ORIGINAL RESEARCH

Marginalization and health service coverage among indigenous, rural, and urban populations: a public health problem in Mexico

AUTHORS

José Antonio Roldán[1] Doctor in social sciences (Soc Sc Dr), Medical sciences researcher *, roldanamaroj@gmail.com

Marsela A. Álvarez [2] Master in Psychology, Medical sciences researcher

María Carrasco[3] Master in Human Nutrition, Medical sciences researcher

Noé Guarneros[4] PHD, Medical sciences researcher

José Á Ledesma[5] Master in Human Nutrition, Medical sciences researcher

Mario Cuchillo-Hilario[6] PHD, Medical sciences researcher

Adolfo Chávez[7] PhD, Medical sciences researcher, adolfo.chavezv@incmnsz.mx

CORRESPONDENCE

*Dr José Antonio Roldán roldanamaroj@gmail.com

AFFILIATIONS

[1, 2, 3, 4, 5, 6, 7] National Institute of Medical Science and Nutrition, Vasco de Quiroga 15, Tlalpan 14080; Mexico City.

ABSTRACT:

Introduction: Marginalization is a significant issue in Mexico, involving a lack of access to health services with differential impacts on Indigenous, rural and urban populations. The objective of this study was to understand Mexico's public health problem across three population areas, Indigenous, rural and urban, in relation to degree of marginalization and health service coverage.

Methods: The sampling universe of the study consisted of 107 458 geographic locations in the country. The study was retrospective, comparative and confirmatory. The study applied analysis of variance, parametric and non-parametric, correlation and correspondence analyses.

Results: Significant differences were identified between the Indigenous, rural and urban populations with respect to their level of marginalization and access to health services. The most affected area was Indigenous, followed by rural areas. The sector that was least affected was urban.

Conclusions: Although health coverage is highly concentrated in urban areas in Mexico, shortages are mostly concentrated in rural areas where Indigenous groups represent the extreme end of marginalization and access to medical coverage. Inadequate access to health services in the Indigenous and rural populations throws the gravity of the public health problem into relief.

KEYWORDS:

Indigenous, marginalization, Mexico, public health, rural and urban populations

FULL ARTICLE:

Introduction

Mexico is a socially heterogeneous country with a population that includes thousands of families living in extreme poverty in the mountains, on the brink of survival, without any food, education, housing or health services[1]. Simultaneously, the population includes prominent members on the Forbes World's Billionaires list, including the richest man in the world. Between these extremes, an entire range of social nuances exists. Therefore, it is impossible to objectively discuss Mexico in terms of a single category or national average, such as the categories managed by the Food & Agriculture Organization and the United Nations (UN). From a qualitative perspective, it is possible to reach a more objective and reliable analysis that provides a demographic division between Indigenous, rural and urban areas.

Qualitative division separates divergent social worlds that cannot be combined without the risk of obscuring the reality of the rural world and, above all, that of the Indigenous world. The methodological error derived from averages that both conceal and erase extreme poverty in rural zones has been widely demonstrated[2]. In Mexico, the Indigenous peoples of the Sierra Tarahumara (one of the most marginalized regions) represent one example of erasure in studies that use national and state averages[3] with the associated imprecisions previously discussed.

Poverty, particularly extreme poverty, is primarily concentrated in the rural regions of countries in transition[4]. One study conducted in 36 low-income countries clearly demonstrates that the problem is by and large exclusive to rural zones. The investigation demonstrates this finding using data on malnutrition among rural children in comparison with children from urban zones[5]. Similarly, some researchers have identified contrasting differences between the rural and urban populations in countries in transition in Europe[6]. The same phenomenon has been shown in Latin America at the regional level, where poverty is concentrated in rural zones[7].

Medical services coverage shows the same pattern. According to the most recent report by the International Labor Organization, more than half of the world's rural population lacks access to health services, particularly noting African countries[8].

In a country-by-country classification, the situation is practically identical. For example, according to World Bank statistics, 51% of the population in China is rural[9] and living in extreme poverty[10]; nevertheless, China was one of the first countries in the world to reach the UN Millennium Development Goals, reducing extreme poverty by half between 1990 and 2015[11]. In Latin America, rural poverty has been analyzed in detail in a comparable manner in Ecuador and El Salvador[12,13]. Likewise, researchers have found marked differences between rural and urban areas in terms of food and nutrition security in Mozambique, a south-east African country[14].

