

## PEER REVIEW HISTORY

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### ARTICLE DETAILS

<b>TITLE (PROVISIONAL)</b>	Using a system dynamics model to study the obesity transition by socioeconomic status in Colombia at the country, regional, and department level
<b>AUTHORS</b>	Meisel, Jose; Ramirez, Angie; Esguerra, Valentina; Montes, Felipe; Stankov, Ivana; Sarmiento, Olga; Valdivia, Juan

### VERSION 1 - REVIEW

<b>REVIEWER</b>	Natalia Tumas National Scientific and Technical Research Council (CONICET) and National University of Córdoba (UNC), Argentina
<b>REVIEW RETURNED</b>	03-Feb-2020

<b>GENERAL COMMENTS</b>	<p>This is a very interesting and well-written manuscript, which addresses one of the most relevant issues in public health nowadays: the obesity epidemic. This is one of the few studies in Latin America and the first one in Colombia that apply system dynamics models to the study of obesity trends by socioeconomic status. The study contributes to filling gaps to understand the obesity transition by SES, and holds great potential for impact in the design of equitable public policies in Colombia. I present my main comments below, which hopefully can help to further improve the work.</p> <ul style="list-style-type: none"><li>-I suggest reviewing and rephrased some parts of the abstract. There is valuable missing information, mainly in the methods section.</li><li>-The reasons to select Colombia for the study were poorly described. I recommend to further explain it. Additionally, I suggest stating other relevant features (such as the high social inequality in the country that allows categorization of the population into very differentiated socioeconomic groups).</li><li>- Although it is stated that it has not been possible to include net migration in the system dynamic model due to unavailability of data by BMI categories, it would be great to provide some information regarding the net migration rates in the country, in order to figure out the magnitude of the omission and potential impact on the results.</li><li>-The trends observed in children are very interesting and in my opinion needs to be further discussed. Why do you think the transference rates to overweight and to obese status in boys aged 0-4 years have increased more rapidly in the higher SES? Why do you think the downward transitions in nutritional status in boys aged 10-14 years and girls aged 5-9 years have increased faster in middle and high SES groups?</li><li>-In the discussion section, lines 310-312, what kind of taxes are you</li></ul>
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	<p>referring to? I suggest explaining this.</p> <p>-The results regarding that transitions from overweight to obesity among adults from lower SES were more evident in women are clearly described and highlighted, however, no discussion about the overlapping categories of inequality involved (SES, gender) were presented. I recommend developing this in the discussion. The intersectionality field could help to shed light on this.</p>
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<b>REVIEWER</b>	Richard L. Bender University of Colorado Boulder, USA
<b>REVIEW RETURNED</b>	11-Feb-2020

