RESEARCH ARTICLE

REVISED Multilevel analysis concerning the relationship between social vulnerability and the healthy use of leisure time in children and adolescents in Argentina: A national population-based study [version 3; peer review: 1 approved, 1 not approved]

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Abstract

Background: Leisure time is a human right and has to be considered part of any health promotion initiative aimed at children and adolescents. The objective of this study was to analyze the relationship between social vulnerability and the healthy use of leisure time in children and adolescents in urban contexts of Argentina, in 2012.

Methods: A cross-sectional and analytical study using data from the Module on Activities of Girls, Boys and Adolescents of the Annual Urban Household Survey was carried out. In this survey, a self-administered instrument was applied to 25,915 individuals aged from 5 to 17. A Social Vulnerability Index (SVI) was developed. Association was estimated by multilevel logistic regression.

Results: Children and adolescents use most of their leisure time to carry out school activities (90.1%) with art activities having the lowest percentage (21.8%). In the multilevel models on the relationship between a Moderate/High SVI and non-performance of art activities, the OR was 1.398 ($p = 0.002$, 95% CI: 1.251-1.561). The association between Moderate/High SVI and non-use of Information and Communications Technology (ICT) gave an OR of 1.580 ($p < 0.001$, 95%

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CI: 1.435-1.741), and between Moderate/High SVI and non-use of internet, an OR of 1.586 ($p < 0.001$, 95% CI: 1.447-1.729).

Conclusions: A Moderate/High SVI negatively impacts on some healthy activities of leisure time for children and adolescents in Argentina. The SVI could be a useful tool to guide health promotion initiatives in this population.

Keywords

Children, Adolescent, Recreation, Social Vulnerability, Health Promotion, Argentina, Multilevel Analysis, Leisure Time

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Any reports and responses or comments on the article can be found at the end of the article.

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REVISED Amendments from Version 2

Our thanks to you and to the reviewers for the extremely helpful comments that have been provided to improve our paper. Based on the comments of the reviewer, new paragraphs are added in the introduction and we added more information in the data collection instruments section.

The creation and handling of variables was clarified and some citations from studies that have found these variables to be of interest have been included. Following the recommendation of the reviewer, the IVS variable was re-categorized, considering new cut-off points where moderate and high stratum joined. Then the models were made, and it was observed that the Odds Ratio (OR) decreased and the confidence interval were reduced, so it was decided to leave OR in all analyzes and not reasons of prevalence.

The Table 3 and Table 4 have been modified according to the requirements of the reviewers, in addition to the new results obtained. The results of Table 3 are reviewed (can read and write). It is added in the table footer that the data is weighted.

Finally, new references were added in the introduction and discussion.

Any further responses from the reviewers can be found at the end of the article

Introduction

Leisure time allows children and adolescents to participate in a diverse range of activities that contribute to developing their identity, improve their self-regulation and express their interests. Several studies show that extracurricular activities benefit the positive development of the child-adolescent population¹⁻³.

In recent decades, Argentina has made notable progress in expanding the rights of children and adolescents through the adoption and promulgation of various laws, and the adoption, and ratification of the Rights of the Child. Despite the progress made in the legal and institutional framework in 2011–2012, it was observed in 2018 that 24.7% of children (0–17 years) in Argentina were affected by multidimensional poverty⁴.

The “Vulnerability” is a complex concept; it has different dimensions. An anthropological dimension, which affirms the intrinsically vulnerable condition of the human being; and a social dimension, which refers to an increased susceptibility caused by the natural environment or social settings, generating “vulnerability spaces” and “vulnerable populations”⁵. Also, social vulnerability influences health risk behaviours and attitudes to preventive medical care, as well as primary and secondary access to care⁶.

Social vulnerability in children and adolescents is a central element in the definition of social protection policies⁷ that seek to improve the quality of life in children and adolescents⁸ and promote healthy free-time uses⁹.

According to data from 2017, it was highlighted that children in Argentina have less time in class than the international average¹⁰, being below all the countries in the region. It means that a significant part of their time is spent outside of school.

Today, leisure time is considered a right. This is claimed by the Convention on the Rights of the Child¹¹, in which it is understood as a time for rest and leisure⁹, and it is considered a necessary element in the approach to health promotion¹²; but it is also one of the main social determinants of health¹³.

The leisure activities can go along with increased or decreased health risk. For example, sufficient physical activity has been shown to contribute to physical, social and mental health¹⁴, whereas excessive media use reported with poorer mental and physical health¹⁵. Regarding the inter-relation between leisure activities, high screen times were significantly associated with less physical activity and less outdoor time. In contrast, physical activity, was significantly related to better social life and more outdoor time¹⁶. These findings highlight the growing importance of use of leisure time in children and adolescents.

Previous studies indicate that the use of leisure time is related to social vulnerability in children and adolescents¹⁷⁻¹⁹. In these, it is observed that as the social stratum diminishes, the low performance of extracurricular recreational activities (sports, art and cultural) increases and the probability of not having access to this type of incentives increases²⁰. The social inequality gap in socialization opportunities is significant and clearly regressive for children and adolescents living in poverty in Argentina²⁰. On the other hand, gender socialization may be an important mechanism to both understand and counteract observed differences in participation in free-time activities among genders^{18,20}.

The scarce evidence documented in the field explored in the Argentina and Latin America highlights the importance of the production of knowledge of the impact of social vulnerability on the healthy use of leisure time in children and adolescents in order to contribute to the quality of life and health of this group from a holistic and integral perspective.

The main objective of this study was to analyze the relationship between social vulnerability and the healthy use of leisure time of children and adolescents in urban contexts in Argentina in 2012.

Methods

Study design and sample

This was a cross-sectional, analytical study of a secondary database of the Module on Activities of Girls, Boys and Adolescents (MANNyA)²¹ that was included as part of the Annual Urban Household Survey (EAHU, by its Spanish initials) during 2012. The MANNyA²¹ was carried out on the basis of an inter-institutional initiative between the Ministry of Labor, Employment and Social Security, the National Secretariat for Children, Youth and Family, the National Commission for the Eradication of Child Labor, the National Institute of Statistics and Censuses (INDEC, by its Spanish initials) and the Provincial Statistical Offices.

Argentina is divided into 6 regions: Gran Buenos Aires: Autonomous City of Buenos Aires and 24 districts of Buenos Aires.

Northwest Region (NOA): Provinces of Catamarca, Tucumán, Jujuy, La Rioja, Salta and Santiago del Estero. Northeast Region (NEA); Provinces of Corrientes, Formosa, Chaco and Misiones. Cuyo Region: Provinces of Mendoza, San Juan and San Luis. Pampeana Region: Provinces of Buenos Aires (except the 24 districts of Greater Buenos Aires), Entre Ríos, Córdoba, Santa Fe and La Pampa. Patagonia Region: Provinces of Río Negro, Neuquén, Chubut, Santa Cruz and Tierra del Fuego.

According to data from the last National Population, Household and Housing Census carried out in 2010²², the country had 40,117,096 inhabitants, 91% of whom lived in urban areas, with a male/female ratio of 0.95/1. The composition of the population in large age groups showed significant differences between each of the provinces; the lowest percentage of girls, boys, and young people registered in CABA (16.3%) (Gran Buenos Aires region), and the highest percentage in the province of Misiones (32.5%) (NEA region).

The MANNyA²¹ was oriented to the population aged 5 to 17 years and framed in the conceptual field of child labor surveys in Argentina. Within this survey, a block of questions was included to collect data on the use of leisure time.

The sample consisted of children and adolescents aged 5 to 17 from urban conglomerates in Argentina. It was a probabilistic,

stratified and multi-stage sample of 34,487 households, with a total of 25,915 children and adolescents surveyed (Figure 1)²¹.

The MANNyA²¹ sample design was based on the sample design of the Annual Survey of Urban Households (EAHU) of the Directorate of Statistical Methodology of INDEC, which considers towns with 2,000 and more inhabitants.

Non-response represented 0.97% of the cases, that was not possible to interview the boy, girl, and/or adolescent is, in 141 households.

The secondary database of the MANNyA²¹, had the weighting of the survey data from three factors: 1) defined by the inverse of the probability of selection of each dwelling in the sample; 2) adjusted the data for non-response of a part of the households, 3) adjusted before the population projections for the survey domains. This last factor calibration process uses marginals that consider the structure of the population by sex and age groups.

Data collection instruments

The data from the MANNyA secondary database²¹, the basis of this analysis, was collected using a self-administered instrument. The databases of MANNyA 2012²¹ are public and can be obtained in the [web site of INDEC](#).

Figure 1. Stages of data collection²¹.

The information-gathering stage was carried out between July and October 2012, during which time each of the selected dwellings visited and applied corresponding questionnaires.

The instrument included closed-ended questions aimed at obtaining what children and adolescents usually do in their leisure time.

During the process of elaboration of the instrument, including the phases of conceptual design, questionnaire tests, preparation of manuals, the training process on data collection, input and criticism of information guided by professionals from the government area included. The provincial statistical offices supervised fieldwork for the survey implementation.

The leisure time questions module designed so that the informants were self-responding. When the child or adolescent was absent or the responsible adults refused to answer the questionnaire, it was determined that the informants could be either the older siblings or another adult in the household.

To facilitate the implementation of the questions of the leisure time block within the MANNyA²¹ in the youngest children, the interviewer had a card of illustrations.

Outcome “*Healthy use of leisure time*”, defined as the time for rest and leisure activities, play and recreational activities suitable for the age. It also implies the right to participate freely in cultural life and the arts⁹. In the framework of the analyzed module, leisure time activities are defined as everything that the child does before or after school, or on the weekends²¹.

The dimensions of analysis for this study were:

- School activities (homework or studying for school). Categories: yes/no.
- Sports (football, swimming, cycling/horseback riding, etc.). Categories: yes/no.
- Art and another course (painting, theatre, music, dance, language, computation, school support, or art-related workshop or course). Categories: yes/no.
- Socialization (going out with friends to the cinema, to the square, to the cyber cafe, etc.). Categories: yes/no.
- Use of Information and Communication Technologies (ICT; computer or netbook). Categories: yes/no.
- Internet use. Categories: yes/no.

Explanatory variable

“*Social vulnerability*”, defined as the situations of insecurity and defenselessness experienced by communities, families, and individuals in their livelihood conditions, as a consequence of the impact caused by any socio-economic event. In addition, the management of resources and the strategies used by them to cope with the effects of this event were considered. Today, social vulnerability is considered one of the main social determinants of health¹³, where most health problems can be attributed to people’s socio-economic conditions.