A similar phenomenon occurs in Indigenous zones across the world. Although it is true that almost all Indigenous areas are found in rural zones, not all rural zones are Indigenous. In that context, nearly 400 million Indigenous people on the planet are living in extreme poverty, characterized by the lowest levels of development in health, malnutrition, overcrowding and infections[15]. Without question, the Indigenous groups of the world live under ongoing marginalization[16]. According to the conclusions of the *United Nations 5th session of the Permanent Forum on Indigenous Issues*, millions of Indigenous peoples spread over 70 countries across the world continue to be

among the poorest social strata[17]. Locations with Indigenous populations are a separate category that should not be studied in combination with high social strata in large cities within the same countries. What may or should occur, at the very least, is the differentiation of the target population into Indigenous and non-Indigenous to reach more objective results[18,19].

The phenomenon of extreme poverty in the Indigenous population is replicated in Latin America. Studies estimate that more than 400 different Indigenous groups remain the most marginalized[20,21]. Presently, 62 ethnic groups exist in Mexico, accounting for approximately 8% of the population. Mexico, not only at the national level[22] but also in federated states such as Oaxaca[23] and Veracruz[24], have a high percentage of marginalized Indigenous people. Many of these groups are threatened with extinction[3,25].

Extreme poverty has been an ongoing conflict since the origins of humanity, and its most severe manifestations are undeniably hunger and disease[26]. In contrast to urban Mexico, in the sierras and mountains of rural and Indigenous Mexico, hunger and its afflictions have been a historical reality. It seems that for these communities, time has stood still and social development is excluded by definition. The living conditions of the majority of families in the poorest localities go unnoticed in official circles at the municipal, state and national levels and, thus, by their social programs and health service coverage as well. Therefore, the objective of this investigation was to study the marginalization and public health service coverage among urban, rural and Indigenous populations in Mexico.

Methods

Mexico has 32 federated states and 2456 municipalities. These municipalities have 107 458 localities that represent the greatest level of administrative territorial disaggregation in the country. For this study, we use the most recent database from the last official national population census of localities in 2010. Localities in the country were used as the experimental unit. Databases from the National Institute of Statistics, Geography and Information Technology were obtained[27]; data from the National Population Council (CONAPO)[28], the National Commission for the Development of Indigenous Peoples (CDI) and some estimates from National Council for the Evaluation of Social Development Policy (CONEVAL) based on the Population and Housing Census in 2010 are also used[29,30]. The study employs the official definition of a rural population that CONAPO has used since 1930, in which rural localities are those with a population of fewer than 2500 inhabitants. Urban settlements are defined as having a population of greater than 2500 inhabitants. For work related to the Indigenous population, the study uses the CDI classification, which describes Indigenous towns as those where more than 40% of the population speaks a language or dialect belonging to any of the country's 62 ethnic groups. Furthermore, it is noteworthy that there are an additional 29 909 localities with an Indigenous population of less than 40% that are not officially considered Indigenous. These localities have percentages that range from 1% to 39%, and are considered to fall under the rural category. The present study is a retrospective, comparative and analytical study conducted to understand the situation of marginalization and lack of health services among the rural, urban and Indigenous populations in the year 2010.

Snedecor's *F*-test and Kruskal–Wallis tests were applied to compare means ($\alpha=0.05$) of the marginalization index categories between Indigenous, rural and urban localities. Snedecor's *F*-test is an analysis of variance that is best utilized to compare the means of big data with numerical information while the Kruskal–Wallis test is a non-parametric analysis of variance with ordinal variables. Additionally, Spearman's correlation was performed to associate two ordinal variables: population type and degree of marginalization. The gradient of marginalization follows the index developed by the National Population Council[28], which established five intervals: *very high, high, medium, low* and *very low* and was used to classify the 107 458 localities. The study takes the percentage of the population that is not eligible for health services (population without medical coverage) from the social gap index, developed by the National Council for the Evaluation of Social Development and Policy[30]. The numeric data were transformed into five intervals from the percentages of the population without health coverage into homogeneous subgroups: (1) 0–30%; (2) 30.01–40%; (3) 40.01–60%; (4) 60.01–80%; and (5) 80.01–100%.

Ethics approval

The Research Ethics Committee from the National Institute of Medical Sciences and Nutrition Salvador Zubirán has reviewed and approved this research under the registration number SNE-1862-16-16-1.

Results

The Indigenous population represents 7.9% of the country's total population and is found in 21.6% of all localities. The rural population comprises 17.7%, distributed among three-quarters of the localities. The three-quarters of the population who belong to the urban area are concentrated in 2.9% of the country's localities (Table 1).