<b>GENERAL COMMENTS</b>	<p>Meisel et al. present an analysis of obesity dynamics in the middle-income Latin American nation of Colombia, using national-level survey data to model time-trends in obesity status by age, gender, and socioeconomic status. Notably, the authors also refine their analysis to sub-national spatial scales (i.e., regions and departments of Colombia). The latter point is both novel and important, since sub-national obesity data are scarce for most parts of the world, and reliance on national-level data may obscure significant spatial heterogeneity in obesity trends, risks, and subsequent public health policy.</p> <p>The manuscript is generally well-written with a thorough analysis and clearly-stated results. I do have three principle comments/concerns.</p> <p>First, the time scale of the analysis should be described more clearly. The idea of “an obesity transition by SES over time” (page 2, lines 13-14) is introduced in the Abstract, but the fact that the data are drawn from 2005 and 2010 surveys does not become readily apparent until the Methods section (page 6, 108). Also, the extrapolative nature of the analysis (i.e., forecasting into the future) can be inferred from certain entries in Table 1, but again, this does not become clear until later in the manuscript (page 10, 154). Overall, these temporal aspects of the research should be made clear, beginning in the Abstract and Introduction. Furthermore, the survey data are from 10-15 years ago, and the authors should explain why these data are sufficient for the research goal of forecasting obesity trends 10 years into the future.</p> <p>Second, sample sizes are not reported in the main text, although they can be found in Supplementary Information 2. For this analysis, specific sample sizes for gender, age group, SES category, etc. are not needed in the main text, but a summary of the sample sizes – even simply the total number of individuals surveyed in 2005 and 2010 – should be reported in the Abstract and the Methods. This information is particularly important for readers who are unfamiliar with the ENSIN data sets.</p> <p>Third, more discussion is needed to explain the observed spatial heterogeneity in obesity dynamics. Outside of a general statement that “variations in obesity transitions at a subnational level may be explained by socioeconomic factors and inequalities” (page 15, lines 292-293), and a broad link between obesity trends and changes in GDP, the authors do not offer a framework for “understanding the obesity transition ... at different spatial scales”, as suggested by the</p>
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	<p>title. To be fair, additional socioeconomic data may not be available in the ENSIN datasets. However, the authors should provide a discussion of the factors that could impact obesity dynamics in various areas of Colombia, such as health infrastructure, education, the physical environment, etc., in addition to socioeconomic status and inequality. This addition to the Discussion is needed to illustrate why the author's focus on spatial differences is worthwhile and important.</p> <p>Additional minor comments are listed below.</p> <p><b>ABSTRACT</b></p> <ul style="list-style-type: none"> <li>• As noted above, sample sizes and time scale should be described here</li> </ul> <p><b>METHODS</b></p> <ul style="list-style-type: none"> <li>• Again, sample sizes should be reported here, and the temporal aspects of the analysis (i.e., survey data from 2005-2010, extrapolation to 2030) should be made clear.</li> <li>• Page 9, line 144: the variable "t" in the equation is not defined in the text.</li> </ul> <p><b>RESULTS</b></p> <ul style="list-style-type: none"> <li>• Page 12, lines 210-211: the phrase "suggesting that Colombia is in the process of undergoing a very fast obesity transition" reads as in interpretation of results; therefore, it should be moved to the Discussion section.</li> </ul> <p><b>DISCUSSION</b></p> <ul style="list-style-type: none"> <li>• Page 15, lines 296 &amp; 300; page 16, line 311: define the acronyms "HDI", "LAC", and "PA".</li> <li>• Page 16, line 305: define or describe "the obesity law".</li> </ul> <p><b>MISCELLANEOUS SUGGESTIONS</b></p> <ul style="list-style-type: none"> <li>• If feasible, a basic map of Colombia, perhaps with the regions delineated, would be helpful to readers who are not familiar with the geography of Latin America.</li> <li>• Standardize the usage of "department" vs. "state" throughout the manuscript.</li> <li>• In Figure 3, the reference line at PR = 1.0 was helpful for interpretation. A similar reference line could be helpful in Figures 4 and 5 as well.</li> </ul>
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### VERSION 1 – AUTHOR RESPONSE

Reviewer # 1

Comment	Author's answer	Page and line of change
This is a very interesting and well-written manuscript, which addresses one of the most relevant issues in public health nowadays: the obesity epidemic. This is one of the few studies in Latin America and the first one in Colombia that apply	We thank the reviewer's comment.	

