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 2; peer review: 2 approved with reservations]

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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 high SVI and non-performance of socialization activities, the OR was 1.99 ($p = 0.002$, 95% CI: 1.28-3.12). The association between high SVI and non-use of ICT gave an OR of 14.17 ($p < 0.001$, 95% CI: 5.13-39.17), and between high SVI and non-use of internet, an OR of 21.89 ($p < 0.001$, 95% CI: 7.50-63.88).

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Conclusions: A 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

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 1

We have corrected some errors in the specifications of the p values in the Abstract, Table 5 and the "Analytical phase" section.

See referee reports

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 that 30.1% of children in Argentina were affected by multidimensional poverty⁴.

Social vulnerability in children and adolescents is a central element in the definition of social protection policies⁵ that seek to improve the quality of life in children and adolescents⁶ and promote healthy free-time uses⁷.

Today, leisure time is considered a right. This is claimed by the Convention on the Rights of the Child⁸, in which it is understood as a time for rest and leisure⁷, and it is considered a necessary element in the approach to health promotion⁹; but it is also one of the main social determinants of health¹⁰.

Previous studies indicate that the use of leisure time is related to social vulnerability in children and adolescents¹¹⁻¹³. 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 increases¹⁴. The social inequality gap in socialization opportunities is significant and clearly regressive for children and adolescents living in poverty in Argentina¹⁴. 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^{12,14,15}.

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)¹⁶ that was included as part of the Annual Urban Household Survey (EAHU, by its Spanish initials) during 2012. The MANNyA 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.

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 surveyed¹⁶.

Data collection instruments

The data from the MANNyA secondary database¹⁶, the basis of this analysis, was collected using a self-administered instrument. The databases of MANNyA 2012 are public and can be obtained in the [web site of INDEC](#).

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

Result variable

"*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 arts⁷. 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 weekends¹⁶.

The dimensions of analysis for this study were:

- School activities (homework or studying for school);
- Sports/physical recreation (football, swimming, cycling/horseback riding, etc.);
- Art (painting, theatre, music, dance, language or art-related workshop or course);
- Socialization (going out with friends to the cinema, to the square, to the cyber cafe, etc.);
- Use of Information and Communication Technologies (ICT; computer or netbook); and
- Internet use

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 considered¹⁷. Today, social vulnerability is considered one of the main social determinants of health¹⁰, 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 database¹⁶. The dimensions and weighting values of the conceptualization of social vulnerability were based on previous publications^{17,18}.

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 them¹⁸.

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 or moderate SVI was assigned to those cases with values between >0.00 and ≤ 0.45 ; high SVI was assigned to those cases with values greater than 0.45.

Statistical analysis

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

Given the hierarchical structure of the data (individuals grouped in regions of the country), a multilevel logistic regression analysis was conducted 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 (performance of domestic and economic activities, gender, age, school attendance, health coverage, illiteracy), and a household level (level of education of the head of household). An empty model (Model 0) was performed, and the level 2 variance (household) and the intraclass correlation coefficient (ICC) were calculated.

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 3) **	0.10
	- Households with critical housing material quality (Calmat 4 or 5) **	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.

Firstly, a univariate analysis was carried out and, from the variables that resulted in statistical significance, a multivariate model of random intersection was constructed by introducing one variable at a time. The standard errors were calculated taking into account the cluster effect of each region of the country. The variable-addition models were compared using the *likelihood ratio test*. The proportion of the variance at level 2 explained (PVE) by the different models was calculated as $PVE = (V) \times 100$.

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 database¹⁶, 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 body¹⁹. 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. In total, 32.2% of the respondents were from Gran Buenos Aires and 30.9% from the Pampas 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%, higher in the group with health coverage (91.9%) and in the literate group (92.6%). Art 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 51.1% and 74.2%, being, in most cases, higher in males than in females. Also, lower values are observed in groups that do not attend school, do not have health coverage and are illiterate.

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 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

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)
Life Stage	
Childhood	9,307 (36.5)
Adolescence	16,608 (63.5)
Region	
Greater Buenos Aires	1,370 (32.2)
Cuyo	2,570 (7.2)
Northeast	4,398 (10.9)
Northwest	5,894 (13.6)
Pampas	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 (%).