Table 1: Number of inhabitants and localities in each category in 2010

Group	Population		Localities	
	N	%	N	%
Indigenous	8 857 907	7.9	23 189	21.6
Rural	19 761 673	17.7	81 103	75.5
Urban	83 235 939	74.4	3166	2.9
Total	111 855 519	100.0	107 458	100.0

Comparison between population areas with respect to average marginalization and lack of access to health services

Significant differences were found among the mean levels of marginalization in the three areas of study (Indigenous, rural and urban). The Indigenous areas were the most marginalized and the urban areas the least (Figure 1). Similarly, each locality was analyzed according to its number of inhabitants in the three population types (Indigenous, rural and urban) and the significant differences were also found; in other words, to know the total number of inhabitants that have no health service coverage classified into Indigenous, rural and urban areas, we considered the total number of inhabitants independent of the number of localities. In the Indigenous and rural areas, marginalization is greater than in urban areas (Table 2). In relation to lack of medical coverage, the Indigenous area was the most disconnected from government health services. Nearly half of the population of Indigenous localities (45.6%) does not have access to medical coverage. The lowest percentage of persons not affiliated with health services occurred in the urban sector. These results are statistically significant. Similarly, Indigenous inhabitants were those with the highest percentage (40.9%) of non-eligible persons.

The urban area has the lowest percentage without medical services (32.6%).
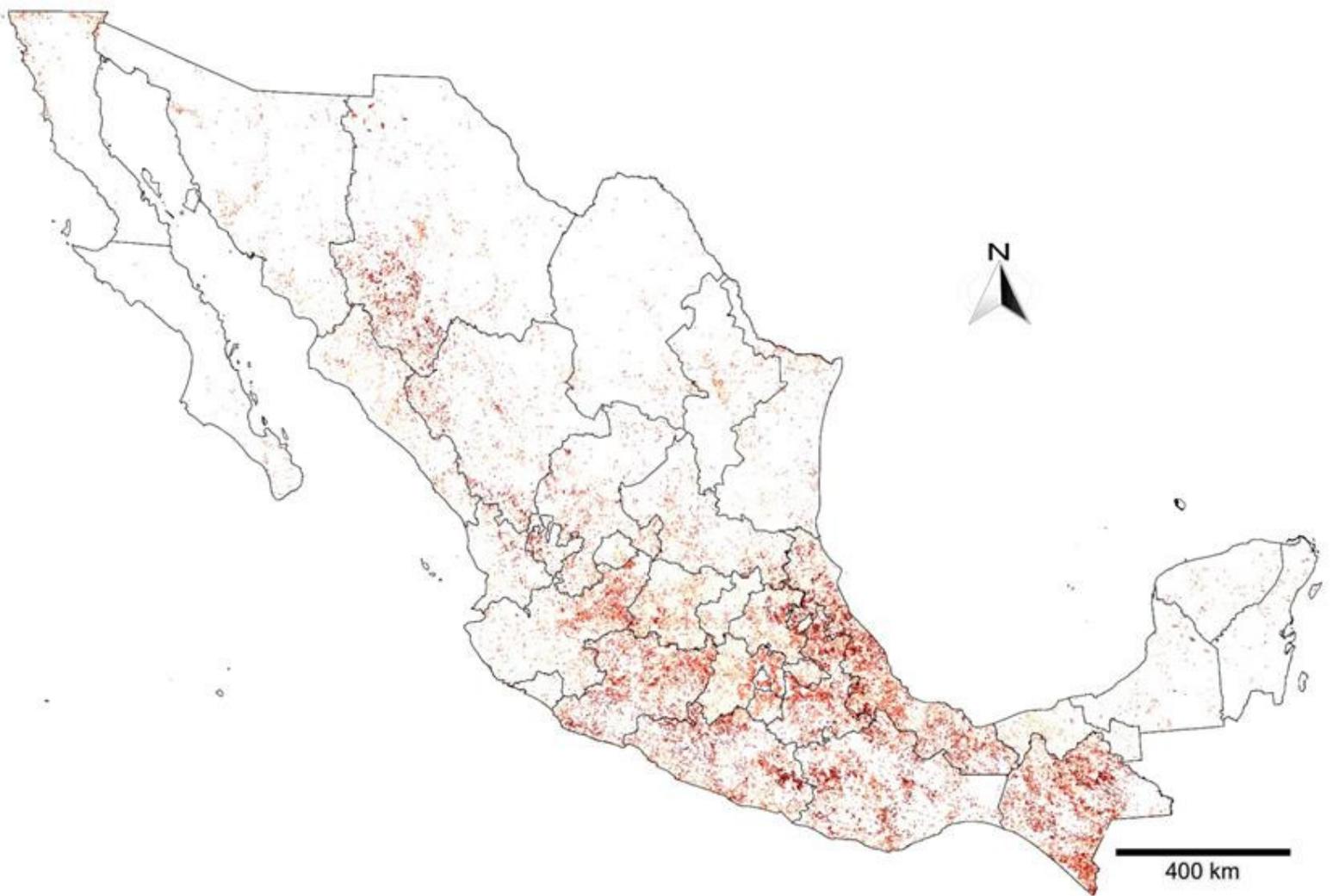
Yellow-green dots = localities without public health service coverage from 0 to 40%; orange dots = localities without public health service coverage from 40.01 to 60%; red dots = localities without public health service coverage from 60.01 to 80%; red-ochre dots = localities without public health service coverage from 80.01 to 100%. White color within the territory represents unpopulated areas of the country.

