Responses to Reviewer 3s' Comments

1. Summary

Dear reviewer, thank you very much for taking the time to review this manuscript. Please find detailed responses below and the corresponding revisions/corrections highlighted/in track changes in the re-submitted files.

2. Questions for General Evaluation	**Reviewer's Evaluation**	**Response and Revisions**
Does the introduction provide sufficient background and include all relevant references?	Yes	
Is the research design appropriate?	Can be improved	We have made the corrections suggested by the reviewer and hope that the research design now meets the required quality standards.
Are the methods adequately described?	Can be improved	We have made the corrections suggested by the reviewer and hope that the methods now meet the required quality standards.
Are the results clearly presented?	Can be improved	We have made the corrections suggested by the reviewer and hope that the results now meet the required quality standards
Are the conclusions supported by the results?	Yes	
Are all figures and tables clear and well-presented?	Yes	

3. Point-by-point response to Comments and Suggestions for Authors

Comment 1: This manuscript presents a population-based cross-sectional analysis investigating individual and contextual factors associated with protection against dental caries among five-year-old children in Minas Gerais, Brazil. Using a salutogenic framework, the authors shift the focus from risk factors toward protective determinants, which represents a relevant and innovative conceptual contribution to pediatric oral epidemiology. The topic is highly relevant to public health, particularly in the context of persistent socioeconomic inequalities in early childhood caries (ECC). The manuscript is generally well structured, methodologically sound, and grounded in an appropriate theoretical framework. However, several methodological and interpretative issues require clarification before publication.

The use of Salutogenic Theory as a conceptual framework represents an important departure from traditional risk-based models in oral epidemiology; the emphasis on

protective factors contributes to health promotion literature and aligns with equity-based policy approaches. The study uses data from the Minas Gerais Oral Health Survey (n = 1,193), ensuring: state-level representativeness, standardized WHO diagnostic criteria, adequate statistical power; this enhances both internal and external validity. The use of two complementary outcomes -absence of caries activity (ACA; d = 0), absence of caries experience (ACE; dmft = 0) strengthens interpretative robustness and allows differentiation between current disease activity and cumulative experience. The hierarchical regression approach (Victora *et al*.) is appropriate and theoretically justified: it reflects causal ordering and minimizes overadjustment. Findings reinforce the central role of socioeconomic equity in oral health promotion. The discussion appropriately links results to broader social determinants of health and policy implications.

Major limitations: the cross-sectional nature of the study limits causal inference; the association between "not visiting the dentist" and absence of caries is likely affected by reverse causality (healthy children may not seek care). While acknowledged, this issue deserves deeper discussion, particularly regarding implications for preventive policy. The manuscript states that contextual variables were not associated with outcomes and therefore multilevel modeling was not performed. However, the null model rationale should be better explained; intraclass correlation coefficient (ICC) values are not reported; the absence of contextual association may reflect insufficient variability or aggregation bias rather than true absence of contextual influence.

Response 1: Dear reviewer, thank you for pointing out these important items.

We highlight the study's cross-sectional nature as a limitation. "*However, the main limitation regards the cross-sectional design, which enables the determination of associations between variables but does not permit the establishment of causality.*" (Discussion, Page 9, Lines 342-345).

We have further elaborated on the discussion related to this finding and included its implications for Public Health, highlighting that our results do not invalidate the recommendation that early dental visits are necessary to achieve better oral health conditions in childhood (Discussion, 7th–10th paragraphs, Page 7-8, Lines 288-330).

Regarding the statistical analysis, we present below part of the results with the parameters adopted for defining the model to be used. We emphasize that, if the reviewer deems it appropriate, we can present the complete document with the Stata output. The null model represents the initial step in verifying the feasibility of the multilevel model. To assess the possibility of conducting a multilevel analysis, the null (or "empty") model must first be estimated, observing whether the outcome variable presents a different distribution considering the contextual level of aggregation (in this case, the municipality). In the syntax, the first term represents the regression type (Poisson mixed effects) followed by the outcome variable. In this response, Output 1 refers to absence of caries activity, d = 0; and Output 2 refers to absence of caries experience, dmft = 0. The two vertical bars indicate that the variable placed next represents the level of aggregation (ID2), i.e., the municipality. The parameters after the comma indicate the estimation using Maximum Likelihood Estimation and that variance was used as the parameter for evaluating random effects. In Outputs 1 and 2, some important elements should be observed. The