<p>system dynamics models to the study of obesity trends by socioeconomic status. The study contributes to filling gaps to understand the obesity transition by SES, and holds great potential for impact in the design of equitable public policies in Colombia. I present my main comments below, which hopefully can help to further improve the work.</p>		
<p>I suggest reviewing and rephrased some parts of the abstract. There is valuable missing information, mainly in the methods section.</p>	<p>According to the reviewer's recommendation, we modified the abstract to include valuable information about the design, participants, and primary and secondary outcome measure of the study.</p>	
<p>The reasons to select Colombia for the study were poorly described. I recommend to further explain it. Additionally, I suggest stating other relevant features (such as the high social inequality in the country that allows categorization of the population into very differentiated socioeconomic groups).</p>	<p>We appreciate this comment. According to the reviewer's recommendations, we explained in more detailed the reasons to select Colombia for the study.</p> <p>Particularly, we included the following paragraph:</p> <p>"This paper focuses on Colombia because it has experienced significant increases in the Gross domestic product (GDP) over the past decade (GDP increased from USD 145.181 billion in 2005 to USD 293.482 billion [19] in 2015). Additionally, Colombia has high social inequality that allows for the categorization of the population into differentiated socioeconomic groups. This socioeconomic differentiation makes it especially relevant for the study of obesity transition patterns. According to the World Bank's GINI index, Colombia is ranked the fourth most unequal country in Latin America[20]. Moreover, there is evidence that Colombia may be undergoing an obesity transition both at the country- and regional-level. According to the 2005 and 2010 "Encuesta Nacional de la Situación Nutricional en Colombia" (ENSIN) survey [21,22], at the country level there was a higher increase in the prevalence of obesity in the lowest wealth index (WI) quintile compared to the highest WI quintile for children, adolescents, and adults. These patterns, however, differ importantly by region- and department-level, but have not</p>	<p>Page 5, lines 72 - 85</p>

	<p>been evaluated. Identifying obesity transition patterns at the national- and subnational levels is key to developing more targeted and effective interventions.”</p>	
<p>Although it is stated that it has not been possible to include net migration in the system dynamic model due to unavailability of data by BMI categories, it would be great to provide some information regarding the net migration rates in the country, in order to figure out the magnitude of the omission and potential impact on the results.</p>	<p>We appreciate this comment. According to the reviewer’s recommendation, we have provided additional information about the net migration rate at the country and the department level.</p> <p>Particularly, we included the following paragraph:</p> <p>The net migration rate (NMR) is another variable that could be included in an ageing chain structure. At the country-level, NMR ranges from -0.23% to - 2.65% for the different age groups of 5 years. At the department-level, the NMR ranges from - 0,18% to -1,47% for negative values and from 0,18% to 1,38% for positive values among the different age groups and departments.</p>	<p>Page 10, lines 165-169</p>
<p>The trends observed in children are very interesting and in my opinion needs to be further discussed. Why do you think the transference rates to overweight and to obese status in boys aged 0-4 years have increased more rapidly in the higher SES? Why do you think the downward transitions in nutritional status in boys aged 10-14 years and girls aged 5-9 years have increased faster in middle and high SES groups?</p>	<p>We appreciate this comment. The transference rates (TR) depicted in figure 1 are estimates generated using just two data points. The estimated transference rates represent a single value which does not change over time i.e., in boys aged 0-4 years, there is one transference rate to overweight, and one value characterizing the transference rate to obesity, by SES. Given we only have one value, we cannot conclude that there has been an increase in the transference rate within a given group. We can, however, discuss the outcomes of the model where we use the transference rate to simulate obesity transition patterns by sex, age and SES over time.</p> <p>In this context, we do not discuss the results of the simulation model for boys aged 0-4 years and 10- 14 years and girls aged 5-9 years because the results did not show that there was an obesity transition among this age groups. As you can see in Figure 2, in both men and women, the obesity prevalence rates in children and adolescents do not change much over time. The most important changes in the obesity prevalence trends are in the adult population.</p>	