Figure 1: Distribution of the Mexican population without public health service coverage.

Table 2: Average marginalization score and percentage of people without health services coverage in 2010 for Indigenous, rural and urban populations

| | Area | | | | | | | |
| | Indigenous | | Rural | | Urban | | | |
	Mean	*N*	Mean	*N*	Mean	*N*	*F*	*p*
Marginalization index								
Localities	0.822	23 189	-0.196	81 103	-0.991	3166	13 756.231	<0.001
Inhabitants	0.104	8 857 907	-0.542	19 761 673	-1.289	83 235 939	72 415 186.060	<0.001
% Average without medical coverage								
Localities	45.6	23 189	38.2	81 103	36.0	3166	672.619	<0.001
Inhabitants	40.9	8 857 907	35.9	19 761 673	32.6	83 235 939	1 536 154.268	<0.001

The prevalence of the degree of marginalization by population area

Comparing the degree of marginalization between the Indigenous, rural and urban populations, we found that 98% of the localities in the Indigenous areas and 75% of rural localities fell under the high and very high classification of marginalization. In the localities in urban areas, no polarization was found, and the highest percentages were distributed between low, medium and high marginalization. However, the very high marginalization was almost zero. The differences were statistically significant between the three areas (Table 3).

Table 3: Distribution of localities by study area and by 2010 degree of marginalization

| Marginalization | Area | | | | | |
| | Indigenous | | Rural | | Urban | |
	N	%	N	%	N	%
Very low	35	0.2	2967	3.7	478	15.1
Low	85	0.4	6052	7.5	1027	32.4
Medium	342	1.5	10 896	13.4	807	25.5
High	11 904	51.3	49 571	61.1	851	26.9
Very high	10 823	46.7	11 617	14.3	3	0.1
Total	23 189	100.0	81 103	100.0	3166	100.0

K-W = 17 290.46; significance at $p<0.001$

Correlation between population area and degree of marginalization

The correlation was calculated between the type of area and the degree of marginalization, taking account of the number of inhabitants in each town. Spearman's coefficient was negative (–0.687), from which it can be inferred that the greater the marginalization, the lower the impact in the most favored social strata, which is urban. This finding confirms that a hierarchy exists between the study areas. As a result, these social strata exist on a continuum that ranges from precarious conditions in Indigenous areas to more favorable conditions in urban areas (see Table 4).

Table 4: Correlation between the population area and the degree of marginalization in 2010

| Marginalization | Number and % inhabitants by area | | | | | |
| | Indigenous | | Rural | | Urban | |
	N	%	N	%	N	%
Very low	940	0.01	649 454	3.3	50 109,988	60.2
Low	200 621	2.3	2 265 160	11.5	20 643 527	24.8
Medium	607 002	6.9	4 138 037	20.9	7 851 715	9.4
High	6 403 560	72.3	12 050 282	61.0	4 617 299	5.5
Very high	1 645 784	18.6	658 740	3.3	13 410	0.02
Total	8 857 907	100.0	19 761 673	100.0	83 235 939	100.0