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). Public plans and insurance were not considered as coverage.

Child/adolescent **Does Not 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 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			Sports/recreational			Art			Socialization			ICT			Internet		
	%	SE	(95%CI)	%	SE	(95%CI)	%	SE	(95%CI)	%	SE	(95%CI)	%	SE	(95%CI)	%	SE	(95%CI)
Total	90.1	0.4	(89.4-90.8)	53.6	0.7	(54.9-47.7)	21.8	0.5	(20.8-22.8)	51.1	0.6	50.0-52.3	74.2	0.6	(0.73- 0.75)	65.60	0.66	(0.64- 0.67)
Sex																		
Male	88.88	0.55	(87.76- 89.91)	62.99	0.88	(61.25- 64.69)	18.31	0.62	(17.13- 19.55)	54.06	0.83	(52.42- 55.69)	74.55	0.78	(72.99- 76.05)	65.23	0.85	(63.54- 66.88)
Female	91.54	0.44	(90.65- 92.36)	43.23	0.88	(41.50- 44.97)	25.66	0.75	(24.22-27.16)	74.78	0.86	(46.10- 49.46)	73.80	0.75	(72.30- 75.26)	66.01	0.80	(64.42- 67.57)
Life Stage																		
Childhood	87.29	0.61	(86.04- 88.45)	48.39	0.99	(46.45- 50.34)	17.30	0.68	(16.01- 18.66)	24.47	0.77	(22.99- 26.01)	61.36	0.93	(59.52- 63.17)	47.79	0.97	(45.90- 49.69)
Adolescence	91.78	0.44	(90.87- 92.60)	56.63	0.77	(55.10- 58.14)	24.37	0.67	(23.08- 25.71)	66.36	0.75	(64.87- 67.81)	81.56	0.67	(80.22- 82.83)	75.82	0.72	(74.39- 77.20)
Region																		
Greater Buenos Aires	88.90	0.98	(86.82- 90.69)	45.33	1.65	(42.11- 48.58)	18.44	1.28	(16.07- 21.08)	42.67	1.54	(39.69- 45.71-)	78.59	1.55	(75.40- 81.48)	72.31	1.65	(68.96- 75.42)
Cuyo	89.93	0.79	(88.26- 91.39)	48.52	1.53	(45.53- 51.51)	17.94	1.11	15.86- 20.24)	56.57	1.44	53.72) (59.37- 75.76	75.76	1.38	(72.96- 78.36)	61.33	1.60	(58.15- 64.42)
Northeast	91.39	0.57	(90.21- 92.45)	63.45	1.10	(61.26- 65.59)	23.11	0.95	(21.29- 25.03)	46.82	1.08	44.71) (48.95- 60.61	60.61	1.19	(58.26- 62.92)	47.21	1.21	(44.85- 49.58)
Northwest	90.94	0.47	(89.97- 91.82)	56.17	0.97	(54.25- 58.06)	21.59	0.75	(20.14- 23.11)	55.35	0.91	(53.56- 57.11)	64.88	0.99	(62.90- 66.81)	55.19	1.03	(53.16- 57.20)