For the construction of this variable, a Social Vulnerability Index (SVI) was prepared (Table 1) based on the data from the MANNyA secondary database²¹. The dimensions and weighting values of the conceptualization of social vulnerability were based on previous publications^{22,23}.

The categories included material assets, such as employment and housing, and non-material assets, such as those related to human capital (access to the health system and educational system of the head of household).

The construction of the SVI was based on the selection of dimensions represented by different categories which, depending on the risk situation, were defined as «moderate» or «critical».

Since each of the selected categories may have different levels of intensity, it was decided to define differential weights within them²⁴.

Next, the SVI of each household where the child or adolescent is living was categorized as follows: without SVI was assigned to those cases with a value of 0.00; low SVI was assigned to those cases with values between >0.00 and ≤0.30; moderate SVI was assigned to those cases with values between >0.30 and ≤0.45; high SVI was assigned to those cases with values greater than 0.45. These categories were defined and adapted by taking the cohort points proposed in a previous study de Argentina²⁴.

Co-variables

“*Household activities*”. Of the child/adolescent defined as: activities carried out in the home in an intensive and/or non-intensive manner in the reference week.

Includes those who took care of their siblings (including the transfer to school) or some other person living at home, who washed the dishes, clothes or ordered the house, and those who did the shopping or errands alone. Household activities can be intensive and non-intensive. Intensive domestic activities defined as those that were carried out for 10 hours or more in the week in the case of children (5 to 13 years) and 15 hours or more in the week for adolescents (14 to 17 years).

“*Economic activities*”. Of the child/adolescent defined as: working in the reference week.

This group is made up of those who carried out an activity that generates goods or services that have a market value for at least one hour. Economic activities include paid in money or in-kind and unpaid (ad-honorem work activities and non-paid activities carried out to help a family member obtain an income).

“*Production activities*”. Of the child/adolescent defined as: the production activities for self-consumption in the reference week.

Those who carried out productive activities for household consumption for more than one hour includes those who helped in the construction or repair of their own home, cultivated; and/

Table 1. Construction of the social vulnerability index.

Dimension	Categories/Definition	Weighting ***
Overcrowding	- Households with “moderate” overcrowding (>2 and ≤3 people per room) *	0.10
	- Households with “critical” overcrowding (>3 people per room) *	0.10
Housing	- Households with moderate housing material quality (Calmat III) **	0.10
	- Households with critical housing material quality (Calmat IV or V) **	0.15
Occupation	- Households with 2 to 4 members per household head employed	0.30
	- Households with 5 or more members per household head employed	0.30
	- Households not receiving any income from work, retirement or pension	0.30
Health Coverage	- Households with head employed without health coverage	0.15
Education	- Households whose head has an average of <7 years of schooling	0.25
	- Households whose head has an average of >7 and <12 years of schooling	0.10

* It represents the ratio between the total number of people in the household and the total number of rooms or spaces available in the household (excluding bathroom(s) and kitchen(s)) (Instituto Nacional de Estadísticas y Censos).

**The predominant materials of the constituent components of the dwelling (floors, walls, and roofs) are assessed and categorized in relation to their strength, resistance, and capacity for thermal, waterproof, and sound insulation. The dwellings are classified as:

Calmat I and II: the dwelling was made from resistant and solid materials used in floors and roofs, although it may/ may not incorporate insulating or finishing elements in at least one of these. Mosaic/tile/wood/ceramic/carpet floors were considered. The roof had a membrane/asphalt singles and did have a ceiling/interior cladding.

Calmat III: the dwelling was made from resistant and solid materials used in floors and roofs, but it lacks elements of insulation or finishing in all of these. Cement floor/fixed brick floor was considered. Roof with tile/slab roof without any cover, slate/clay tile, and no ceiling/interior cladding.

Calmat IV and V: the dwelling was made of non-resistant materials in at least one of the constituent components. Loose brick/earth floor and roofs of sheet metal without cover, fiber cement/plastic sheet, corrugated roofing sheet, cane/board/straw with mud/ straw alone were considered and there was no ceiling/interior cladding.

***In the weighting structure, greater importance has been given to the *occupation* dimension (dependency burden of income earners), given that the association of the population with the labor market becomes a key factor in social vulnerability, and monetary income can change the situation of social inclusion/exclusion more immediately.

or harvested in the garden; and/or taking care of the farm; and/or farm animals to consume at home and those who went out to fetch water or firewood.

“Age”. Is defined as childhood <10 years old and adolescence ≥ 10 to 19 years old according to the World Health Organization (WHO) classification²⁵.

“School Attendance”. Of the child/adolescent defined as: self-report of attending school at the time of the survey.

“Decile group of total household income in the region (DGHIR)”²⁶. Variable elaborated and defined by the government agency and found included in the secondary database²¹.

It is defined as the total family income, at of the total income of all its members. The construction of deciles consists of ordering the population or households by income amounts from lowest to highest according to the defined income variable and then grouping it into subsets that each contain 10% of the units (households). From this ordering, the income intervals corresponding to each of the ten subsets formed (income deciles) were determined. The

potential of this indicator is that categorizes households taking two dimensions: region and household income.

Statistical analysis

The variables of interest were analyzed descriptively using position and dispersion measurements and frequency distribution.

Weighting proportions in descriptive analysis was, used considering the sample method proposed by the MANNyA secondary database²¹.

Firstly, it was carried out a univariate analysis and the variables that presented statistical significance were introduced for the fix-effects multivariate model^{27–29}. Given the hierarchical structure of the data (individuals grouped in regions of the country), we conducted a multilevel logistic regression analysis to explore the relationship between the social vulnerability and the healthy use of leisure time. The models considered socio-economic and socio-demographic variables at two levels: an individual level, relating to the child/adolescent (domestic, production, and economic activities, gender, age and, school attendance), and a contextual level (decile group of total household income in

the region). An empty model (Model 0) was performed, and calculated the level 2 variance and the intraclass correlation coefficient (ICC). The proportion of the variance at level 2 explained (PVE) by the different models was calculated as $PVE = (V) \times 100$.

We have performed AIC-BIC statistics to judge the goodness of fit shown in each table.

The statistical package Stata® v14.2 (Stata Corporation, College Station, Texas, USA) was used for all the analyses, and a $p < 0.05$ value was considered statistically significant.

Ethical considerations

The study was carried out on the basis of a secondary analysis of the MANNyA database²¹, compiled by different public bodies under the leadership of the INDEC. In Argentina, public statistics produced by the State are part of the National Statistical System created by Law No. 17622, which guarantees confidentiality and the Protection of Personal Data through Law No. 25326.

The database is currently public and open-access, and is de-identified by the responsible public body³⁰. Thus, this study did not require an evaluation by an ethics committee and, in addition, qualifies for the status of being exempt from obtaining informed consent.

Results

Descriptive phase

As shown in Table 2, the sample consisted of 52.6% males and 63.5% adolescents, where 6.9% are less than 6 years old. In total, 32.2% of the respondents were from Gran Buenos Aires and 30.9% from the Pampeana region. It is also observed that 95.5% were attending school at the time of the survey and 58.1% had some kind of health coverage.

Table 3 shows the prevalence of activities of healthy use of leisure time, according to socio-demographic characteristics. It was observed that the prevalence of performance of school activities was 90.1%. Art and other courses activities (21.8%) had the lowest prevalence of performance as compared to the other activities of free-time use.

The socialization, sports/recreational activities, use of ICTs and the Internet showed an intermediate prevalence between

Characteristics	n (%)
Life Stage	
Childhood	9,307 (36.5)
Adolescence	16,608 (63.5)
Region	
Gran Buenos Aires	1,370 (32.2)
Cuyo	2,570 (7.2)
Northeast	4,398 (10.9)
Northwest	5,894 (13.6)
Pampeana	6,027 (30.9)
Patagonia	5,656 (5.9)
Current School Attendance	
Yes	24,735 (95.5)
No	1,180 (4.5)
Health Coverage	
Yes	14,901 (58.1)
No	11,014 (41.9)
Knows How to Read and Write	
Yes	1,925 (7.3)
No	23,990 (92.7)
Social Vulnerability Index (SVI)	
Without social vulnerability	3,220 (10.9)
Low/moderate social vulnerability	22,044 (87.1)
High social vulnerability	651 (2.1)

Values expressed in proportions (%). **Sex.** Categories. Female and male.

Age defined as: childhood <10 years old and adolescence ≥ 10 to 19 years old according to the WHO classification²⁵.

School Attendance of the child/adolescent defined as: self-report of attending school at the time of the survey.

Health Coverage of the child/adolescent defined as: health insurance (including Comprehensive Medical Attention Program (PAMI), mutual/prepaid/emergency service).

Does Know How to Read or Write defined as: self-reporting of not knowing how to read or write at the time of the survey.

Social Vulnerability Index (SVI) of the child/adolescent defined as: The SVI of each household where the child or adolescent is included according to the categories (Without SVI: value of 0.00/SVI low/moderate: >0.00 and ≤0.45/SVI high: >0.45).

Life Stage of children/adolescents defined as: childhood <10 years old and adolescence ≥ 10 to 19 years old according to the WHO classification.

Data Weighted by age and gender stratum for each city to represent the general population.

Table 2. Sociodemographic characteristics of children and adolescents in Argentina, 2012 (n= 25,915).

Characteristics	n (%)
Sex	
Female	12,689 (47.4)
Male	13,226 (52.6)

Table 3. Prevalence of activities of healthy use of leisure time according to sociodemographic characteristics in children and adolescents from Argentina, 2012 (n= 25.915).