	<p>To clarify these points, we have removed language relating to ‘increases’ and ‘decreases’ where the transference rates are discussed:</p> <p>“The results of the heuristic show that estimated TRs towards overweight (<math>\tau_1</math>) and obese (<math>\tau_2</math>) were larger among individuals in the lower SES group, particularly women (mean <math>\tau_1 = 0.0195</math> and mean <math>\tau_2 = 0.0059</math>, for men; and mean <math>\tau_1 = 0.0245</math> and mean <math>\tau_2 = 0.0125</math>, for women), than among those in the middle (mean <math>\tau_1 = 0.0159</math> and mean <math>\tau_2 = 0.0037</math>, for men; and mean <math>\tau_1 = 0.0164</math> and mean <math>\tau_2 = 0.0095</math>, for women), or higher SES groups (mean <math>\tau_1 = 0.0143</math> and mean <math>\tau_2 = 0.0061</math>, for men; and mean <math>\tau_1 = 0.0169</math> and mean <math>\tau_2 = 0.0041</math>, for women) (Figures 1A, 1B, 1C, and 1D). For boys aged 0 to 4 years, the TRs to overweight (<math>\tau_1</math>) and obese (<math>\tau_2</math>) were larger in the highest SES than the other SES groups (Figures 1A and 1C). For boys aged 10 to 14, the TR from obese to overweight (<math>\tau_3</math>) and from overweight to not overweight (<math>\tau_4</math>) were larger in the middle and higher SES groups than in the lower SES group according to heuristic estimates. For girls aged 5 to 9, on the other hand, the TR from obese to overweight (<math>\tau_3</math>) were larger in the middle and higher SES groups than in the lower SES group. For girls aged 0 to 4, the TR from overweight to not overweight (<math>\tau_4</math>) were larger in the lower SES group than the other SES groups (Figures 1E, 1F, 1G, and 1H).”</p> <p>We have also modified the results section to state more directly, that no changes in obesity prevalence were found in children and adolescents:</p> <p>“Simulation results show that children and adolescents aged 0 to 14 (both boys and girls) will show no major changes in their BMI category distribution over time, across all SES populations.”</p>	<p>Page 12, lines 214-228</p>
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		Page 13, lines 232-234
In the discussion section, lines 310-312, what kind of taxes are you referring to? I suggest explaining this.	According to the reviewer's recommendation, we clarified that the taxes in these lines are related to tax schemes for sugar-sweetened beverages and ultra-processed foods.	Page 18, lines 369-370
The results regarding that transitions from overweight to obesity among adults from lower SES were more evident in women are clearly described and highlighted, however, no discussion about the overlapping categories of inequality involved (SES, gender) were presented. I recommend developing this in the discussion. The intersectionality field could help to shed light on this.	<p>We appreciate this comment. The purpose of this study is to investigate the obesity dynamics by SES, sex, and age within the Colombian urban population at the country, regional, and department level over time. Specifically, we seek to identify in which regions and departments of Colombia the burden of obesity have shifted towards the lower SES. Therefore, discuss about the overlapping categories of inequality involved (SES, gender) is beyond the scope of this study. However, we agree with you that this topic could be important to discuss in the future. Particularly, we included the following paragraph:</p> <p>“Fifth, given the purpose of the study and aims defined for the SD model, we focus on characterize obesity transition patterns by SES, sex, and age at different levels over time. Nevertheless, it is important to study the effect that the intersectionality between SES and sex could generate in the dynamics of obesity and in the health system. Particularly, it could be important to study and characterize vulnerable population subgroups such as lower SES women who, based on the findings of our study, are increasingly transitioning from overweight to obesity. Therefore, future studies should focus on assess the overlapping categories of inequality that could be involved in the relationship between BMI categories, SES, and sex.”</p>	Page 19, lines 391-398