Pampas	90.67	0.50	(89.64- 91.61)	57.56	1.03	(55.52- 59.57)	24.61	0.86	22.96- 26.34)	57.37	0.98	(55.44- 59.27)	77.18	0.91	(75.35- 78.91)	70.08	1.00	(68.09- 72.01)
Patagonia	90.26	0.69	(88.82- 91.53)	61.29	1.12	(58.91- 63.63)	28.80	1.11	(26.62- 31.08)	55.86	1.16	(53.58- 58.13)	79.84	0.11	(77.52- 81.98)	69.14	1.24	(66.65- 71.52)
Current School Attendance																		
Yes	93.22	0.31	(92.58- 93.80)	54.44	0.67	(53.12- 55.76)	22.38	0.54	(21.34- 23.45)	50.67	0.64	(49.43- 51.92)	74.95	0.60	(73.75- 76.11)	66.24	0.65	(64.95- 67.50)
No	25.25	0.24	(20.88- 30.19)	36.31	2.55	(31.47- 41.44)	9.51	1.42	(7.07- 12.69)	59.75	2.74	(54.29- 64.98)	58.35	2.63	(53.13- 63.39)	52.15	2.68	(46.89- 57.35)
Health Coverage																		
Yes	91.85	0.43	(90.96- 92.66)	58.39	0.83	(56.76- 60.00)	26.35	0.71	(14.07- 16.97)	54.03	0.79	(52.46- 55.59)	82.98	0.61	(81.75- 84.13)	75.32	0.70	(73.92- 76.67)
No	87.77	0.64	(86.47- 88.96)	47.01	1.07	(44.92- 49.10)	15.47	0.74	(24.98- 27.78)	46.99	1.01	(45.03- 48.97)	62.02	1.11	(59.82- 64.16)	52.12	1.14	(49.88- 54.34)
Knows How to Read and Write																		
No	58.52	0.35	(54.49- 62.44)	35.60	1.96	(31.86- 39.53)	8.62	0.89	(7.02- 10.54)	14.78	1.26	(12.48- 17.43)	41.78	2.08	(37.77- 45.91)	29.15	1.98	(25.42- 33.18)
Yes	92.63	2.03	(91.90- 93.29)	55.04	0.68	(53.69- 56.38)	22.83	0.55	(21.76- 23.93)	53.93	0.65	(52.66- 55.20)	76.74	0.61	(75.52- 77.92)	69.46	0.67	(67.15- 69.75)
SVI																		
Without SVI	90.9	0.01	(88.9-92.5)	54.9	0.2	(51.2-58.6)	19.2	0.1	(16.9-21.8)	50.9	0.2	46.8-54.9)	72.5	0.2	(69.2-75.6)	63.1	0.2	(59.5-66.5)
Low/moderate SVI	90.2	0.04	(89.4-91.0)	53.6	0.1	(52.2-55.0)	22.4	0.01	(21.2-23.5)	51.5	0.01	(50.2-52.8)	75.1	0.07	(73.8-76.4)	66.7	0.01	(65.2-68.1)
High SVI	83.1	0.3	(75.8-88.5)	48.1	0.4	(40.1-56.1)	11.4	0.2	(7.6-16.6)	36.3	0.4	(29.9-44.3)	45.1	0.5	(35.7-54.9)	33.7	0.5	(25.4-43.2)