Spearman's coefficient = -0.687; significance at $p<0.001$

Correlation between degree of marginalization and lack of health services

The 0.288 correlation between degree of marginalization and lack of medical coverage was positive and significant ($p<0.001$), indicating that the higher the marginalization, the higher the percentage of lack of medical coverage. Figure 2 shows the distribution of the degrees of marginalization of the localities with the highest percentage of population without access to health services (interval 5). As marginalization increases, the percentage of those localities also increases.
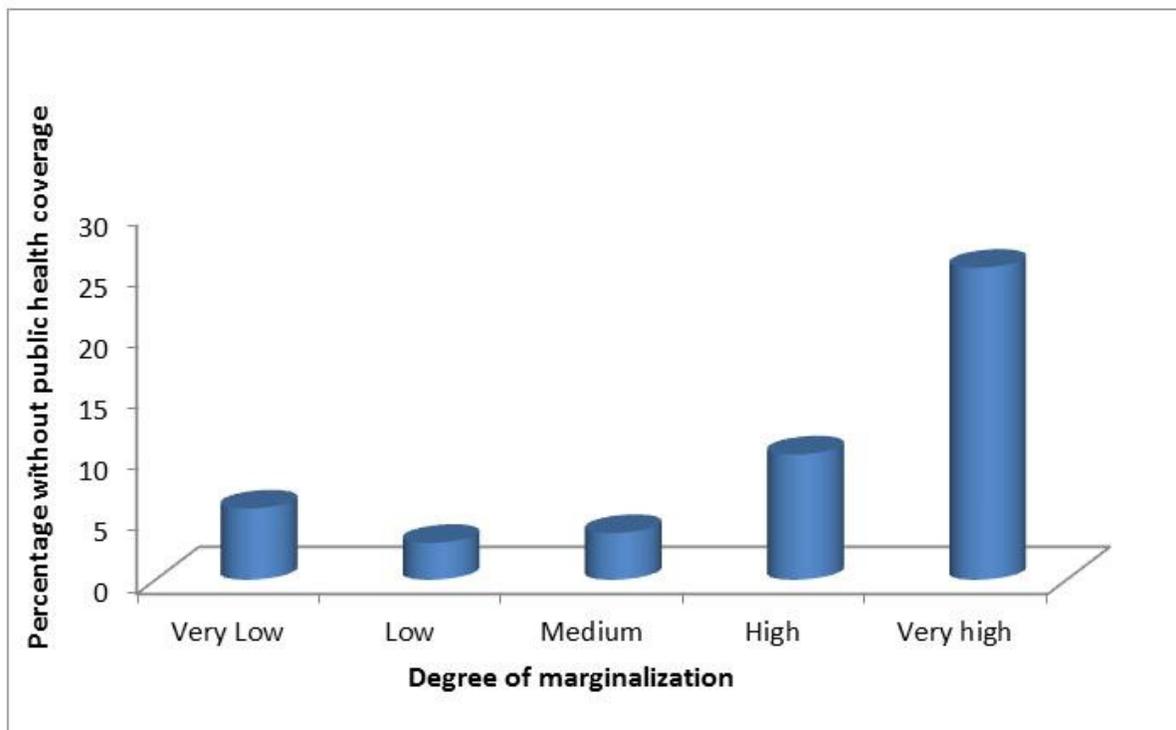
$\chi^2 = 6753.84$; significance at $p < 0.001$

Figure 2: Distribution of population in terms of percentage without health coverage by degree of marginalization.