Reviewer # 2

Comment	Author's answer	Page and line of change
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<p>Meisel et al. present an analysis of obesity dynamics in the middle-income Latin American nation of Colombia, using national-level survey data to model time-trends in obesity status by age, gender, and socioeconomic status. Notably, the authors also refine their analysis to sub-national spatial scales (i.e., regions and departments of Colombia). The latter point is both novel and important, since sub-national obesity data are scarce for most parts of the world, and reliance on national-level data may obscure significant spatial heterogeneity in obesity trends, risks, and subsequent public health policy. The manuscript is generally wellwritten with a thorough analysis and clearly-stated results. I do have three principle comments/concerns</p>	<p>We thank the reviewer's comment.</p>	
<p>First, the time scale of the analysis should be described more clearly. The idea of "an obesity transition by SES over time" (page 2, lines 13-14) is introduced in the Abstract, but the fact that the data are drawn from 2005 and 2010 surveys does not become readily apparent until the Methods section (page 6, 108). Also, the extrapolative nature of the analysis (i.e., forecasting into the future) can be inferred from certain entries in Table 1, but again, this does not become clear until later in the manuscript (page 10, 154). Overall, these temporal aspects of the research should be made clear, beginning in the Abstract and Introduction.</p>	<p>According to the reviewer's recommendation, we modified the abstract to clarify the time scale, the design type, the survey used, participants, and primary and secondary outcome measure of the study. However, it is important to clarify that we used a simulation model for assessing the obesity dynamics of the Colombian urban population by sex, age, and SES at the country, regional and department level projected to 2030. Therefore, we modified the abstract and the introduction to clarify that we used a simulation model that extrapolates obesity dynamics to 2030.</p>	
<p>Furthermore, the survey data are from 10-15 years ago, and the authors should explain why these data are sufficient for the research goal of forecasting</p>	<p>According to the reviewer's recommendation, we explain that data from ENSIN 2005 and 2010 are sufficient to simulate the obesity dynamics.</p>	



<p>obesity trends 10 years into the future.</p>	<p>It is important to highlight that the system dynamics (SD) approach is a method that helps practitioners and policymakers to learn about the dynamic complexity of a problem or system, to understand the sources of policy resistance, and to design more effective policies. SD is grounded in the theory of nonlinear dynamics and feedback control to understand the dynamics of a real problem. Particularly, the ageing chain structure that used the model is a very robust structure that allows understanding the evolution and the ageing of the population. This generate that the model will not be highly dependent of the data (Sterman JD. Business Dynamics: Systems Thinking and Modeling for a Complex World. USA: McGrawHill/Irwin 2000.).</p> <p>Additionally, the SD model that we used were based on a validated and calibrated model [15]. The suitability of the SD model was assessed through five tests (see reference [15] in the article): integration error, parameter assessment, extreme conditions, behaviour reproduction, and sensitivity analysis. The results of these tests showed that the model was robust and the behaviour pattern of the model were consistent with the expected results for the estimated prevalence rates for each BMI category. Particularly, the results of the behaviour mode sensitivity analysis for each age group showed that the behaviour pattern of the model is consistent with expected trends for the estimated prevalence rates by BMI category. Furthermore, the results of the behaviour reproduction method showed that the SD model is able to reproduce the behaviour of the prevalence rates by age of each BMI category and SES group in the population. Therefore, we modified the following paragraphs to clarify why the data used are sufficient:</p> <p>“We used a population-level SD model to assess the obesity dynamics by SES at the national- and sub-national levels. The model is characterised by ageing chains, which are robust structures commonly used</p>	
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	<p>in SD models to understand the evolution of ageing in a population. They are especially important when population data are sparse. Our population-level SD model includes ageing chains for three BMI categories (not overweight, overweight, and obese); in which the population aged 0-59 years was divided into age groups of 5 years. People in the 60 to 64 age group are not represented in the SD model.”</p> <p>“To analyse the obesity dynamics at the national and sub-national levels, we developed a population-level SD model and used a heuristic to estimate the transition rates (TRs) between BMI categories by age, sex, and SES using data obtained, mainly from the 2005 and 2010 ENSIN for individuals aged 0 to 64 years, which were based on a validated and calibrated model [15,40]. Specifically, tests assessing the suitability of the SD model showed that the model was robust and that the simulated behaviour was consistent with the expected results for the estimated prevalence rates for each BMI category and age [15].”</p>	<p>Page 9, lines 153-159</p> <p>Page 7, lines 121-127</p>
<p>Second, sample sizes are not reported in the main text, although they can be found in Supplementary Information 2. For this analysis, specific sample sizes for gender, age group, SES category, etc. are not needed in the main text, but a summary of the sample sizes – even simply the total number of individuals surveyed in 2005 and 2010 – should be reported in the Abstract and the Methods. This information is particularly important for readers who are</p>	<p>According to the reviewer’s recommendations, we specified the sample sizes of the ENSIN 2005 and 2010 in the abstract and in the methods section.</p> <p>Particularly, we modified the following paragraph in the methods section:</p> <p>“The study is based on cross-sectional data obtained from the 2005 and 2010 ENSIN [21,22]. The ENSIN used a multistage, stratified, populationbased cluster sampling design that included both household and individual components. The questionnaire was administered in the home by female</p>	<p>Page 7, line 133-144</p>