SE: Standard Error.

95%CI: 95% Confidence Interval.

Values expressed in proportions (%).

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

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

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

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/recreational			Art			Socialization		
	%	SE	(95%CI)	%	SE	(95%CI)	%	SE	(95%CI)	%	SE	(95%CI)
Total	90.9	0.0	(88.9-92.5)	54.9	0.2	(51.2-58.6)	19.2	0.1	(16.9-21.8)	50.9	0.2	(46.8-54.9)
Sex												
Male	88.3	0.1	(85.2-90.8)	62.6	0.2	(58.2-66.8)	15.3	0.1	(12.8-18.2)	54.3	0.3	(48.7-59.7)
Female	94.3	0.1	(92.5-95.6)	44.9	0.3	(39.9-49.9)	24.3	0.2	(20.7-28.4)	46.4	0.2	(41.7-51.1)
Life Stage												
Childhood	88.8	0.2	(85.2-91.5)	45.9	0.3	(40.9-51.0)	16.1	0.2	(12.8-20.1)	25.4	0.2	(21.2-30.1)
Adolescence	92.0	0.1	(89.7-93.9)	59.7	0.2	(55.2-64.1)	20.9	0.2	(17.9-24.3)	64.5	0.2	(59.7-69.1)
Region												
Greater Buenos Aires	92.3	0.2	(85.9-96.0)	42.6	0.5	(32.9-52.9)	10.1	0.2	(5.7-17.1)	37.1	0.6	(26.2-49.5)
Cuyo	91.1	0.2	(85.9-94.4)	42.4	0.4	(35.1-49.9)	16.0	0.3	(11.1-22.5)	53.4	0.4	(45.8-60.9)
Northeast	92.4	0.1	(89.6-94.5)	66.5	0.3	(60.9-71.6)	17.8	0.2	(14.2-22.1)	45.3	0.2	(40.5-50.2)
Northwest	90.8	0.1	(87.9-93.1)	55.1	0.2	(50.6-59.6)	21.3	0.2	(17.8-25.2)	57.3	0.2	(52.8-61.7)
Pampas	89.3	0.2	(85.3-92.3)	61.2	0.3	(54.4-67.6)	26.0	0.2	(21.5-31.0)	58.8	0.4	(51.7-65.6)
Patagonia	89.5	0.2	(85.1-92.8)	65.0	0.3	(58.5-71.0)	24.7	0.3	(19.0-31.5)	59.4	0.4	(52.3-66.2)
With low/moderate SVI												
Activities	School			Sport/recreational			Art			Socialization		
	%	SE	(95%CI)	%	SE	(95%CI)	%	SE	(95%CI)	%	SE	(95%CI)
	%	SE	(95%CI)	%	SE	(95%CI)	%	SE	(95%CI)	%	SE	(95%CI)
Total	90.2	0.04	(89.4-91.0)	53.6	0.1	(52.2-55.0)	22.4	0.01	(21.2-23.5)	51.5	0.0	(50.2-52.8)
Gender												
Male	89.0	0.06	(87.8-90.1)	63.2	0.1	(61.3-65.1)	18.8	0.1	(17.5-20.2)	54.4	0.1	(52.7-56.1)
Female	91.5	0.0	(90.6-92.4)	43.2	0.1	(28.4-49.2)	26.2	0.1	(24.6-27.8)	48.3	0.1	(46.5-50.1)
Life Stage												
Childhood	87.1	0.1	(85.7-88.4)	48.9	0.1	(46.8-51.0)	17.7	0.1	(16.3-19.2)	24.5	0.1	(22.9-26.1)
Adolescence	92.0	0.0	(91.0-92.9)	56.3	0.1	(54.7-57.9)	25.1	0.1	(23.6-26.5)	67.0	0.1	(65.5-68.6)
Region												
Greater Buenos Aires	88.8	0.1	(86.6-90.7)	45.6	0.2	(42.2-49.1)	19.5	0.1	(16.9-22.3)	43.6	0.2	(40.5-46.8)
Cuyo	90.0	0.1	(88.2-91.6)	49.4	0.2	(46.1-52.7)	18.3	0.1	(16.0-20.8)	57.0	0.2	(53.9-60.1)
Northeast	91.5	0.1	(90.2-92.6)	63.3	0.1	(60.9-65.6)	24.3	0.1	(22.3-26.5)	47.7	0.1	(45.3-50.1)
Northwest	91.1	0.1	(90.1-92.1)	56.8	0.1	(56.7-58.9)	22.3	0.1	(20.6-24.0)	55.4	0.1	(53.5-57.4)
Pampas	90.9	0.2	(89.8-91.9)	57.2	0.1	(55.1-59.3)	24.6	0.1	(22.8-26.4)	57.5	0.1	(55.5-59.5)
Patagonia	90.3	0.1	(88.8-91.7)	60.9	0.1	(58.3-63.4)	29.3	0.3	(19.0-31.5)	55.4	0.1	(52.9-57.8)