Finally, a correspondence analysis was performed to ascertain how the five intervals in each area of the study cluster. Figure 3 shows that interval 5, which involves the highest percentage without health services coverage (80.1% and above), is mainly related to the population located in the Indigenous area. Meanwhile, interval 60.1 to 80% is associated with rural areas, and the least affected interval in health services (0 to 30%) corresponds to the population in urban areas. Figure 3 clearly demonstrates how a lack of access to health services is an issue that mainly corresponds to populations living in rural and Indigenous communities.
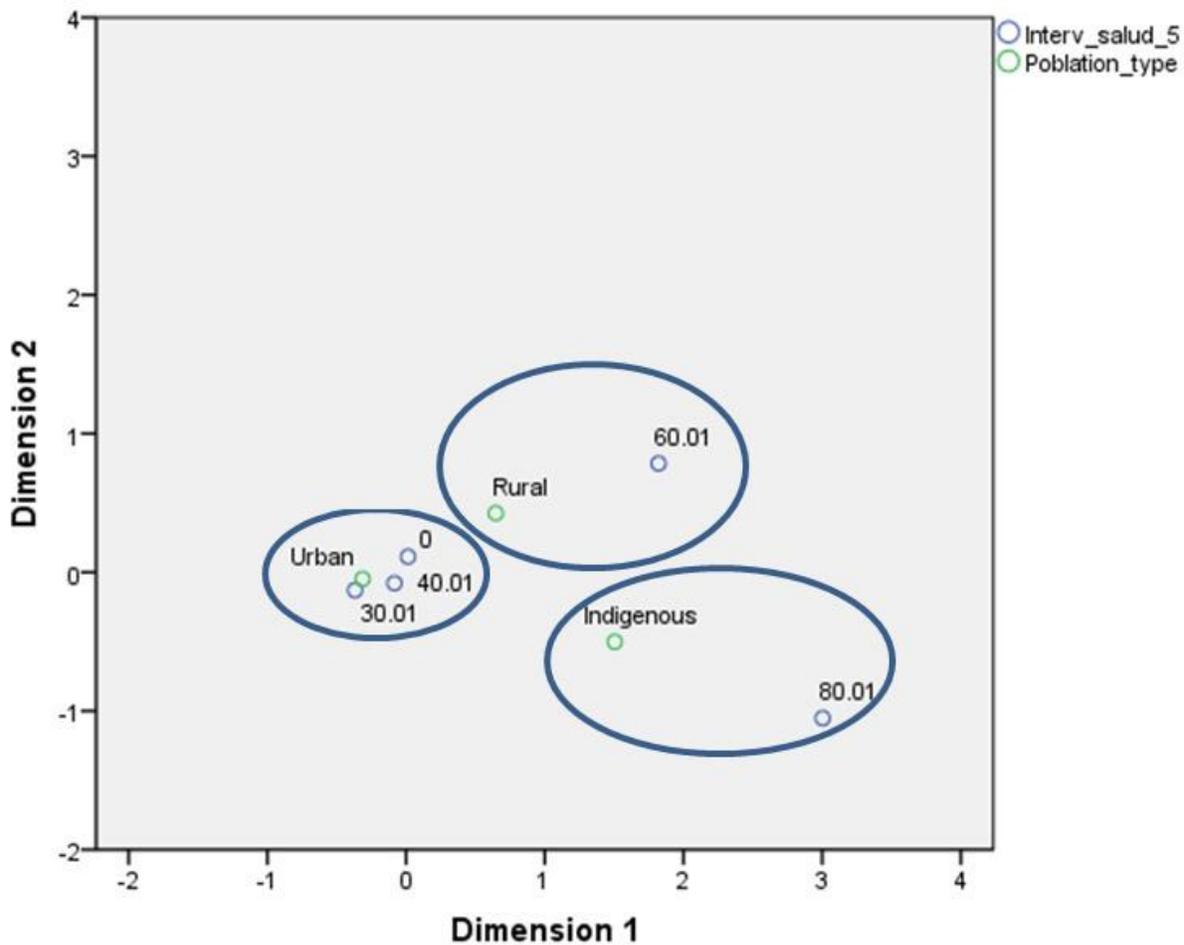
$\chi^2=1.6016$; inertia=0.143; corr=0.250; significance at $p<0.001$.

Figure 3: Distribution of five intervals without medical coverage in each type of locality: Indigenous, rural and urban.

Discussion

A full analysis of 107 458 localities sheds light on an unknown scenario within the overall national focus in Mexico. The analysis highlights the local needs and problems that cannot be seen in general contexts or state and national averages[2]. Therefore, it is imperative to reexamine the rural and Indigenous scenarios, preferably by studying the Indigenous population in a separate category to obtain the best results[18], as in the present study. This is line with the recommendation of a study carried out in the region of Kerala, India – an excellent work that considered the division of the population into Indigenous versus non-Indigenous and health coverage services[19]. Likewise, any study of social polarization in Mexico must be preceded by a division of the population into urban, rural and Indigenous. Anyone who omits this qualitative separation in the analysis, quite simply loses objectivity and has results that would not reflect the reality of Mexico.

It is recommended to study the micro-regional universe, which is only accessible through case studies on the geographical scale of localities, their individual histories, and the histories of their inhabitants, their ethnicities and their homes[31]. The Indigenous population is recognized as a historical constant that occupies the bottom rung of social development not only in Mexico but around the world[17]. This situation in Mexico at national level is also repeated at the state level, given that the states with the largest Indigenous populations also have greater marginalization and a worse lack of basic health services[23,24]. As socially critical regions of the country, the situation in rural areas is not an issue that is unique to Mexico; it is a global issue that is prevalent in nations with high social heterogeneity such as China[10,11] and Mozambique[14].

Nevertheless, the problem exists within a large contradiction, an unlikely paradox. Especially when we consider that socially critical zones are rich in food and natural resources, studies have shown successful proposals to benefit poor rural farmers in Mexico[32]. What is occurring, as this study has clearly shown, is the concentration of marginalization in the majority of rural localities, which, historically, are the majority and remain the same[4]. They are the mountainous areas where elements of progress do not reach and from where one escapes at the cost of identity, culture and way of life. Alternatively, we observe less marginalization in the majority of urban localities, which, historically, are the minority and where the benefits of social development are monopolized[19]. Impoverished communities have

the misfortune of living on the precipice, under conditions of high social inequality. In this setting, they are subject to whichever economic, political and climate turn that can break this fragile balance. The most recent example is the famine reported in the Sierra Tarahumara at the end of 2011 in Chihuahua, Mexico, where severe drought, combined with frost, destroyed vegetation and grasslands. These events triggered hunger and diseases in this ethic group, the Raramuri.

