpret the odds ratios as a measure of strength and direction of the statistical associations found due to the existence of a "time bias"; a consequence of the way in which the information was obtained. This "time bias" (considered as one of the "information biases") arises from the authors' inability to demonstrate that exposure to potential risk or protective factors (i.e., education and housing characteristics variables) occurred before the events (Szklo and Nieto (2003)). This is because the information on events of public health concern reported to Sivigila was obtained at different times than those used to collect information with the Fichas Familiares on education and housing variables in this population. In addition, some variables that appeared in the family files could not be analyzed (since in most of the individuals these boxes had not been filled in), many of the statistical associations found could not be directly compared with those of other populations (because of not having a representative sample, not finding similar evaluation criteria for the variables studied and/or not having a similar statistical analysis) and the results obtained cannot be extrapolated or allow inferences to be made to the general population because they were obtained from a sample chosen by convenience.

Despite these limitations, to the authors' knowledge, this is the first study in Colombia to evaluate the possible associations between education and housing variables that are rarely investigated in our population and events that, given their importance for the country, have been considered of "public health interest".

Taking into account that the units of observation in this study were individuals (and not populations) characterized individually (and not through aggregate, environmental or global measurements), the authors consider that the statistical associations found are particularly valuable and allow us to advance our knowledge of the factors that influence the occurrence of these events of public health interest in the population studied.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1. CONCLUSIONS

The distribution of variables related to educational level, housing conditions, and individually notifiable events of public health interest in the study population were similar to those described in other populations.

The statistically significant associations found between these variables coincide, at least partially, with those described in other populations.

The statistically significant associations found between these variables coincide, at least partially, with those reported by other authors.

Although some variables related to educational level and housing conditions allow us to estimate the probability of the occurrence.

Although some variables related to educational level and housing conditions make it possible to estimate the probability of occurrence of individually notifiable

events of public health individual notification, their predictive power is predominantly low.

Some limitations were found in interpreting the results; however, the authors consider the findings of this study to be relevant because of the importance of the events studied for the public health of the country and because of the innovative way in which the information was obtained and analyzed.

5.2. RECOMMENDATIONS

The findings of this study should be taken into account when planning public health interventions in our population, especially those aimed at preventing events that, given their importance for collective health, are considered by the Ministry of Health and Social Protection to be of "public health interest". More specifically, the authors consider that the fact of having found statistically significant associations between some of these events and some variables of education and housing conditions in the population studied justifies the need to consider the implementation of intersectoral actions (involving entities related to the education and housing sectors) in order to effectively prevent them.

The authors consider it important that measures be taken to guarantee the complete completion of the family records in the rest of the population of Caldas and that the results obtained in this study be used as a fundamental basis for future analytical research studies (with greater power on the scale of causality and with representative samples of the population) to corroborate them before making decisions aimed at improving the health of the inhabitants of our country and our region.

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