Activities	With high SVI																	
	School			Sport/recreational			Art			Socialization			ICT			Internet		
	%	SE	(95%CI)	%	SE	(95%CI)	%	SE	(95%CI)	%	SE	(95%CI)	%	SE	(95%CI)	%	SE	(95%CI)
Total	83.1	0.3	(75.8-88.5)	48.1	0.4	(40.1-56.1)	11.4	0.2	(7.6-16.6)	36.3	0.4	(29.9-44.3)	45.1	0.5	(35.7-54.9)	33.7	0.5	(25.4-43.2)
Sex																		
Male	86.9	0.3	(80.6-91.4)	56.3	0.5	(46.7-65.6)	13.2	0.3	(8.0-20.5)	39.7	0.6	(29.5-50.8)	47.0	0.6	(35.5-58.8)	32.5	0.6	(22.4-44.5)
Female	78.5	0.6	(64.7-88.0)	38.3	0.5	(28.4-49.2)	9.2	0.2	(5.6-14.7)	32.2	0.5	(23.4-42.5)	42.9	0.6	(31.5-55.1)	35.1	0.6	(24.2-47.9)
Life Stage																		
Childhood	88.0	0.3	(80.5-92.9)	39.7	0.5	(30.4-49.7)	7.7	0.3	(3.7-15.2)	19.5	0.3	(13.6-27.1)	22.8	0.5	(14.7-33.6)	12.0	0.3	(7.7-18.2)
Adolescence	80.0	0.5	(68.0-88.2)	53.3	0.5	(43.9-62.5)	13.7	0.3	(8.7-20.8)	46.8	0.5	(36.5-57.4)	59.1	0.6	(47.7-69.6)	47.4	0.6	(35.3-59.8)
Region																		
Greater Buenos Aires	72.5	1.1	(46.9-88.7)	44.1	1.3	(21.6-69.2)	5.3	0.5	(1.0-29.8)	17.5	0.8	(6.4-39.5)	22.1	1.5	(4.7-62.0)	43.4	1.5	(18.9-71.6)
Cuyo	83.0	0.5	(69.9-91.1)	46.0	0.1	(32.3-60.4)	14.8	0.7	(5.6-33.7)	53.8	0.8	38.1-68.8)	54.3	0.9	(36.8-70.8)	42.5	0.9	(26.8-59.9)
Northeast	83.8	0.4	(74.1-90.3)	54.1	0.7	(39.5-68.0)	11.1	0.3	(5.9-19.9)	27.3	0.4	(19.4-36.9)	24.1	0.6	(14.7-36.9)	9.6	0.3	(5.0-17.6)
Northwest	88.0	0.2	(82.2-92.1)	47.7	0.5	(38.7-56.8)	10.5	0.2	(1.0-16.3)	48.0	0.5	(38.9-57.1)	45.1	0.4	(37.0-53.4)	34.5	0.4	(26.4-43.8)
Pampas	86.3	0.4	(75.0-93.0)	49.5	0.8	(33.9-65.1)	17.4	0.6	(8.5-32.6)	36.9	0.9	(21.2-56.0)	45.8	1.1	(26.1-66.9)	35.1	0.9	(19.4-54.7)
Patagonia	100.0	.	.	51.0	1.1	(30.6-71.1)	21.1	0.6	(11.7-34.9)	80.4	1.3	(44.6-95.4)	22.1	1.5	(4.7-62.0)	22.1	1.5	(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.

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

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

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

Health Coverage of the child and adolescent defined as: health insurance (including Comprehensive Medical Attention Program (PAMI), mutual/prepaid/emergency service), Public plans and insurance were not considered as coverage.

Child/adolescent **knows 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 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.

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

of the group without SVI, although with higher values in the cases of ICTs (75.1%), Internet (66.7%) and art activities (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 activities (11.4%) continues to be the most and least popular choice, respectively, sports/recreational activities are in second place (48.1%), replacing ICTs, 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).

In the multilevel model, the non-performance of school activities was statistically associated with low/moderate SVI, with an OR of 1.165 ($p=0.023$).

In analyzing the relationship between high SVI and the risk of not performing sports/recreational activities, it was observed that the OR was 1.292, although this association was not significant ($p=0.088$).

With respect to the relationship between high SVI and the non-performance of art activities, an OR of 2.232 was found; that is, a higher risk of not performing these activities, being statistically significant ($p<0.001$). This was similarly reflected in the relationship between SVI in the highest stratum and the socialization activities (OR 1.999 and $p=0.002$).

With respect to the relationship between high SVI and the non-use of ICTs, a statistically significant association was observed, in which the OR was 14.171; that is, high SVI resulted to be a risk factor ($p<0.001$). On the other hand, it could be observed that the non-use of the Internet during leisure time in the group with high SVI yielded an OR of 21.887, being significant ($p<0.001$).

Based on the aforementioned, in the final models (Model 3), which considered individual and contextual variables, a clear upward gradient in the likelihood of unhealthy use of leisure time is observed when there are increased SVI levels in the cases of art, socialization, ICT, and the Internet.

Discussion

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

A new look at the concepts of leisure time in Latin America has to be constructed, rescuing the profound knowledge and practices already elaborated in Latin American territories²⁰. However, reflection on this relationship requires various perspectives and levels of analysis. In this sense, it is necessary to

highlight the influence of the public social protection policies in guaranteeing the right to leisure time in childhood and adolescence.

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 epidemiology²¹.

As Feito²² 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 significant part of the population under analysis had some degree of social vulnerability, which makes us consider this indicator as one social determinant of health¹⁰.