This phenomenon can also be observed more widely in Latin America[6,7], where, similarly, Indigenous groups are recognized as the most marginalized[20]. We find obvious examples in the cases of Ecuador[12], Brazil[21], and El Salvador[13]. The social polarization in Mexico found in this study exposes extreme marginalization between the Indigenous and urban worlds and inequality of access to health services. The lack of public health service coverage most frequently occurs in Indigenous and rural localities. In those conditions, Indigenous and rural localities are deprived of fundamental necessities for preserving health and wellbeing status. For instance, childbirths in Indigenous and rural areas are often assisted by midwifes while in urban scenarios childbirths are supported by the public health service. Such precarious conditions in Indigenous and rural areas represent a direct threat to life. This situation highlights a national social problem[15] and a public health problem[16].

It's apparent that there is a serious public health problem, such that the health problems of the neediest population can hardly be addressed when there is no corresponding medical coverage. The paradox of the problem is that Mexico celebrated the bicentennial of the War of Independence (1810) and the centennial of the Mexican Revolution (1910). These were armed movements involving a marginalized rural and Indigenous social base that struggled for fundamental rights. However, as this study shows, given the knowledge that there is severe social deprivation among millions of Mexicans, without the universal right to health services after 200 years, the celebrations are pointless, at least for Indigenous and rural populations.

Conclusions

Significant differences between the three population areas – Indigenous, rural and urban – in relation to the degree of marginalization and access to health services were found. The present study confirms that the localities and inhabitants in the Indigenous area are the most marginalized and most deprived of health services and that urban areas are the least affected in this respect. Governmental policies aimed to overcome the lack of access to health service coverage should pay attention to rural populations with special emphasis on Indigenous areas.

REFERENCES:

1 Roldán JA, Carrasco Q R, Guarneros N. *El hambre, parte de la cultura en los hogares marginales de México. Los casos de la huasteca potosina y la sierra tarahumara.* Saarbrücken, Germany: Editorial Académica Española, 2012.

2 Haynes R, Gale S. Deprivation and poor health in rural areas: inequalities hidden by averages. *Health and Place* 2000; **6(4):** 275-285. https://doi.org/10.1016/S1353-8292(00)00009-5

3 Roldan JA, Avila A, Chávez A, Álvarez M, Muñoz M, Shamah T. *Regionalización de la situación nutricional en México.* México: Instituto Nacional de Nutrición, 2004.

4 Tickamyer AR. *International encyclopedia of human geography.* Dayton, OH: Elsevier, 2009.

5 Smith LC, Ruel MT, Ndiaye A. Why is child malnutrition lower in urban than in rural areas? Evidence from 36 developing countries. *World Development* 2005; **33(8):** 1285-1305. https://doi.org/10.1016/j.worlddev.2005.03.002

6 Macours K, Swinnen JFM. Rural-urban poverty differences in transition countries. *World Development* 2008; **36(11):** 2170-2187. https://doi.org/10.1016/j.worlddev.2007.11.003

7 de Janvry A, Sadoulet E. Rural poverty in Latin America: Determinants and exit paths. *Food Policy* 2000; **25(4):** 389-409. https://doi.org/10.1016/S0306-9192(00)00023-3

8 International Labour Organization (ILO). *World Social Protection Report.* 2015. Available: http://www.ilo.org/global/research/global-reports/world-social-security-report/2014/lang--en/index.htm (Accessed 5 August 2015).

9 The World Bank. *Data from World Bank Listing: China.* Available: http://data.worldbank.org/country/china (Accessed 5 August 2013).

10 Zhang Y, Wan G. The impact of growth and inequality on rural poverty in China. *Journal of Comparative Economics* 2006; **34(4):** 694-712. https://doi.org/10.1016/j.jce.2006.08.008

11 Fan S, Chan-Kang C. Regional road development, rural and urban poverty: evidence from China. *Transport Policy* 2008; **15(5):** 305-314. https://doi.org/10.1016/j.tranpol.2008.12.012

12 Hentschel J, Waters FW. Rural poverty in Ecuador: Assessment local realities for the development of anti-poverty programs. *World Development* 2002; **30(1):** 33-47. https://doi.org/10.1016/S0305-750X(01)00099-7

13 Lanjouw P. Nonfarm employment and poverty in rural El Salvador. *World Development* 2012; **29(3):** 529-547. https://doi.org/10.1016/S0305-750X(00)00105-4

14 Garrett JL, Ruel MT. Are determinants of rural and urban food security and nutritional status different? Some insights from Mozambique. *World Development* 1999; **27(11):** 1955-1975. https://doi.org/10.1016/S0305-750X(99)00091-1

15 Gracey M, King M. Indigenous health part 1: determinants and disease patterns. *Lancet* 2009; **374(9683):** 65-75. https://doi.org/10.1016/S0140-6736(09)60914-4

16 Cameron E, de Leeuw S, Greenwood M. *International encyclopedia of human geography.* Prince George, BC: University of Northern British Columbia, 2009.