Activities	School		Sport/recreational		Art and another course		Socialization		ICT		Internet	
	%	(95%CI)	%	(95%CI)	%	(95%CI)	%	(95%CI)	%	(95%CI)	%	(95%CI)
Total	90.1	(89.4-90.8)	53.6	(54.9-47.7)	21.8	(20.8-22.8)	51.1	50.0-52.3	74.2	(0.73- 0.75)	65.60	(0.64- 0.67)
Sex												
Male	88.88	(87.76- 89.91)	62.99	(61.25- 64.69)	18.31	(17.13- 19.55)	54.06	(52.42- 55.69)	74.55	(72.99- 76.05)	65.23	(63.54- 66.88)
Female	91.54	(90.65- 92.36)	43.23	(41.50- 44.97)	25.66	(24.22-27.16)	74.78	(46.10- 49.46)	73.80	(72.30- 75.26)	66.01	(64.42- 67.57)
Life Stage												
Childhood	87.29	(86.04- 88.45)	48.39	(46.45- 50.34)	17.30	(16.01- 18.66)	24.47	(22.99- 26.01)	61.36	(59.52- 63.17)	47.79	(45.90- 49.69)
Adolescence	91.78	(90.87- 92.60)	56.63	(55.10- 58.14)	24.37	(23.08- 25.71)	66.36	(64.87- 67.81)	81.56	(80.22- 82.83)	75.82	(74.39- 77.20)
Region												
Gran Buenos Aires	88.90	(86.82- 90.69)	45.33	(42.11- 48.58)	18.44	(16.07- 21.08)	42.67	(39.69- 45.71-)	78.59	(75.40- 81.48)	72.31	(68.96- 75.42)
Cuyo	89.93	(88.26- 91.39)	48.52	(45.53- 51.51)	17.94	(15.86- 20.24)	56.57	(53.72)(59.37-	75.76	(72.96- 78.36)	61.33	(58.15- 64.42)
Northeast	91.39	(90.21- 92.45)	63.45	(61.26- 65.59)	23.11	(21.29- 25.03)	46.82	(44.71)(48.95-	60.61	(58.26- 62.92)	47.21	(44.85- 49.58)
Northwest	90.94	(89.97- 91.82)	56.17	(54.25- 58.06)	21.59	(20.14- 23.11)	55.35	(53.56- 57.11)	64.88	(62.90- 66.81)	55.19	(53.16- 57.20)
Pampeana	90.67	(89.64- 91.61)	57.56	(55.52- 59.57)	24.61	(22.96- 26.34)	57.37	(55.44- 59.27)	77.18	(75.35- 78.91)	70.08	(68.09- 72.01)
Patagonia	90.26	(88.82- 91.53)	61.29	(58.91- 63.63)	28.80	(26.62- 31.08)	55.86	(53.58- 58.13)	79.84	(77.52- 81.98)	69.14	(66.65- 71.52)
Current School Attendance												
Yes	93.22	(92.58- 93.80)	54.44	(53.12- 55.76)	22.38	(21.34- 23.45)	50.67	(49.43- 51.92)	74.95	(73.75- 76.11)	66.24	(64.95- 67.50)
No	25.25	(20.88- 30.19)	36.31	(31.47- 41.44)	9.51	(7.07- 12.69)	59.75	(54.29- 64.98)	58.35	(53.13- 63.39)	52.15	(46.89- 57.35)
SVI												
Without SVI	90.9	(88.9-92.5)	54.9	(51.2-58.6)	19.2	(16.9-21.8)	50.9	46.8-54.9)	72.5	(69.2-75.6)	63.1	(59.5-66.5)
Low/moderate SVI	90.2	(89.4-91.0)	53.6	(52.2-55.0)	22.4	(21.2-23.5)	51.5	(50.2-52.8)	75.1	(73.8-76.4)	66.7	(65.2-68.1)
High SVI	83.1	(75.8-88.5)	48.1	(40.1-56.1)	11.4	(7.6-16.6)	36.3	(29.9-44.3)	45.1	(35.7-54.9)	33.7	(25.4-43.2)

Data Weighted by age and gender stratum for each city to represent the general population.

SE: Standard Error.

95%CI: 95% Confidence Interval.

Values expressed in proportions (%).

Sex categories: Female and male.

Life Stage defined as childhood <10 years old and adolescence ≥ 10 to 19 years old according to the WHO classification²⁵.

Region of the child/adolescent defined as: Gran Buenos Aires, Cuyo, Northeast, Northwest, Pampeana, and Patagonia.

School Attendance of the child/adolescent defined as: self-report of attending school at the time of the survey.

51.1% and 74.2%, being, in most cases, higher in males than in females.

Table 4 shows the main results of the subgroup analysis. In the group without SVI (10.9% of the sample), it was observed that the highest prevalence was the performance of school activities (90.9%), with the art and other courses activities being the least prevalent (19.2%).

Among those with a low or moderate SVI (87.1%), the distribution of the performance of leisure time activities was the same as that of the group without SVI, although with higher values in the cases of ICT (75.1%), Internet (66.7%) and Art and other course (22.4%).

In the group composed of those with a high SVI (2.1%), the distribution of the performance of leisure time activities changes as compared to the other two groups of SVI. While school activities (83.1%) and Art and other course (11.4%) continues to be the most and least popular choice, respectively, Sports are in second place (48.1%), replacing ICT, which have moved into third place (45.1%). In turn, Socialization activities (36.3%) were more prevalent than Internet use (33.7%).

Analytical phase

In the multilevel models, statistically significant associations between some leisure time use activities and social vulnerability are seen (**Table 5**).

Regarding the relationship between moderate/high SVI and the non-performance of Art and other course, an OR of 1.398 was found to be statistically significant ($p < 0.001$).

The empty model of the dependent variable of Art and other course shows a variance between the deciles of household income in the region of 0.20, a standard error (SE) of 0.37, and an ICC of 0.058. In other words, 5.8% of the variability observed in the non-performance of art activities is attributable to the decile of household income at the regional level. It was introduced the explanatory variable and other covariates into the model, this variability decreases to 0.09, with a SE of 0.21 and an ICC of 0.026, and the PVE is 55.45% (**Table 5**).

Similarly, this was reflected in the relationship between SVI in the highest stratum and the internet use activities (OR 1.586 and $p = 0.000$).

On the other hand, it could be observed that the non-use of the ICT during leisure time in the group with moderate/high SVI yielded an OR of 1.580, being significant ($p < 0.001$).

Based on the aforementioned, in the final models (Model 2), which considered individual and contextual variables, an increase in the likelihood of unhealthy use of leisure time is observed when there are increased moderate/high SVI levels in the cases of Art and other course, ICT, and the Internet.

Discussion

Principal findings

Our results highlighted the impact of a moderate/high social vulnerability index on the reduced performance of some healthy leisure time activities such as art, ICT and internet use, among children and adolescents in Argentina.

Some risk factors from the social sphere where biographies of children and adolescents are developed may have an impact on the ways in which they perform in society. The fact that a significant part of the risk to their health and quality of life occurs in this context was highlighted in the field of social epidemiology³¹.

Comparison with prior studies

As Feito⁵ suggests that vulnerability has a dimension of susceptibility to harm, conditioned by intrinsic and extrinsic factors, anchored in the radical fragility of the human being, but undoubtedly largely attributable to social and environmental elements. In this sense, our study showed that a part of the population under analysis had some degree of social vulnerability.

Regarding the healthy use of leisure time in the population under analysis, it was observed that some activities were more prevalent than others; generally, art sports, and socialization activities were less frequent. This information is important because, as other authors have shown^{32,33}, these activities should be proposed as strategies to promote the health of children and adolescents at social risk³⁴, since they contribute to the psychosocial and physical state of children and adolescents, while at the same time promoting life skills.

Another aspect to consider is that of gender differences in the performance of activities during leisure time. For example, it is observed that “sexual division in the activities between men and women is already established in childhood and adolescence”³⁵. Our results showed that boy tended to do more ICT activities and girl more art activities. These differences between boys and girls already had been found in other previous studies^{36,37}.

Furthermore, it should be noted that the use of digital-free time, mainly focused on the use of the Internet and ICT, has become increasingly present in the activities of children and adolescents and has become an agent of socialization³⁸.

However, our results show that the use of the Internet is significantly conditioned by social vulnerability. In this sense, it was observed that, in the group with the highest level of vulnerability, there is a much better chance of not using the Internet and ICT. This is relevant and shows how the condition of vulnerability becomes a determinant barrier when accessing certain goods and services, especially if progress is to be made in reducing digital divides³⁹.

Our findings on the use of ICT were similarly, reflected in the use of the Internet (models adjusted); it was observed that there

Table 4. Prevalence of healthy use of leisure time activities within each stratum of social vulnerability of children and adolescents in Argentina according to sociodemographic characteristics, 2012 (n= 25,915).