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/recreational, and socialization activities were less frequent. This information is important because, as other authors have shown^{23,24}, these activities should be proposed as strategies to promote the health of children and adolescents at social risk²⁵, since they contribute to the psychosocial and physical state of children and adolescents, while at the same time promoting life skills. This fact is relevant since they could also be the activities to be promoted through different public health policies and programs in the country.

In addition, some activities such as sports and recreation were performed only by half of the sample. This leads to the need to promote these activities in order to have a positive impact on some aspects related to the physical and mental health and nutrition of children and adolescents in a complex epidemiological context, characterized by the increase in chronic diseases, low physical activity, and malnutrition^{26,27}.

Another aspect to highlight is the high prevalence of school activities during leisure time. This can be explained by the implementation of public policies of great impact in the years prior to this survey, such as the Universal Child Allowance (AUH), in force since 2009²⁸ and considered a key element for staying at school.

In this sense, the debate on the psychosocial development in childhood and adolescence should be focused not only on school activities, but also on the possibility of choosing and performing multiple leisure time activities freely; activities that entail an enjoyment linked to them. In this sense, we agree with what Fredriksson and colleagues stated in a recent publication, in which they suggest that increasing the participation of young people in leisure activities, especially those from more socially vulnerable environments, can help to reduce social inequalities in health. In this sense, it is necessary to promote varied activities, both structured and unstructured, during free time²⁹.

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. Multilevel logistic regression model (n= 25,915). Module on Activities of Girls, Boys and Adolescents, Annual Urban Household Survey, 2012.

School											
SVI	Model 0		Model 1			Model 2			Model 3		
			OR	95%CI	p	OR	95%CI	p	OR	95%CI	p
Without SVI			Ref. 1			Ref. 1			Ref. 1		
Low/moderate SVI			1.069	0.936-1.220	0.326	1.170	1.028-1.331	0.018	1.165	1.022-1.328	0.023
High SVI			1.783	1.483-2.144	<0.001	1.371	0.991-1.752	0.058	1.317	0.992-1.749	0.057
Variance level 2 (SE)	1.497	0.231	1.494	0.234		2.476	0.399		2.434	0.395	
ICC	0.313		0.312			0.429			0.425		
Sport/recreational											
SVI	Model 0		Model 1			Model 2			Model 3		
			OR	95%CI	p	OR	95%CI	p	OR	95%CI	p
Without SVI			Ref. 1			Ref. 1			Ref. 1		
Low/moderate SVI			0.991	0.841-1.167	0.911	0.973	0.788-1.202	0.801	0.973	0.788-1.202	0.801
High SVI			1.669	1.304-2.136	<0.001	1.122	0.963-1.732	0.088	1.292	0.963-1.732	0.088
Variance level 2 (SE)	4.655	0.563	4.651	0.566		5.760	0.784		5.759	0.784	
ICC	0.586		0.586			0.636			0.636		
Art											
SVI	Model 0		Model 1			Model 2			Model 3		
			OR	95%CI	P	OR	95%CI	p	OR	95%CI	p
Without SVI			Ref. 1			Ref. 1			Ref. 1		
Low/moderate SVI			0.681	0.516-0.899	0.007	0.753	0.567-0.995	0.046	0.872	0.665-1.145	0.325
High SVI			3.499	2.958-4.138	<0.001	2.510	1.983-3.178	<0.001	2.232	1.602-3.109	<0.001
Variance level 2 (SE)	7.466	0.770	7.354	0.771		7.306	0.828		3.123	0.839	
ICC	0.694		0.691			0.690			0.487		
Internet											
SVI	Model 0		Model 1			Model 2			Model 3		
			OR	95%CI	P	OR	95%CI	p	OR	95%CI	p
Without SVI			Ref. 1			Ref. 1			Ref. 1		
Low/moderate SVI			0.689	0.540-0.879	0.003	0.701	0.579-0.850	<0.001	0.701	0.579-0.850	<0.001
High SVI			19.272	5.539-67.055	<0.001	21.889	7.499-63.889	<0.001	21.887	7.499-63.880	<0.001
Variance level 2 (SE)	0.262	0.132	11.371	3.252		18.041	5.047		18.040	5.047	
ICC	0.777		0.776			0.846			0.846		
Socialization											
SVI	Model 0		Model 1			Model 2			Model 3		
			OR	95%CI	P	OR	95%CI	P	OR	95%CI	p
Without SVI			Ref. 1			Ref. 1			Ref. 1		
Low/moderate SVI			1.082	0.964-1.216	0.180	1.056	0.971-1.149	0.205	1.056	0.971-1.149	0.205
High SVI			2.031	1.396-2.954	<0.001	1.999	1.282-3.116	0.002	1.999	1.282-3.116	0.002
Variance level 2 (SE)	2.690	0.182	2.680	0.177		4.343	0.435		4.343	0.435	
ICC	0.450		0.449			0.569			0.569		