<p>unfamiliar with the ENSIN data sets.</p>	<p>interviewers equipped with computerassisted personal interview technology. The sample for 2005 comprised 8,515 children younger than five years, 32,009 children and adolescents aged 5–17 years, and 48,056 adults aged 18–64 years. In 2010 the corresponding numbers for the sample were 11,368, 32,524, and 64,425, respectively. All the protocols were reviewed and approved by the Profamilia Institutional Review Board on Research Involving Human Subjects. All the data used in the model were obtained from public sources and are fully available in S2 and S3 supplementary files. Table 1 describes the data sources used in the model.”</p>	
<p>Third, more discussion is needed to explain the observed spatial heterogeneity in obesity dynamics. Outside of a general statement that “variations in obesity transitions at a subnational level may be explained by socioeconomic factors and inequalities” (page 15, lines 292-293), and a broad link between obesity trends and changes in GDP, the authors do not offer a framework for “understanding the obesity transition ... at different spatial scales”, as suggested by the title. To be fair, additional socioeconomic data may not be available in the ENSIN datasets. However, the authors should provide a discussion of the factors that could impact obesity dynamics in various areas of Colombia, such as health infrastructure, education, the physical environment, etc., in addition to socioeconomic status and inequality. This addition to the Discussion is needed to illustrate why the author’s focus on spatial differences is worthwhile and important.</p>	<p>We appreciate this comment.</p> <p>To clarify, the aim of our paper was to characterize and describe obesity transition patterns by SES, sex, and age within the Colombian urban population at the country, regional, and department levels over time. And, to descriptively represent how these obesity transition patterns correspond to changes in GDP over the course of the simulation. The reason we chose to focus on describing the obesity transition at the country, regional and department levels was to identify potentially important heterogeneity between urban populations and to facilitate more effective targeting of obesity prevention initiatives at different levels of government.</p> <p>The purpose and scope of this article therefore was not to identifying the drivers of, or possible factors that could differentially impact obesity dynamics at the national- and subnational-level. We also did not intend to offer a framework for understanding the obesity transition at different spatial scales, though we acknowledge that this would be an important area for future work.</p> <p>Therefore, according to the reviewer’s recommendations, and to clarify our intent, we have removed reference to “spatial scales” from the title and the rest of the paper. We have also clarified our aims in</p>	