Activities	Without SVI											
	School		Sport		Art and other course		Socialization		ICT		Internet	
	%	(95%CI)	%	(95%CI)	%	(95%CI)	%	(95%CI)	%	(95%CI)	%	(95%CI)
Total	90.9	(88.9-92.5)	54.9	(51.2-58.6)	19.2	(16.9-21.8)	50.9	(46.8-54.9)	72.5	(69.2-75.6)	63.1	(59.5-66.5)
Sex												
Male	88.3	(85.2-90.8)	62.6	(58.2-66.8)	15.3	(12.8-18.2)	54.3	(48.7-59.7)	72.8	(68.4-76.7)	62.9	(58.2-67.5)
Female	94.3	(92.5-95.6)	44.9	(39.9-49.9)	24.3	(20.7-28.4)	46.4	(41.7-51.1)	72.1	(68.0-75.9)	63.2	(58.7-67.5)
Life Stage												
Childhood	88.8	(85.2-91.5)	45.9	(40.9-51.0)	16.1	(12.8-20.1)	25.4	(21.2-30.1)	54.9	(49.5-60.1)	41.3	(36.1-46.7)
Adolescence	92.0	(89.7-93.9)	59.7	(55.2-64.1)	20.9	(17.9-24.3)	64.5	(59.7-69.1)	81.9	(78.4-85.0)	74.7	(70.9-78.2)
Region												
Gran Buenos Aires	92.3	(85.9-96.0)	42.6	(32.9-52.9)	10.1	(5.7-17.1)	37.1	(26.2-49.5)	78.3	(69.1-85.3)	66.9	(57.3-75.3)
Cuyo	91.1	(85.9-94.4)	42.4	(35.1-49.9)	16.0	(11.1-22.5)	53.4	(45.8-60.9)	74.5	(67.1-80.8)	60.6	(53.1-67.6)
Northeast	92.4	(89.6-94.5)	66.5	(60.9-71.6)	17.8	(14.2-22.1)	45.3	(40.5-50.2)	59.6	(53.9-65.0)	44.8	(39.4-50.4)
Northwest	90.8	(87.9-93.1)	55.1	(50.6-59.6)	21.3	(17.8-25.2)	57.3	(52.8-61.7)	63.3	(58.5-67.9)	56.2	(51.3-61.0)
Pampeana	89.3	(85.3-92.3)	61.2	(54.4-67.6)	26.0	(21.5-31.0)	58.8	(51.7-65.6)	76.3	(69.3-82.1)	70.4	(63.2-76.7)
Patagonia	89.5	(85.1-92.8)	65.0	(58.5-71.0)	24.7	(19.0-31.5)	59.4	(52.3-66.2)	80.2	(74.6-84.8)	69.7	(63.4-75.4)
With low/moderate SVI												
Activities	School		Sport/ recreational		Art and other course		Socialization		ICT		Internet	
	%	(95%CI)	%	(95%CI)	%	(95%CI)	%	(95%CI)	%	(95%CI)	%	(95%CI)
Total	90.2	(89.4-91.0)	53.6	(52.2-55.0)	22.4	(21.2-23.5)	51.5	(50.2-52.8)	75.1	(73.8-76.4)	66.7	(65.2-68.1)
Sex												
Male	89.0	(87.8-90.1)	63.2	(61.3-65.1)	18.8	(17.5-20.2)	54.4	(52.7-56.1)	75.5	(73.8-77.1)	66.3	(64.5-68.1)
Female	91.5	(90.6-92.4)	43.2	(28.4-49.2)	26.2	(24.6-27.8)	48.3	(46.5-50.1)	74.7	(73.1-76.2)	67.0	(65.3-68.7)
Life Stage												
Childhood	87.1	(85.7-88.4)	48.9	(46.8-51.0)	17.7	(16.3-19.2)	24.5	(22.9-26.1)	63.1	(61.1-65.0)	49.5	(47.4-51.5)
Adolescence	92.0	(91.0-92.9)	56.3	(54.7-57.9)	25.1	(23.6-26.5)	67.0	(65.5-68.6)	82.0	(80.6-83.4)	76.6	(75.1-78.1)
Region												
Gran Buenos Aires	88.8	(86.6-90.7)	45.6	(42.2-49.1)	19.5	(16.9-22.3)	43.6	(40.5-46.8)	69.2	(66.5-71.7)	73.3	(69.7-76.6)
Cuyo	90.0	(88.2-91.6)	49.4	(46.1-52.7)	18.3	(16.0-20.8)	57.0	(53.9-60.1)	76.5	(73.5-79.4)	62.0	(58.5-65.4)
Northeast	91.5	(90.2-92.6)	63.3	(60.9-65.6)	24.3	(22.3-26.5)	47.7	(45.3-50.1)	62.0	(59.4-64.5)	48.8	(46.2-51.5)
Northwest	91.1	(90.1-92.1)	56.8	(56.7-58.9)	22.3	(20.6-24.0)	55.4	(53.5-57.4)	66.3	(64.1-68.4)	56.2	(53.9-58.4)
Pampeana	90.9	(89.8-91.9)	57.2	(55.1-59.3)	24.6	(22.8-26.4)	57.5	(55.5-59.5)	77.8	(76.0-79.6)	70.6	(68.6-72.6)
Patagonia	90.3	(88.8-91.7)	60.9	(58.3-63.4)	29.3	(19.0-31.5)	55.4	(52.9-57.8)	79.9	(77.4-82.2)	69.2	(66.5-71.7)

With high SVI												
Activities	School		Sport/ recreational		Art and other course		Socialization		ICT		Internet	
	%	(95%CI)	%	(95%CI)	%	(95%CI)	%	(95%CI)	%	(95%CI)	%	(95%CI)
Total	83.1	(75.8-88.5)	48.1	(40.1-56.1)	11.4	(7.6-16.6)	36.3	(29.9-44.3)	45.1	(35.7-54.9)	33.7	(25.4-43.2)
Sex												
Male	86.9	(80.6-91.4)	56.3	(46.7-65.6)	13.2	(8.0-20.5)	39.7	(29.5-50.8)	47.0	(35.5-58.8)	32.5	(22.4-44.5)
Female	78.5	(64.7-88.0)	38.3	(28.4-49.2)	9.2	(5.6-14.7)	32.2	(23.4-42.5)	42.9	(31.5-55.1)	35.1	(24.2-47.9)
Life Stage												
Childhood	88.0	(80.5-92.9)	39.7	(30.4-49.7)	7.7	(3.7-15.2)	19.5	(13.6-27.1)	22.8	(14.7-33.6)	12.0	(7.7-18.2)
Adolescence	80.0	(68.0-88.2)	53.3	(43.9-62.5)	13.7	(8.7-20.8)	46.8	(36.5-57.4)	59.1	(47.7-69.6)	47.4	(35.3-59.8)
Region												
Gran Buenos Aires	72.5	(46.9-88.7)	44.1	(21.6-69.2)	5.3	(1.0-29.8)	17.5	(6.4-39.5)	22.1	(4.7-62.0)	43.4	(18.9-71.6)
Cuyo	83.0	(69.9-91.1)	46.0	(32.3-60.4)	14.8	(.56-33.7)	53.8	38.1-68.8)	54.3	(36.8-70.8)	42.5	(26.8-59.9)
Northeast	83.8	(74.1-90.3)	54.1	(39.5-68.0)	11.1	(5.9-19.9)	27.3	(19.4-36.9)	24.1	(14.7-36.9)	9.6	(5.0-17.6)
Northwest	88.0	(82.2-92.1)	47.7	(38.7-56.8)	10.5	(1.0-16.3)	48.0	(38.9-57.1)	45.1	(37.0-53.4)	34.5	(26.4-43.8)
Pampeana	86.3	(75.0-93.0)	49.5	(33.9-65.1)	17.4	(8.5-32.6)	36.9	(21.2-56.0)	45.8	(26.1-66.9)	35.1	(19.4-54.7)
Patagonia	100.0	.	51.0	(30.6-71.1)	21.1	(11.7-34.9)	80.4	(44.6-95.4)	22.1	(4.7-62.0)	22.1	(4.7-62.0)

SE: Standard Error.

95%CI: 95% Confidence Interval.

Values expressed in proportions (%).

Social Vulnerability Index (SVI) of the child and adolescent defined as: The SVI of each household where the child or adolescent is included according to the cohort categories of: Without SVI: value of 0.00/low/moderate SVI: >0.00 and ≤0.45/ high SVI: >0.45.

Sex categories: female and male.

Life Stage defined as: childhood <10 years old and adolescence ≥ 10 to 19 years old according to the WHO classification²⁵.

Region of the child and adolescent defined as: Gran Buenos Aires, Cuyo, Northeast, Northwest, Pampeana, and Patagonia.

Data Weighted by age and gender stratum for each city to represent the general population.

Social Vulnerability Index (SVI) of the child and adolescent defined as: The SVI of each household where the child or adolescent is included according to the cohort categories of: Without SVI: value of 0.00/low/moderate SVI: >0.00 and ≤0.45/ high SVI: >0.45.

was a risk of not using ICT and Internet in the groups with moderate/high levels of social vulnerability. It should be noted that two years before this survey, Argentina implemented the “Connecting Equality” policy⁴⁰, a federal broad-scope program. This is important because the effectiveness of the digital divide reduction policies, especially among the most vulnerable groups, could present certain barriers to access⁴¹.

These results in the use of screens were opposite to what Auhuber *et al.*¹⁶ in her study published in 2019 in children and adolescents in Germany. The results revealed that girls, children with lower leisure-economic status as well as older children reported using screen-based media more often (models adjusted). These differences may be differential access to ICT between countries with high vs. middle-low income. Also, to the period

difference between our study with the work carried out in German children and adolescents.

There were also marked differences with respect to art activities, where it was found that the higher the social vulnerability index, the higher the probability of not performing these activities. However, this result highlights the importance of promoting this type of activity in children and adolescents, since, according to the evidence and based on the findings by Wald⁴², the changes perceived as a result of participating in art workshops are closely linked to feelings of well-being, the development of personal capacities and the strengthening of group relations, which may be linked in a broad sense to the paradigm of health promotion. A narrative study postulated the need to focus on mental health risk related to social

Table 5. Multi-level analysis of the risk of not making healthy use of leisure time according to the Social Vulnerability Index (SVI) of children and adolescents in Argentina (n= 25,915).

School							
SVI	Model 0	Model 1			Model 2		
		OR	95%CI	p	OR	95%CI	p
Without SVI		Ref. 1			Ref. 1		
Low SVI		0.996	0.869-1.140	0.950	1.038	0.885-1.216	0.649
Moderate/High SVI		1.361	1.175-1.577	0.000	1.196	1.004-1.424	0.045
Variance level 2 (SE)	0.021 (0.035)	0.028 (0.047)			0.001 (0.003)		
ICC	0.006	0.008			0.0003		
PCV (%)	Ref.	-33.33			95.24		
AIC	16188.34	16151.13			11796.74		
BIC	16204.67	16183.78			11878.36		
Sport/recreational							
SVI	Model 0	Model 1			Model 2		
		OR	95%CI	p	OR	95%CI	p
Without SVI		Ref. 1			Ref. 1		
Low SVI		0.957	0.885-1.032	0.249	0.925	0.855-1.001	0.054
Moderate/High SVI		1.256	1.152-1.369	0.000	1.191	1.089-1.302	0.000
Variance level 2 (SE)	0.184 (0.305)	0.190 (0.314)			0.226 (0.368)		
ICC	0.053	0.055			0.064		
PCV (%)	Ref.	-3.26			-22.83		
AIC	35533.52	35455.13			33985.85		
BIC	35549.85	35487.78			34067.48		
Art and other course							
SVI	Model 0	Model 1			Model 2		
		OR	95%CI	P	OR	95%CI	p
Without SVI		Ref. 1			Ref. 1		
Low SVI		0.743	0.677-0.814	0.000	0.745	0.679-0.818	0.000
Moderate/High SVI		1.419	1.272-1.583	0.000	1.398	1.251-1.561	0.000
Variance level 2 (SE)	0.202 (0.370)	0.128 (0.268)			0.090 (0.215)		
ICC	0.058	0.037			0.026		
PCV (%)	Ref.	36.63			55.45		
AIC	28338.27	28037.45			27460.41		
BIC	28354.59	28070.1			27542.04		
Internet							
SVI	Model 0	Model 1			Model 2		
		OR	95%CI	P	OR	95%CI	p
Without SVI		Ref. 1			Ref. 1		
Low SVI		0.764	0.707-0.826	0.000	0.726	0.668-0.788	0.000
Moderate/High SVI		1.628	1.492-1.776	0.000	1.586	1.447-1.729	0.000
Variance level 2 (SE)	0.040 (0.102)	0.020 (0.074)			0.0003 (0.051)		
ICC	0.012	0.006			0.0009		
PCV (%)	Ref.	50.00			99.25		
AIC	34816.84	34201.98			31648.71		
BIC	34833.17	34234.63			31722.18		

Socialization							
SVI	Model 0	Model 1			Model 2		
		OR	95%CI	P	OR	95%CI	P
Without SVI		Ref. 1			Ref. 1		
Low SVI		1.005	0.931-1.085	0.894	0.963	0.885-1.047	0.375
Moderate/High SVI		1.229	1.128-1.339	0.000	1.179	1.072-1.297	0.001
Variance level 2 (SE)	0.083 (0.163)	0.099 (0.185)			0.104 (0.202)		
ICC	0.025	0.029			0.030		
PCV (%)	Ref.	-19.28			-25.30		
AIC	36043.77	36000.48			31097.72		
BIC	36060.09	36033.13			31179.35		
ICT							
SVI	Model 0	Model 1			Model 2		
		OR	95%CI	P	OR	95%CI	P
Without SVI		Ref. 1			Ref. 1		
Low SVI		0.767	0.705-0.835	0.000	0.739	0.676-0.807	0.000
Moderate/High SVI		1.636	1.492-1.795	0.000	1.580	1.435-1.741	0.000
Variance level 2 (SE)	0.068 (0.145)	0.048 (0.118)			0.017 (0.078)		
ICC	0.020	0.014			0.005		
PCV (%)	Ref.	29.41			75.00		
AIC	31043.24	30493.98			28464.2		
BIC	31059.57	30526.63			28545.82		

OR: (odds ratio) obtained by a logistic regression model, where the dependent variable was the leisure time use per each activity.

p: level of statistical significance <0.05.