ICTs											
SVI	Model 0		Model 1			Model 2			Model 3		
			OR	95%CI	P	OR	95%CI	P	OR	95%CI	p
Without SVI			Ref. 1			Ref. 1			Ref. 1		
Low/moderate SVI			0.751	0.683-0.825	<0.001	0.804	0.705-0.916	0.001	0.804	0.705-0.916	0.001
High SVI			20.510	2.793-150.61	0.003	14.171	5.127-39.175	<0.001	14.171	5.126-39.175	<0.001
Variance level 2 (SE)	15.251	8.901	14.922	8.531		17.930	5.982		17.930	5.982	
ICC	0.823		0.819			0.845			0.845		

OR: (odds ratio) obtained by a logistic regression model, where the dependent variable was the leisure time use activities (such as dichotomous).

p: level of statistical significance <0.05.

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

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/moderate SVI: >0.00 and ≤0.45/high SVI: >0.45.

Healthy Use of Leisure Time Activities: as a dichotomous variable (yes/no) (school, sports/recreational, art, socialization, ICT and Internet).

Region defined as: Greater Buenos Aires, Cuyo, Northeast, Northwest, Pampas, and Patagonia.

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: worked in the reference week and/or worked during the last year.

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

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). Public plans and insurance were not considered as coverage.

Child/adolescent **Knows How to Read or Write** defined as: self-reporting of not knowing how to read or write at the time of the survey.

Contextual variables:

Head of Household's Education Level defined as: incomplete elementary education (including special education), complete elementary education, incomplete high school education, complete high school education, incomplete college education, complete college education, and without schooling.

Sex of Household Head defined as: male and female.

Employment Status of the Household Head defined as: employed, unemployed, inactive, less than 10 years.

Model 0: empty model only of random intersection of the dependent variable attributable to the region.

Model 1: bivariate analysis between healthy leisure time activities and the SVI.

Model 2: individual multivariate. Model 1+ all individual variables such as child/adolescent's household activities (intensive or non-intensive) 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, health coverage of the child/adolescent, child/adolescent can read and write with random intersection.

Model 3: multivariate multilevel final model: all individual and contextual variables with random intersection.

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”³⁰. Our results showed that men tended to do more sports activities and women more art activities.

With respect to some social determinants of health, such as literacy or school attendance, in all the activities the prevalence was found to be higher in the low and without SVI subgroups, highlighting the weight of these determinants. In this sense, the ecological study conducted by Viner *et al.* on the health of adolescents suggested that the most effective health interventions are probably those addressing structural changes, e.g. access to education³¹.

Furthermore, it should be noted that the use of digital-free time, mainly focused on the use of the Internet and ICTs, has

become increasingly present in the activities of children and adolescents and has become an agent of socialization³².

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 14 times higher risk of not using the Internet. 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 divides³³.

Our findings on the use of ICTs were similarly, albeit less strongly, reflected in the use of the Internet; that is, it was observed that there was a risk of not using ICTs in the groups with high levels of social vulnerability. It should be noted that two years before this survey, Argentina implemented the “Connecting Equality” policy³⁴, 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 access³⁵.

There were also marked differences with respect to art and socialization practices, where it was found that the higher the social vulnerability index, the higher the risk 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 Wald³⁶, 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.

Furthermore, the subjective processes of socialization in human health acquires a central role. In this line, the World Health Organization³⁷ hierarchized and gave relevance to these aspects within the concept of quality of life. Several points can be highlighted in our results and our contributions to the knowledge of the situation of leisure time use in children and adolescents.