	<p>the abstract and at the end of the introduction, to more clearly reflect our aim, which was to describe the relationship between obesity prevalence and GDP at different levels. We also outlined more clearly why we chose to describe these patterns at the country, regional and department levels:</p> <p>“Although different SD models have been developed to study obesity dynamics at the population-level, to date there has been no attempt to understand this complex system at the national- and sub-national-level. Characterizing obesity dynamics at these levels could afford important insights relevant to the development of targeted obesity prevention initiatives that low SES and female gender can create ‘a double burden of intersecting disadvantages’ that have been linked not just to higher rates of obesity (as was shown in this study) but also other health-related at different levels of government. This study seeks to bridge this gap by applying SD modelling to investigate obesity transitions by SES, sex, and age, along with their relationship to GDP, within the Colombian urban population at the country-, regional-, and department-level over time. Specifically, we seek to identify in which regions and departments of Colombia the burden of obesity have shifted towards the lower SES populations, and how these shifts relate to regional and department-level GDP.”</p>	<p>Page 6, Lines 107-118</p>
<p><b>ABSTRACT</b></p> <ul style="list-style-type: none"> <li>• As noted above, sample sizes and time scale should be described here</li> </ul>	<p>According to the reviewer’s recommendation, we specified the sample sizes of the ENSIN 2005 and 2010 and the time scale of the study in the abstract.</p>	
<p><b>METHODS</b></p> <ul style="list-style-type: none"> <li>• Again, sample sizes should be reported here, and the temporal aspects of the analysis (i.e., survey data from 2005-2010, extrapolation to 2030) should be made clear.</li> </ul>	<p>According to the reviewer’s recommendations, we specified the sample sizes of the ENSIN 2005 and 2010 and the temporal aspects of the analysis in the methods section.</p> <p>Particularly, we modified the following paragraphs in the methods section:</p> <p>“To analyse the obesity dynamics at the national and sub-national levels, we developed a population-level SD model and used a heuristic to estimate the transition</p>	<p>Page 7, lines 121-</p>

	<p>rates (TRs) between BMI categories by age, sex, and SES using data obtained, mainly from the 2005 and 2010 ENSIN for individuals aged 0 to 64 years, which were based on a validated and calibrated model [15,40]. Specifically, tests assessing the suitability of the SD model showed that the model was robust and that the simulated behaviour was consistent with the expected results for the estimated prevalence rates for each BMI category and age [15]. We estimated the TRs between BMI categories by age, sex, and SES and applied the SD model to simulate and investigate the obesity dynamics by SES within the Colombian urban population from 2005 to 2030. We only simulated the urban population because the highest SES group in rural areas is poorly represented (i.e., less than 0.05% of the population) [41].”</p> <p>“The study is based on cross-sectional data obtained from the 2005 and 2010 ENSIN [21,22]. The ENSIN used a multistage, stratified, populationbased cluster sampling design that included both household and individual components. The questionnaire was administered in the home by female interviewers equipped with computerassisted personal interview technology. The sample for 2005 comprised 8,515 children younger than five years, 32,009 children and adolescents aged 5–17 years, and 48,056 adults aged 18–64 years. In 2010 the corresponding numbers for the sample were 11,368, 32,524, and 64,425, respectively. All the protocols were reviewed and approved by the Profamilia Institutional Review Board on Research Involving Human Subjects. All the data used in the model were obtained from public sources and are fully available in S2 and S3 supplementary files. Table 1 describes the data sources used in the model.”</p>	<p>131</p> <p>Page 7, lines 133-144</p>
<p>Page 9, line 144: the variable “t” in the equation is not defined in the text</p>	<p>According to the reviewer’s recommendations, we defined the variable t in the text of the article.</p>	<p>Page 11, line 183</p>
<p>RESULTS</p> <ul style="list-style-type: none"> <li>• Page 12, lines 210-211: the phrase “suggesting that Colombia is in the process of</li> </ul>	<p>According to the reviewer’s recommendations, we deleted the phrase “suggesting that Colombia is in the process of undergoing a very fast obesity transition”</p>	<p>Page 14, line 263</p>

undergoing a very fast obesity transition” reads as in interpretation of results; therefore, it should be moved to the Discussion section.	because a similar idea is already described in the discussion.	
DISCUSSION • Page 15, lines 296 & 300; page 16, line 311: define the acronyms “HDI”, “LAC”, and “PA”. • Page 16, line 305: define or describe “the obesity law”.	According to the reviewer’s recommendations, we defined the acronyms “HDI”, “LAC”, and “PA” and explained the obesity law.	
MISCELLANEOUS SUGGESTIONS If feasible, a basic map of Colombia, perhaps with the regions delineated, would be helpful to readers who are not familiar with the geography of Latin America.	According to the reviewer’s recommendations, we included in the S1 appendix a map of Colombia by regions and departments.	
Standardize the usage of “department” vs. “state” throughout the manuscript	According to the reviewer’s recommendations, we standardize the usage of department. We change the words “states” by “departments”.	
In Figure 3, the reference line at PR = 1.0 was helpful for interpretation. A similar reference line could be helpful in Figures 4 and 5 as well.	According to the reviewer’s recommendations, we included the reference lines in the figures 4 and 5.	