SE: Standard Error; **ICC:** Intraclass Correlation Coefficient.

PCV: Proportional Change in Variance ($(V_{N-1} - V_{N-2}) / V_{N-1}$).

Explicative variable:

Social Vulnerability Index (SVI) defined as: The SVI of each household where the child or adolescent is included according to the cohort categories of: Without SVI: value of 0.00/low SVI: >0.00 and ≤0.30/ moderate/high SVI: >0.30.

Outcome: Healthy Use of Leisure Time: as a dichotomous variable (yes/no) (Art other courses, Socialization, Sports, School, ICT and Internet).

Context variable:

Decile group of total household income in the region (DGHIR)

Individual variables:

Household activities of the child/adolescent defined as: activities carried out in the home in an intensive and/or non-intensive manner;

Economic activities of the child/adolescent defined as: any work in the reference week and/or work during the last year. **Production activities** of the child/adolescent defined as: the production activities for self-consumption in the reference week.

Sex. Categories: female and male.

Age defined as: childhood <10 years old and adolescence ≥ 10 to 19 years old according to the WHO classification²⁵.

School Attendance of the child/adolescent defined as: self-report of attending school at the time of the survey.

Model 0: empty model only of random intercept attributable to the cluster variable.

Model 1: bivariate analysis between healthy leisure time activities and the SVI, with random intercept attributable to the cluster variable.

Model 2: multivariate multilevel final model: Model 1+ all individual variables such as child/adolescent's household activities (intensive or non-intensive), child/adolescent's productive activities (self-consumption) and child/adolescent's economic activities (worked in the reference week or worked during the last year) sex of the child/adolescent, age of the child/adolescent, current school attendance of the child/adolescent, with random intercept.

vulnerability aspects in children and adolescents in Sub-Saharan Africa⁴³.

A relevant fact of this study is that it was observed that the contextual level had a greater weight in the definition of the activities carried out during the free time of children and adolescents. Being consistent with other studies that highlighted the positive association between variables of the physical and social environment of the home with the performance of the always activity^{44,45}.

In some free time use activities, such as internet use, ICT, and art, statistically significant associations were found with OR less than one between low IVS and not performing these activities. The low IVS in this case, acts as a factor of protector to leisure time activities.

This protective effect could be because despite having a low IVS, children and adolescents could have still resilience capacity⁴⁶. In this line, a study carried out in children in Chile, demonstrated the resilience capacity even with low resources⁴⁷.

This result may also be related to the presence of capitals⁴⁸ (economic, cultural and social capitals) in this group. Where Individuals and groups draw on a variety of resources—capitals—to maintain and enhance their positions in the social order⁴⁹.

Also, in this way, it would facilitate the recognition of strengths in groups usually considered “vulnerable”⁵⁰. This interesting result will be need to be addressed in future research.

Strengths and limitations

The weakness of the proposal is that the research question was addressed based on the analysis of a secondary data source, so it is possible that some aspects related to the construction of the SVI were left out. However, the methodology for the construction of this index is flexible and there is not a sole theoretical frame of reference.

Regarding the construction of the social vulnerability index and where it was visualized that a part of the sample had a certain degree of vulnerability, it could be a limitation when achieving better discrimination between the strata and considering other variables of the socio-economic sphere that were not available in the secondary database. However, this work serves as a background for the generation of new studies and lines of work using other methodologies.

This approach has potential because it arose from the data itself, although it was guided by a previous antecedent in our country²⁴. However, from the scientific literature search, we found the construction of other social vulnerability indices applied to health outcomes, where they take the dimensions included in our proposal in a similar way^{51,52}.

Another limitation was the data collection date (2012), where some aspects may have been modified so far.

Also, the public database did not have data on non-responders, which may have led to selection biases. Although according to the institution that carried out the survey, this percentage was less than 1 % of the selected households represented by 141 households.

The advantages of using multilevel analysis in social problems are clear, both from the statistical point of view⁵³; and from the interactions of individual and social factors analysis⁵⁴.

In the case, the hierarchical cluster analysis provided additional information about the percentage of the residual variance is explained by the variable “deciles of household income according to the region”.

Estimating the effect of this contextual variable has a relevant contribution to the sociological debate, accounting for the “social structure” of the family⁵⁵, assigning added value to the problem explored in this work and to the development of public policies and their differentiated impacts among the different classes that make up a specific society.

However, in some specific activities, such as school, sports, and socialization, lower quality models were observed, with high ICCs. These findings could be due to the multilevel analysis method; where some findings through this method could be difficult to explain⁵⁶, so the creation of more evidence will be needed. Also, more complicated models may be closer to reality but testing model fit and examination of model assumptions is more difficult^{57,58}.

However, this study has many important strengths. Among them, the large sample size stands out. It allowed for multivariate and multilevel analyses and the national representativeness of the sample, since the survey of the secondary database was coupled to the Annual Urban Household Survey (EAHU)²¹ by following the application of a rigorous probabilistic sampling, thus ensuring the accuracy of the data obtained and the scope of the entire urban population of the country.

This study can serve as the basis for new research lines in the field of leisure time in the child and adolescents, where there are few published antecedents in the Southern Cone and low- and middle-income countries. Future national surveys will need to deepen aspects related to the leisure time activities such as type of activity, frequency, number of hours per week carried out, etc.

The results may serve as a baseline for monitoring policies and programs aimed at the healthy use of leisure time, considering the context of the social inequalities.

Conclusions

In conclusion, the presence of social vulnerability has an unfavorable impact on the performance of some healthy leisure time activities, such as art, ICT, and use of the Internet in the group of children and adolescents in Argentina. The obtained findings lead us to highlight some strategic moves concerning the field of health social determinants where the SVI could be a useful tool to guide health promotion initiatives in the population of children and adolescents.

Data availability

The MANNyA data²¹ and documentation are available at <https://www.indec.gob.ar/bases-de-datos.asp?solapa=7>.

Acknowledgment

The authors acknowledge the kind cooperation of the researchers Lina Lay Mendivil, Veronica Hidalgo, and Alvaro Paiva by added their review to this manuscript.

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Open Peer Review

Current Peer Review Status:

Version 3

Reviewer Report 28 May 2021

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After reviewing the last version (V3) of the manuscript cited above, the conclusion is that it is not recommended to indexing, based on the following reasons:

General Comments: Although recognizing any effort to improve this version, the authors did not accomplish most of the recommendations related to the version 2.

The language is somehow not appropriate, and there are some mistakes not permitted in a scientific publication, as described below:

Specific Comments:

Methods: The explanation related to the questions addressed to Children and Adolescents is very poor, and the statements related to do not clarify many questions. The variable SVI should be well characterized, and homogeneous strata should be referred in all Tables. The question related to the same weight attributed to different categories in the dimensions of SVI (overcrowding and occupation) were not explained as questioned. The Prevalence Ratios (not Reasons of Prevalence) should be adequate effect measure instead of Odds Ratios. The explanation based on the authors tried to justify the use of odds ratios do not seems to be reasonable.

Results: Although the authors have complied some suggestions, the main questions addressed to Tables 2, 3, 4 e 5 have not been replied such as questioned. The variable SVI has different strata as referred in Table 2, 3 and 4 compared to Table 5. So, those Tables should be reviewed. Also, should be the footnotes in Tables 3 and 4. In Table 5 is recommended to add a bold line under the last categories of SVI, in order to separate the measures of association from the parameters of models. PVE was described in 'Methods' but has not been showed in Table 5. On the other hand,

PCV was showed in Table 5 but is not mentioned in 'Methods'.

Discussion: The paragraphs were extensively written, and somewhere is not possible to understand what the authors intend to explain. There is a profusion of words which do not add quality to the manuscript.

Most suggestions related to this section has not been included or clarified as recommended causing, instead, some difficulty to understand what the authors intend to discuss.

There is a lot of paragraphs related to 'Strengths and Limitations', too important to be cited, although the main items related to have not been discussed by the authors, whereas there are many statements which are not appropriate. The secondary data source is not necessarily a study limitation '*de per si*', since detailed information related to the data collection had been described into the section 'Methods'.

Since 90% of the population have been classified as having any degree of social vulnerability, the discriminatory power of this variable is poor, and it is a problem because SVI seems to be the main independent variable. The authors have referred ICCs as a measure of adjusted quality models, whereas AIC and BIC, such cited is 'Methods', seem to be the index related to. On the other hand, ICC indicates the contribution of level 2. The ICCs described in Table 5 are very low, pointing out the poor contribution of level 2 in relation to the total variance of models.

In Sum, besides the underlined misleading cited above, the Discussion is broken and does not take into consideration adequate comparisons required, in relation to similar studies.

Along with the section 'Methods', 'Discussion' should be robust and consistent in respect to the characteristics of the study. The manuscript did not accomplish this imposition so that it is not recommended to be indexed.

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Epidemiology; Statistical methods applied to Epidemiology

We confirm that we have read this submission and believe that we have an appropriate level of expertise to state that we do not consider it to be of an acceptable scientific standard, for reasons outlined above.

Reviewer Report 26 May 2021

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Myriam Guerra-Balic

Faculty of Psychology, Education and Sports Sciences Blanquerna, Ramon Llull University, Barcelona, Spain

Approved after reading the new version of the manuscript and the answers to the review. It has

improved a lot. I agree to be indexed without any other changes..