Firstly, it was found that in 2012 there was a social inequality gap, as measured by the SVI. On this point, and going back to the theoretical framework that underpinned this proposal, it is necessary to reflect on the weakening of social networks, unfavorable economic scenarios and the differential impact of targeted social protection policies at national level³⁸.

Secondly, the negative effect of social vulnerability on some specific activities was highlighted, such as those related to art, socialization processes and access to goods and services such as the Internet. From here, it is possible to postulate that this would not be fully contributing to the achievement of the Rights of the Child⁸, which claim the free participation in cultural life and the arts⁷.

Thirdly, it was observed that, in a large part of the activities of healthy leisure time use, the presence of social vulnerability conditions its full performance; in this sense, it could be believed that these activities are hampered or compete with other activities e.g. those that are domestic and economic³⁰.

In a study carried out in Ecuador, Mexico and Peru, CEPAL and UNICEF stressed that work, both paid and unpaid, is another activity that occupies an important part of adolescents' time;

this reality is not in line with the fundamental rights of this group³⁰. Thus, we face a double challenge concerning the effective right to the healthy use of leisure time. On the one hand, the aim is to promote leisure and welfare activities for children and adolescents³⁰; sports, art, and socialization activities. On the other hand, it is necessary to consider the digital divide and access to differential goods and services, which could be considered as socialization agents³² in this group.

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

However, this study has many important strengths. Among them, the large sample size stands out. It allowed for multivariate analyses and adjustments by multiple confounders and the national representativeness of the sample, since the survey of the secondary database was coupled to the Annual Urban Household Survey (EAHU) 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 country¹⁶.

Conclusions

In conclusion, the presence of social vulnerability has an unfavorable impact on the performance of some healthy leisure time activities, such as art, socialization 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 data and documentation are available at <https://www.indec.gob.ar/bases-de-datos.asp?solapa=7>.

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Open Peer Review

Current Peer Review Status: ? ?

Version 2

Reviewer Report 27 June 2019

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

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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.

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

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

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Suzana Alves de Moraes

¹ Ribeirao Preto College of Nursing, PAHO/WHO Collaborating Centre for Nursing Research Development, University of São Paulo, Ribeirão Preto, Brazil

² Epidemiology Research Group, University of São Paulo, São Paulo, 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.

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-e00dadc6f63d/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.**References**

1. Auhuber L, Vogel M, Grafe N, Kiess W, Poulain T: Leisure Activities of Healthy Children and Adolescents. *Int J Environ Res Public Health*. 2019; 16 (12). PubMed Abstract | Publisher Full Text
2. Anderssen N, Wold B: Parental and peer influences on leisure-time physical activity in young adolescents. *Res Q Exerc Sport*. 1992; 63 (4): 341-8 PubMed Abstract | Publisher Full Text
3. Larson R: How U.S. Children and Adolescents Spend Time: What It Does (and Doesn't) Tell Us About Their Development. *Current Directions in Psychological Science*. 2001; 10 (5): 160-164 Publisher Full Text
4. Taveras EM, Field AE, Berkey CS, Rifas-Shiman SL, Frazier AL, Colditz GA, Gillman MW: Longitudinal relationship between television viewing and leisure-time physical activity during adolescence. *Pediatrics*. 2007; 119 (2): e314-9 PubMed Abstract | Publisher Full Text
5. Parker KE, Salmon J, Costigan SA, Villanueva K, Brown HL, Timperio A: Activity-related behavior typologies in youth: a systematic review. *Int J Behav Nutr Phys Act*. 2019; 16 (1): 44 PubMed Abstract | Publisher Full Text
6. Harrell JS, Gansky SA, Bradley CB, McMurray RG: Leisure time activities of elementary school children. *Nurs Res*. 46 (5): 246-53 PubMed Abstract
7. Mahoney JL, Stattin H: Leisure activities and adolescent antisocial behavior: the role of structure and social context. *J Adolesc*. 2000; 23 (2): 113-27 PubMed Abstract | Publisher Full Text
8. Cherney I, London K: Gender-linked Differences in the Toys, Television Shows, Computer Games, and Outdoor Activities of 5- to 13-year-old Children. *Sex Roles*. 2006; 54 (9-10): 717-726 Publisher Full Text

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

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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.

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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.

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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