### VERSION 2 – REVIEW

<b>REVIEWER</b>	Natalia Tumas Centro de Investigaciones y Estudios sobre Cultura y Sociedad, Consejo Nacional de Investigaciones Científicas y Técnicas; Facultad de Ciencias de la Salud, Universidad Católica de Córdoba; Facultad de Ciencias Médicas, Universidad Nacional de Córdoba, Argentina.
<b>REVIEW RETURNED</b>	06-Apr-2020

<b>GENERAL COMMENTS</b>	The authors have satisfactorily included the suggestions in the manuscript. A few minor comments related to the reviewed manuscript version are listed below: -The following sentence (lines 109-113) is too long and a little confusing: “Characterizing obesity dynamics at these levels could afford important insights relevant to the development of targeted obesity prevention initiatives that low SES and female gender can create ‘a double burden of intersecting disadvantages’ that have been linked not just to higher rates of obesity (as was shown in this study) but also other health-related at different levels of government”. I suggest rephrasing.
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	-Through the lens of intersectionality, gender rather than sex is the category that overlaps with social class.
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<b>REVIEWER</b>	Richard L Bender University of Colorado Boulder, USA
<b>REVIEW RETURNED</b>	08-Apr-2020

<b>GENERAL COMMENTS</b>	I thank the authors for their clear and thorough responses to my comments and for their effective modifications to the manuscript. The authors have done a fine job in addressing concerns regarding reported sample sizes and the time scale of the analysis. Also, the re-framing of the Abstract and Introduction has greatly clarified the aims of the paper; specifically, that the goal was to describe the relationship between GDP and obesity at national and sub-national levels, rather than to identify drivers of obesity at different spatial scales. Since all of my comments have been addressed, I recommend that this interesting paper be accepted for publication.
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### VERSION 2 – AUTHOR RESPONSE

Reviewer # 1

Comment	Author's answer	Page and line of change
The authors have satisfactorily included the suggestions in the manuscript.	We thank the reviewer's comment.	
A few minor comments related to the reviewed manuscript version are listed below: -The following sentence (lines 109-113) is too long and a little confusing: "Characterizing obesity dynamics at these levels could afford important insights relevant to the development of targeted obesity prevention initiatives that low SES and female gender can create 'a double burden of intersecting disadvantages' that have been linked not just to higher rates of obesity (as was shown in this study) but also other healthrelated at different levels of government". I suggest rephrasing.	According to the reviewer's recommendation, we modified this sentence.  "Characterizing obesity dynamics at these levels could afford important insights relevant to the development of targeted obesity prevention initiatives by age, gender, and SES."	Page 6, lines 97 -99
-Through the lens of intersectionality, gender rather	According to the reviewer's recommendation, we agree that gender is	

than sex is the category that overlaps with social class.	the category that overlaps with social class. Therefore, we changed the term sex by gender in the manuscript.	
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Reviewer # 2

Comment	Author's answer	Page and line of change
The authors have a done a fine job in addressing concerns regarding reported sample sizes and the time scale of the analysis. Also, the re-framing of the Abstract and Introduction has greatly clarified the aims of the paper; specifically, that the goal was to describe the relationship between GDP and obesity at national and sub-national levels, rather than to identify drivers of obesity at different spatial scales. Since all of my comments have been addressed, I recommend that this interesting paper be accepted for publication.	We thank the reviewer's comment.	