Competing Interests: No competing interests were disclosed.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Version 2

Reviewer Report 27 June 2019

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Myriam Guerra-Balic

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General comments:

This manuscript studies the relationship between social vulnerability index and healthy use of leisure time. The manuscript can be considered as a case study, as it focuses only on the Argentinian population. Some information is missing in order to understand better what authors would like to show, and they also need to improve the interpretation of the results obtained at the discussion section. Please, find my specific comments that can help authors.

Specific comments:

Abstract:

Even it is known what ICT means, I suggest to add what it means in words.

Introduction:

This section can be considered somehow weak.

Concerning schools, it is missing information about how school schedule is in Argentina, for example, how long children are staying at school daily; is it the same schedule for primary, secondary and high school? Do they have all afternoon free, or some of them? Do they have more than one turn (morning turn and afternoon turn? It could be interesting to know about public/private schools, because sometimes their schedule is different, and if some activities are included into the daily schedule. In fact, the survey asks about the timetable they have at school, but has not been considered.

Updated data from other countries (not only Latin American) are missing, just to compare and discuss later about them.

It could be of interest to conceptualize what health is, and how leisure time can be healthy, not only physically (aerobic, strength, body composition, etc), but also from a functional, psychological

and social point of view.

Methods:

It could be interesting to explain more about how data collection was done.

Searching the original [survey](#) [spanish] it is understood that it is not intended to know about leisure time (only one block of questions, of a total of 28, asked about it), but to know about their working activities. Perhaps, because of that, this information is not enough to interpret when analysing data. It is suggested, as well, to annex the survey, even it is in Spanish.

If it is a self-administered survey, all the questions were the same for all the children and adolescents (5-17 years old)? If there were the same, for a 5 year old child it can be difficult to answer some (or all) the questions, so it is needed to know who helped them to answer. Moreover, authors presented a number of participants that did not know how to read and write, so who answered? In fact, the item 29 of the survey asks about the adult's participation when answering, but, was a parent, older brother/sister, relative, baby sit...? Was there an age cut-off point considered when receiving support for answering? Did the survey taker participate, as well? All these aspects make the methods confusing for getting the data. Was it really a self-administered survey or there was a survey taker?

As the data studied were obtained from the 2012, co-authors should state if there was or not a later survey that explores leisure time. More than 5 years could give different results. In fact, in the website, there is another survey applied during 2016-2017 obtaining data concerning children's and adolescent's work activities (

https://www.indec.gov.ar/ftp/cuadros/sociedad/eanna_2018.pdf) [Spanish]

Social Vulnerability Index: Why the dimensions Overcrowding and Occupation have the same weighting?

In Table 1 it is suggested to use the same format when referring to Calmat (use Roman numbers in the table and in the notes)

No information about regions is given in Methods, when later it is included in results. Why? If considering Regions, it would be necessary to describe better each region: number of population, number of children, socio-economic level of the region.

I suggest to present the methods with a flowchart, so it could be easier to understand what methods authors applied and.

Results:

Table 2: Why are there children not attending schools? Was it because illness, or education at home, or need to work and earn money, or other? Are correct the results given related to knowing how to read and write? Could it be a confusion and the numbers are changed?

Did authors control by members or number of children/adolescents in each family?

Why public health plans and insurance were not considered? All the children and adolescents have it by law?

When talking about performing sport/recreational activities, were they structured, or simply playing at home/neighbourhood involving physical activity? Were they paid or not?

When authors stated that: "our study showed that a significant part of the population under analysis had some degree of social vulnerability, which makes us consider this indicator as one social determinant of health", couldn't it be a bias?

Discussion:

This section can be improved, taking into account all the suggestions about information to be added.

More structured text is necessary for understanding what authors wanted to show. Sometimes the information is mixed, and it is confusing. This can take to weak conclusions, not giving properly answers to the objectives proposed.

Limitations have been considered, but not clear enough, and the proposals for future studies are missing.

References:

In general, references are limited. First, they should be more updated. And if updated, data obtained from could not match with the period the survey was done. For example, reference number 28, from year 2018, does it give information about the Asignación Universal por Hijo during 2012? If it is not, authors should discuss it.

Many other references are simply informative, based on websites (most of them official ones). When I consulted some of these websites (for example reference 4 and 34), I did not find information about when the data were obtained, so it might be difficult to interpret the results comparing the survey of 2012.

Please, find several papers suggested for improving the content of this manuscript, even authors can find other ones for sure.

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Is the work clearly and accurately presented and does it cite the current literature?

No

Is the study design appropriate and is the work technically sound?

Partly

Are sufficient details of methods and analysis provided to allow replication by others?

No

If applicable, is the statistical analysis and its interpretation appropriate?

I cannot comment. A qualified statistician is required.

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

No

Competing Interests: No competing interests were disclosed.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Reviewer Report 27 November 2018

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General Comments: The study aims to investigate the association between Social Vulnerability Index (SVI) and *healthy use of leisure time* (outcome). The authors applied multilevel analysis including in the models SVI and individual variables potentially related to the outcome. In general, the manuscript is reasonably well written (exception the section Discussion), and some specific questions, listed below, claim to be replied.

Specific Comments:

1. Abstract: The Abstract is structured, although if taking into consideration the specific comments listed forward, the Abstract might be re-written. The keywords might include: 'multilevel analysis' and 'leisure time' instead of recreation.

2. Introduction: This section is adequately formatted, although it should be opportune to include 2 or 3 papers which have identified similar or different associations, in order to reinforce the

present purpose.

3. Methods:

3.1. Response rates in different multi-stage sampling process should be reported. On the other hand, non-respondent characteristics should be shown, related to participants. Moreover, it is important to ask if the authors had tested interactions between potential differences in any variable and the main variable (SVI) (participants versus non-participants) related to the outcome to evaluate potential selection bias [See Szklo & Nieto: Epidemiology- beyond the basics- 2nd Edition, 2007]. Weighting variables to correct 'design effect' (multi-stage sampling) has been considered? It should be clear.

3.2. How the authors could be sure that a self-administered Instrument in that population corresponds to their reality? Perhaps it should be relevant to replicate some information among, at least, 10% of the population and calculate the intraclass correlation coefficient to evaluate reliability. If this procedure or a similar one has been considered to that evaluation it might be important to refer it.

3.3. The term 'Result Variable' should be rewritten as "Outcome".

3.4. **SVI**- The variable was classified as 'No risk', 'Low/Moderate' and 'High risk", so those 3 strata should be described in the 4th paragraph of the explanatory variables (page 4).

3.5. In **Table 1** (Method section), why different categories into the same dimension have got equal weight? Ex.; To the dimension *Occupation*, different categories has been attributed the same weight (0,30). This comment seems to be reasonable, mainly because the authors reported (last footnote under Table 1) the great importance of this variable, in terms of its discrimination power ('a key factor').

3.6. **Statistical Analysis**: In complex sampling (multistage), odds ratios use to be overestimated, being preferable to use prevalence ratios. It seems to be recommended to comment about that. How many levels has been considered in the multilevel analysis? What variables composed the level 2: Region or households? It is not clear. The cluster effect of Region, doesn't seem to be estimated (where are ICC values for Region?). The formula $PVE = V \times 100$ might be better explained, it doesn't seem to be clear. If Region was not considered as an ecological variable in the analysis (level 2 or 3) it is not plausible to show prevalence according Regions in the descriptive analysis. What References related to multilevel analysis were used?

4. Results:

4.1. **Table 2**: In classifying the variable: *Knows how to read and write as yes/no*, it is recommended to review the results since they seem to be inverted in relation to the definition shown in footnote.

4.2. **Tables 3 e 4**: The information on those tables are heavy and it is redundant to show SE and CI. Perhaps SE should be suppressed. Please, review the results related to the variable: *Knows how to read and write classified as yes/no* (Table 3). Why Region has been included, since the group of variables shown here are individual variables? See comment referred on item 3.6. (statistical analysis). In Table 3, there is no mention related to weighted data, why?

4.3. **Table 5**: a) In general, odds ratios showed higher magnitudes than expected. Probably, as

referred above, it is a result of using odds ratios instead of prevalence ratios. Moreover, the large confidence intervals denote lack of precision, due to the strata dilution (high SVI category). On the other hand, multicollinearity between SVI and other contextual variables shown on the footnote may contribute to that. It might be a good strategy to join moderate + high strata as one. b) ICC values are highest than expected and they increase from model 0 to model 3. How does it is plausible, since after adjusting by individual variables, ICC should decrease because the influence of the last one variables? c) By the way, those contextual variables has not been described in the sections 'Methods' and/or descriptive 'Results', as well as some individual variables like *household activities of the child/adolescents*, etc... d) One strategy to evaluate multicollinearity is to run matrix correlations among the independent variables. e) It is recommended to add the model quality adjusted indexes (Hosmer & Lemeshow χ^2 in the case of logistic regression models or likelihood ratios if prevalence ratios are used).

5. Discussion: Most paragraphs on this Section are not in consonance with the study purposes and results. Some of them are only related to the descriptive analysis (Ex: paragraphs 6 e 7). There were neither specific discussion related to the multilevel analysis nor comparison between such results and those found in the literature. Some paragraphs are extremely far from the supposed aims of the present study (Ex:, paragraphs 2, 5, 8, 10,11, 12). In paragraph 4 the authors reported: ... *"in this sense, our study showed that a significant part of the population under analysis, had some degree of social vulnerability, which makes us consider this indicator as one social determinant of health"*. Based on the text highlighted above, it should be emphasized that just because most of the population (around 90%) were classified as moderate or high SVI, this variable probably does not keep good discrimination power, so that it should not be considered as a good determinant of health. There is a statement that is not found in the respective Table 5 (in paragraph 12, the authors reported an odds ratio = 14. This value was not found in Table 5, and its interpretation is misleading, since odds ratio is not risk). Strengths and limitations reported in paragraphs 21 and 22 were poorly described. The main limitation is not the study base (secondary) but mainly related to the representatives what was not reported by authors (missing data in the sample process could lead to selection bias), and the *'self-administered instrument'* without mention about who replied the questions (parents, children, adolescents) could lead to measurement bias. No statement related to potential selection or measurement bias was reported by authors. The conclusions are equally misleading. Taking into consideration the scope of this section, the authors did not present a consistent discussion, and, so, the section should be completely re-written.