17 Horton R. Indigenous peoples: time to act now for equity and health. *Lancet* 2006; **367(9524):** 1705-1707. https://doi.org/10.1016/S0140-6736(06)68745-X

18 King M, Smith A, Gracey M. Indigenous health part 2: the underlying causes of the health gap. *Lancet* 2009; **374(9683):** 76-85. https://doi.org/10.1016/S0140-6736(09)60827-8

19 Haddad S, Mohindra KS, Siekmans K, Màk G, Narayana D. "Health divide" between indigenous and non-indigenous populations in Kerala, India: Population based study. *BMC Public Health* 2012; **12(1):** 390. https://doi.org/10.1186/1471-2458-12-390

20 Montenegro RA, Stephens C. Indigenous health in Latin America and the Caribbean. *Lancet* 2006; **367(9525):** 1859-1869. https://doi.org/10.1016/S0140-6736(06)68808-9

21 Guedes GR, Brondízio ES, Barbieri AF, Anne R, Penna-Firme R, D'Antona ÁO. Poverty and inequality in the rural Brazilian Amazon: A multidimensional approach. *Human Ecology* 2012; **40(1):** 41-57. https://doi.org/10.1007/s10745-011-9444-5

22 Puyana A, Murillo S. Trade policies and ethnic inequalities in Mexico. *European Journal of Development Research* 2012; **24(5):** 706-734. https://doi.org/10.1057/ejdr.2012.23

23 Reyes ME, Chavez GB, Little BB, Malina RM. Community well-being and growth status of indigenous school children in rural Oaxaca, southern Mexico. *Economics and Human Biology* 2010; **8(2):** 177-187. https://doi.org/10.1016/j.ehb.2010.05.009

24 Ellis EA, Baerenklau KA, Marcos-Martínez R, Chávez E. Land use/land cover change dynamics and drivers in a low-grade marginal coffee growing region of Veracruz, Mexico. *Agroforestry Systems* 2010; **80(1):** 61-84. https://doi.org/10.1007/s10457-010-9339-2

25 Stephens C, Porter J, Nettleton C, Willis R. Disappearing, displaced, and undervalued: a call to action for indigenous health worldwide. *Lancet* 2006; **367(9527):** 2019-2028. https://doi.org/10.1016/S0140-6736(06)68892-2

26 Rotberg RI, Rabb TK. *El hambre en la historia: el impacto de los cambios en la producción de alimentos y los modelos de consumo sobre la sociedad.* Madrid, Spain. Siglo XXI de Espa-a Editores. 1990.

27 National Institute of Statistics, Geography and Information Technology (INEGI). *Censo de Población y Vivienda 2010 (Cuestionario ampliado).* Available: http://www3.inegi.org.mx/sistemas/TabuladosBasicos/Default.aspx?c=27303 (Accessed 5 August 2015).

28 National Population Council (CONAPO). *Índice de Marginación por Localidad 2010.* Available: http://www.conapo.gob.mx/es/CONAPO/Indice_de_Marginacion_por_Localidad_2010 (Accessed 5 August 2015).

29 National Commission for the Development of Indigenous Peoples (CDI). *6ª. Expo de los Pueblos Indígenas.* Available: https://www.gob.mx/cdi/articulos/6a-expo-de-los-pueblos-indigenas (Accessed 5 August 2015).

30 National Council for the Evaluation of Social Development Policy (CONEVAL). *Índice de Rezago Social 2010 a Nivel Municipal y por Localidad.* Available: http://www.coneval.gob.mx/Medicion/Paginas/ndice-de-Rezago-social-2010.aspx (Accessed 5 August 2015).

31 De Alba, González GI. La pobreza en México desde una perspectiva étnica. *México, Revista de Desarrollo Humano y Capacidades* 2010; **11(3):** 449-465.

32 Bellon MR, Hodson D, Bergvinson D, Beck D, Martinez-Romero E, Montoya Y. Targeting agricultural research to benefit poor farmers: relating poverty mapping to maize environments in Mexico. *Food Policy* 2005; **30(5-6):** 476-492. https://doi.org/10.1016/j.foodpol.2005.09.003