6. References: As already reported by Reviewers, no relevant references related to the analytical phase (multilevel analysis) were found. Among 38, 15 References are related to International Institutions, or similar. There should be specific references related to the study aims and the main findings.

Is the work clearly and accurately presented and does it cite the current literature?

No

Is the study design appropriate and is the work technically sound?

Partly

Are sufficient details of methods and analysis provided to allow replication by others?

No

If applicable, is the statistical analysis and its interpretation appropriate?

Partly

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

No

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Epidemiology; Statistical methods applied to Epidemiology

We confirm that we have read this submission and believe that we have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however we have significant reservations, as outlined above.

Comments on this article

Version 2

Author Response 03 Apr 2021

Akram Hernández-Vásquez, Universidad San Ignacio de Loyola, Peru

Dear Jeniffer Jeyakumar,
F1000Research
Article ID: 16273

Title: Multilevel analysis concerning the relationship between social vulnerability and the healthy use of leisure time in children and adolescents in Argentina: A national population-based study.

Our thanks to you and to the reviewers for the extremely helpful comments that have been provided to improve our paper. We've addressed all the reviewers' as well as the editorial comments. They are at the end of this letter.

Best regards,
The Authors.

Open Peer Review

Current Peer Review Status:

Version 2

Reviewer Report 27 June 2019

<https://doi.org/10.5256/f1000research.18168.r40066>

Myriam Guerra-Balic

Faculty of Psychology, Education and Sports Sciences Blanquerna, Ramon Llull University, Barcelona, Spain

General comments:

This manuscript studies the relationship between social vulnerability index and healthy use of leisure time.

The manuscript can be considered as a case study, as it focuses only on the Argentinian population.

Some information is missing in order to understand better what authors would like to show, and they also need to improve the interpretation of the results obtained at the discussion section. Please, find my specific comments that can help authors.

Answer: Thank you for the observation.

Specific comments:

Abstract:

Even it is known what ICT means, I suggest to add what it means in words.

Answer: The acronym ICT was defined in the abstract.

Introduction:

This section can be considered somehow weak.

Concerning schools, it is missing information about how school schedule is in Argentina, for example, how long children are staying at school daily; is it the same schedule for primary, secondary and high school? Do they have all afternoon free, or some of them? Do they have more than one turn (morning turn and afternoon turn? It could be interesting to know about public/private schools, because sometimes their schedule is different, and if some activities are included into the daily schedule. In fact, the survey asks about the timetable they have at school, but has not been considered.

Updated data from other countries (not only Latin American) are missing, just to compare and discuss later about them.

It could be of interest to conceptualize what health is, and how leisure time can be healthy, not only physically (aerobic, strength, body composition, etc), but also from a functional, psychological and social point of view.

Answer: Based on the comments of the reviewer, new paragraphs are added in the introduction detailing the requested points.

Methods:

It could be interesting to explain more about how data collection was done.

Answer: We added more information in the data collection instruments section.

Searching the original survey[spanish] it is understood that it is not intended to know about leisure time (only one block of questions, of a total of 28, asked about it), but to know about their working activities.

Answer: Although, it is a survey aimed at eradicate child labor in Argentina, this survey has a group of questions related to leisure time. This point was added to the methods section.

Perhaps, because of that, this information is not enough to interpret when analysing data. It is suggested, as well, to annex the survey, even it is in Spanish.

Answer: There are few similar studies related to this subject in the region and no studies references in the Southern Cone and Argentina, for that reason the relevance of this study.

The questionnaires [in Spanish] was in the links:

https://www.indec.gob.ar/ftp/cuadros/menusuperior/mannya/MANNyA_tarjetas.pdf

https://www.indec.gob.ar/ftp/cuadros/menusuperior/mannya/MANNyA_cuestionario.pdf

If it is a self-administered survey, all the questions were the same for all the children and adolescents (5-17 years old)? If there were the same, for a 5 year old child it can be difficult to answer some (or all) the questions, so it is needed to know who helped them to answer. Moreover, authors presented a number of participants that did not know how to read and write, so who answered? In fact, the item 29 of the survey asks about the adult's participation when answering, but, was a parent, older brother/sister, relative, baby sit...? Was there an age cut-off point considered when receiving support for answering? Did the survey taker participate, as well? All these aspects make the methods confusing for getting the data. Was it really a self administered survey or there was a survey taker?

Answer: The data collection was made by a trained survey taker. We added more information in the data collection instruments section.

As the data studied were obtained from the 2012, co-authors should state if there was or not a later survey that explores leisure time. More than 5 years could give different results. In fact, in the website, there is another survey applied during 2016-2017 obtaining data concerning children's and adolescent's work activities

(https://www.indec.gov.ar/ftp/cuadros/sociedad/eanna_2018.pdf)[Spanish]

Answer: In preparing this manuscript, we could only access the database from 2012 that was published on the INDEC website for free access.

Social Vulnerability Index: Why the dimensions Overcrowding and Occupation have the same weighting?

Answer: For the construction of the SVI, we used the cited methodology (Con M, Susini S, Catalá S, et al, 2011) in all cases have the same dimensions and weighting values. Also, the international references showed that between moderate and critical overcrowding; there are no differences in weighting values.

In the case of overcrowding in this study, it was decided to treat this indicator as dichotomous, that is, only the 0.10 weight was used when the criteria of more than two people per room were met. This decision is based on the revision of the methodology for measuring overcrowding in Latin America (ECLAC. Non-monetary indicators of poverty: progress and challenges for their measurement. 2017. Available at

<https://www.cepal.org/sites/default/files/presentations/2017-05-pablo-villatoro.pdf>.

Also, in another index on housing developed in Argentina, two or more people per household were defined as the cut-off point (<http://datos.acumar.gob.ar/dataset/ceba000d-184f-4f36-9bc4-611f22ed2faf/resource/bad60aa0-4b46-4e05-9f71-e00dad6f63d/download/icv-metodologia-de-calculo.pdf>)

In this way, this same weighting was use and thus avoid overestimating social vulnerability in this aspect.

In Table 1 it is suggested to use the same format when referring to Calmat (use Roman numbers in the table and in the notes)

Answer: The change was made.

No information about regions is given in Methods, when later it is included in results. Why? If considering Regions, it would be necessary to describe better each region: number of population, number of children, socio-economic level of the region.

Answer: We add a descriptive paragraph in methods on the information of the regions of Argentina according to the last national census, 2010.

I suggest to present the methods with a flowchart, so it could be easier to understand what methods authors applied and.

Answer: More information was added in text and graphic in the methods section.

Results:

Table 2: Why are there children not attending schools? Was it because illness, or education at home, or need to work and earn money, or other? Are correct the results given related to knowing how to read and write? Could it be a confusion and the numbers are changed?

Answer: The reasons for not attending school were not revealed in this survey. The analyzes were re-corroborated and 7% of the children cannot read and write and 4% do not attend school. Of the total sample, 6.9% are less than 6 years old.

Did authors control by members or number of children/adolescents in each family?

Answer: In the new multilevel models, we consider a variable that includes two dimensions: household income and region. For this, the variable was used, of "Decile group of total family income in the region". This variable is developed in the methods section.

Why public health plans and insurance were not considered? All the children and adolescents have it by law?

Answer: In the multilevel models and descriptive analysis, health coverage of the child and adolescent defined as health insurance presence (including Comprehensive Medical Attention Program (PAMI), mutual/prepaid/emergency service). We eliminated the phrase "Public plans and insurance were not considered as coverage" in footnotes the tables.

When talking about performing sport/recreational activities, were they structured, or simply playing at home/neighbourhood involving physical activity? Were they paid or not?

Answer: The questionnaire only refers to sports activities. This denomination is corrected throughout the manuscript.

When authors stated that: "our study showed that a significant part of the population under analysis had some degree of social vulnerability, which makes us consider this indicator as one social determinant of health", couldn't it be a bias?

Answer: More information was added in the bias section.

Discussion:

This section can be improved, taking into account all the suggestions about information to be added.

Answer: More information and studies were added in the discussion section.

More structured text is necessary for understanding what authors wanted to show. Sometimes the information is mixed, and it is confusing. This can take to weak conclusions, not giving properly answers to the objectives proposed.

Answer: We proposed subtitles in the discussion section to improve the structure, and the wording of the conclusions was improved align with the objectives of the study.

Limitations have been considered, but not clear enough, and the proposals for future studies are

missing.

Answer: Limitations and proposals for future studies are added in the discussion section.

References:

In general, references are limited. First, they should be more updated. And if updated, data obtained from could not match with the period the survey was done. For example, reference number 28, from year 2018, does it give information about the Asignación Universal por Hijo during 2012? If it is not, authors should discuss it.

Answer: We added new references from 2017 and 2019.

Many other references are simply informative, based on websites (most of them official ones). When I consulted some of these websites (for example reference 4 and 34), I did not find information about when the data were obtained, so it might be difficult to interpret the results comparing the survey of 2012.

Answer: We review all the references and added new cites.

Please, find several papers suggested for improving the content of this manuscript, even authors can find other ones for sure.

Answer: We added some of the studies proposed by the reviewer.

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Is the work clearly and accurately presented and does it cite the current literature?

No

Is the study design appropriate and is the work technically sound?

Partly

Are sufficient details of methods and analysis provided to allow replication by others?

No

If applicable, is the statistical analysis and its interpretation appropriate?

I cannot comment. A qualified statistician is required.

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

No

Competing Interests: No competing interests were disclosed.

I confirm that I have read this submission and believe that I have an appropriate level of

F1000Research 2018, 7:1619 Last updated: 27 JUN 2019

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

=====

Reviewer Report 27 November 2018

<https://doi.org/10.5256/f1000research.18168.r40064>

Suzana Alves de Moraes

Ribeirao Preto College of Nursing, PAHO/WHO Collaborating Centre for Nursing Research Development, University of São Paulo, Ribeirão Preto, Brazil

Isabel Cristina de Freitas

Epidemiology Research Group, University of São Paulo, São Paulo, Brazil

General Comments:

The study aims to investigate the association between Social Vulnerability Index (SVI) and healthy use of leisure time (outcome). The authors applied multilevel analysis including in the models SVI and individual variables potentially related to the outcome. In general, the manuscript is reasonably well written (exception the section Discussion), and some specific questions, listed below, claim to be replied.

Answer: Thank you for the observations.

Specific Comments:

1. Abstract: The Abstract is structured, although if taking into consideration the specific comments listed forward, the Abstract might be re-written. The keywords might include: 'multilevel analysis' and 'leisure time' instead of recreation.

Answer: we add the keyword: 'multilevel analysis', and 'leisure time'.

2. Introduction: This section is adequately formatted, although it should be opportune to include 2 or 3 papers which have identified similar or different associations, in order to reinforce the present purpose.

Answer: we add similar studies in the introduction section.

3. Methods:

3.1. Response rates in different multi-stage sampling process should be reported. On the other hand, non-respondent characteristics should be shown, related to participants. Moreover, it is important to ask if the authors had tested interactions between potential differences in any variable and the main variable (SVI) (participants versus non-participants) related to the outcome to

evaluate potential selection bias [See Szklo & Nieto: Epidemiology- beyond the basics- 2 Edition, 2007]. Weighting variables to correct 'design effect' (multi-stage sampling) has been considered? It should be clear.

Answer: In the methodological section, we already added the final non-response rate, which was less than 1%, although the information on loss in each stage is not available.

Unfortunately, we do not have available data on non-responders, since the public database only includes subjects who agreed to answer the survey. As we did not have data on non-responders, it wasn't possible to test terms of the interaction between responders and non-responders.

In all descriptive analyzes, the weighting variable has been considered, taking the weighting carried out by the institution that prepared the survey and construction of the database (INDEC <https://www.indec.gob.ar/indec/web/Institucional-Indec-BasesDeDatos-5>). This is indicated in data analysis and footnotes.

3.2. How the authors could be sure that a self-administered Instrument in that population corresponds to their reality? Perhaps it should be relevant to replicate some information among, at least, 10% of the population and calculate the intraclass correlation coefficient to evaluate reliability. If this procedure or a similar one has been considered to that evaluation it might be important to refer it.

Answer: This study was based on secondary data where the institution that carried out the survey is a government area, where it is reported that the instruments have been tested and visual models were implemented. We send these materials and expand this information in the methodology.

3.3. The term 'Result Variable' should be rewritten as "Outcome".

Answer: we replaced 'Result Variable' with "Outcome".

3.4. SVI- The variable was classified as 'No risk', 'Low/Moderate' and 'High risk', so those 3 strata should be described in the 4 paragraph of the explanatory variables (page 4).

Answer: In the method section, a sentence is added to expand the description of the chosen categories and the methodology used, already validated in the country.

3.5. In Table 1 (Method section), why different categories into the same dimension have got equal weight? Ex:, To the dimension Occupation, different categories has been attributed the same weight (0,30). This comment seems to be reasonable, mainly because the authors reported (last footnote under Table 1) the great importance of this variable, in terms of its discrimination power ('a key factor').

Answer: For the construction of the SVI, we used the cited methodology (Con M, Susini S, Catalá S, et al, 2011) in all cases have the same dimensions and weighting values. Also, the international references showed that between moderate and critical overcrowding; there are no differences in weighting values.

In the case of overcrowding in this study, it was decided to treat this indicator as dichotomous, that is, only the 0.10 weight was used when the criteria of more than two people per room were met. This decision is based on the revision of the methodology for measuring overcrowding in Latin America (ECLAC. Non-monetary indicators of poverty: progress and challenges for their measurement. 2017. Available at <https://www.cepal.org/sites/default/files/presentations/2017-05-pablo-villatoro.pdf>).

Also, in another index on housing developed in Argentina, two or more people per household were defined as the cut-off point (<http://datos.acumar.gob.ar/dataset/ceba000d-184f-4f36-9bc4-611f22ed2faf/resource/bad60aa0-4b46-4e05-9f71-e00dad6f63d/download/icv->

metodologia-de-calculo.pdf)

In this way, this same weighting was use and thus avoid overestimating social vulnerability in this aspect.

3.6. Statistical Analysis: In complex sampling (multistage), odds ratios use to be overestimated, being preferable to use prevalence ratios. It seems to be recommended to comment about that. How many levels has been considered in the multilevel analysis? What variables composed the level 2: Region or households? It is not clear. The cluster effect of Region, doesn't seem to be estimated (where are ICC values for Region?). The formula $PVE = V \times 100$ might be better explained, it doesn't seem to be clear. If Region was not considered as an ecological variable in the analysis (level 2 or 3) it is not plausible to show prevalence according Regions in the descriptive analysis. What References related to multilevel analysis were used?

Answer: All proposed changes were considered; new multilevel models are generated and more information is added in the data analysis section described below:

Following the recommendation of the reviewer; the IVS variable recategorized, considering new cut-off points where moderate and high stratum joined. Then the models were made, and it was observed that the OR decreased and the CI were reduced, so it was decided to leave OR in all analyzes and not reasons of prevalence.

In these new multilevel models, two levels are left: individual and contextual level. For the second level, the variable of "Decile group of total family income in the region" was used, which is explained in the methods section. Although models tested taking the third level of the region, the performance of said models (ICC) was not adequate and did not add a further explanation to the phenomenon studied. So, we decided not to include the third level.

The ICC values were added in all the proposed models, taking only a second level. As described in the previous paragraph.

In the method section, the formula $PVE = V \times 100$ is further developed, and references are added.

4. Results:

4.1. Table 2: In classifying the variable: Knows how to read and write as yes/no, it is recommended to review the results since they seem to be inverted in relation to the definition shown in footnote.

Answer: we corrected the variable in the table number 2, leavening as: "Know How to Read or Write".

4.2. Tables 3 e 4: The information on those tables are heavy and it is redundant to show SE and CI. Perhaps SE should be suppressed. Please, review the results related to the variable: Knows how to read and write classified as yes/no (Table 3). Why Region has been included, since the group of variables shown here are individual variables? See comment referred on item 3.6. (statistical analysis). In Table 3, there is no mention related to weighted data, why?

Answer: The "SE" is eliminated in tables 3 and 4. The results of table 3 are reviewed (can read and write). It is added in the table footer that the data is weighted.

4.3. Table 5: a) In general, odds ratios showed higher magnitudes than expected. Probably, as referred above, it is a result of using odds ratios instead of prevalence ratios. Moreover, the large confidence intervals denote lack of precision, due to the strata dilution (high SVI category). On the other hand, multicollinearity between SVI and other contextual variables shown on the footnote may contribute to that.

It might be a good strategy to join moderate + high strata as one. b) ICC values are highest than expected and they increase from model 0 to model 3. How does it is plausible, since after adjusting

by individual variables, ICC should decrease because the influence of the last one variables? c) By the way, those contextual variables has not been described in the sections 'Methods' and/or descriptive 'Results', as well as some individual variables like household activities of the child/adolescents, etc... d) One strategy to evaluate multicollinearity is to run matrix correlations among the independent variables. e) It is recommended to add the model quality adjusted indexes (Hosmer & Lemeshow χ^2 in the case of logistic regression models or likelihood ratios if prevalence ratios are used).

Answer: All proposed changes were considered; new multilevel models are generated, and more information is added in the data analysis section described below:

Following the reviewers' recommendations, the IVS variable recategorized, considering new cut-off points where the moderate and high stratum joined. Then the models were carried out, and it observed that the OR decreased and the CI reduced, so we decided to leave OR in all analyzes and not reasons of prevalence.

Multicollinearity was analyzed, and we decided to remove from the individual variables: "can read and write" and "child's health coverage". The new variable of the individual level "self-consumption activities" was added, which is explained in the methods section.

The ICC recalculated in all the models, where it observed that they are reduced, and are lower values concerning the models previously presented. The ICC values were added in all the proposed models (Table 5).

Contextual and individual variables were included in methods. The quality-adjusted index of the models were added. We have performed AIC-BIC statistics to judge the goodness of fit shown in each table (Table 5).

In these new multilevel models, two levels are left: individual and contextual level. For the second level, the variable of "Decile group of total family income in the region" was used, which is explained in the methods section. Although models tested taking the third level of the region, the performance of said models (ICC) was not adequate and did not add a further explanation to the phenomenon studied. So, we decided not to include the third level.

We have added a PCV explanation that stands for Proportional Change in Variance ($V_{N-1} - V_{N-2} / V_{N-1}$) where V_{N-1} is the DGHIR (cluster) variance in the empty model and V_{N-2} is the DGHIR variance in the model including individual characteristics. In the method section, the formula $PVE = V \times 100$ is further developed and references added.

5. Discussion: Most paragraphs on this Section are not in consonance with the study purposes and results. Some of them are only related to the descriptive analysis (Ex: paragraphs 6 e 7). There were neither specific discussion related to the multilevel analysis nor comparison between such results and those found in the literature. Some paragraphs are extremely far from the supposed aims of the present study (Ex: paragraphs 2, 5, 8, 10,11, 12). In paragraph 4 the authors reported: ... "in this sense, our study showed that a significant part of the population under analysis, had some degree of social vulnerability, which makes us consider this indicator as one social determinant of health". Based on the text highlighted above, it should be emphasized that just because most of the population (around 90%) were classified as moderate or high SVI, this variable probably does not keep good discrimination power, so that it should moderate or high SVI, this variable probably does not keep good discrimination power, so that it should not be considered as a good determinant of health. There is a statement that is not found in the respective Table 5 (in paragraph 12, the authors reported an odds ratio = 14. This value was not found in Table 5, and its interpretation is misleading, since odds ratio is not risk). Strengths and limitations reported in paragraphs 21 and 22 were poorly described. The main limitation is not the study base (secondary)

but mainly related to the representatives what was not reported by authors (missing data in the sample process could lead to selection bias), and the 'self-administered instrument' without mention about who replied the questions (parents, children, adolescents) could lead to measurement bias. No statement related to potential selection or measurement bias was reported by authors. The conclusions are equally misleading. Taking into consideration the scope of this section, the authors did not present a consistent discussion, and, so, the section should be completely re-written.

Answer: Modifications suggested by the reviewer in the discussion section, where subtitles were added for better structure; results are discussed with other studies and added a paragraph on the multilevel studies. Also, paragraphs suggested were removed; and limitations paragraphs were added.

6. References: As already reported by Reviewers, no relevant references related to the analytical phase (multilevel analysis) were found. Among 38, 15 References are related to International Institutions, or similar. There should be specific references related to the study aims and the main findings.

Answer: new references were added in the introduction and discussion.

Is the work clearly and accurately presented and does it cite the current literature?

No

Is the study design appropriate and is the work technically sound?

Partly

Are sufficient details of methods and analysis provided to allow replication by others?

No

If applicable, is the statistical analysis and its interpretation appropriate?

Partly

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

No

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Epidemiology; Statistical methods applied to Epidemiology

We confirm that we have read this submission and believe that we have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however, we have significant reservations, as outlined above.

Competing Interests: No competing interests were disclosed.

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