number of observations (1,193) indicates the sample size included in the analysis. The number of groups represents the aggregation units, in this case the 57 municipalities included in the sample. The distribution of observations across municipalities ranged from a minimum of two cases to a maximum of 200, with an average of 20.9 observations per municipality. Next, we must analyze the significance of the calculated coefficient and its respective confidence interval (95% CI). The 95% CI does not include zero, and the p-value is <0.001 in both null models. The random effects, in turn, are evaluated from the variance (0.0168398 for d=0 and 0.00000 for dmft=0) and their respective 95% CI. The significance of the random effects can also be assessed using the Likelihood Ratio (LR) test comparing the multilevel model with the single-level model (p = 0.1592 and p = 1.000, respectively). These results indicate negligible variability between municipalities and suggest that the use of a multilevel model would not substantially improve model fit.

Output 1 - d=0

```
xtmepoisson C0 || ID2:, mle var

Refining starting values:

Iteration 0:   log likelihood = -987.81342  (not concave)

Iteration 1:   log likelihood =   -966.713

Iteration 2:   log likelihood = -958.35709

 Performing gradient-based optimization:

Iteration 0:   log likelihood = -958.35709

Iteration 1:   log likelihood = -957.89212

Iteration 2:   log likelihood = -957.89104

Iteration 3:   log likelihood = -957.89104

Mixed-effects Poisson regression              Number of obs          =       1193

Group variable: ID2                           Number of groups       =         57

                                                 Obs per group: min =          2

                                                               avg =       20.9

                                                               max =        200

Integration points =   7                      Wald chi2(0)           =          .

Log likelihood = -957.89104                   Prob > chi2            =          .

------------------------------------------------------------------------------

          C0 |    Coef.   Std. Err.      z      P>|z|     [95% Conf. Interval]
```

```
-------------+----------------------------------------------------------------
       _cons |  -.8386011   .0529052   -15.85   0.000      -.9422935   -.7349088
------------------------------------------------------------------------------


------------------------------------------------------------------------------
  Random-effects Parameters  |   Estimate   Std. Err.      [95% Conf. Interval]
-----------------------------+------------------------------------------------
ID2: Identity                |
               var(_cons) |   .0168398   .0226978    .0011996       .2363988
------------------------------------------------------------------------------
LR test vs. Poisson regression:  chibar2(01) =      1.00 Prob>=chibar2 = 0.1592
```

Output 2 - dmft-=0

```
 xtmepoisson CEOD0 || ID2:, mle var

Refining starting values:

Iteration 0:   log likelihood = -1050.3974  (not concave)
Iteration 1:   log likelihood = -1026.8278
Iteration 2:   log likelihood =  -1015.575

Performing gradient-based optimization:

Iteration 0:   log likelihood =  -1015.575
Iteration 1:   log likelihood = -1011.0196
Iteration 2:   log likelihood = -1011.0002
Iteration 3:   log likelihood = -1011.0001

Mixed-effects Poisson regression            Number of obs         =       1193
```

```
Group variable: ID2                             Number of groups   =         57

                                                Obs per group: min =          2
                                                               avg =       20.9
                                                               max =        200

Integration points =   7                        Wald chi2(0)       =          .
Log likelihood = -1011.0001                     Prob > chi2        =          .

------------------------------------------------------------------------------
       CEOD0 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _cons |  -.6906342    .040893   -16.89   0.000    -.7707831   -.6104854
------------------------------------------------------------------------------

------------------------------------------------------------------------------
  Random-effects Parameters  |   Estimate   Std. Err.      [95% Conf. Interval]
-----------------------------+------------------------------------------------
ID2: Identity                |

               var(_cons) |   1.41e-10   2.95e-06           0              .
------------------------------------------------------------------------------
LR test vs. Poisson regression:  chibar2(01) =      0.00 Prob>=chibar2 = 1.0000
```

To confirm this analysis, we also constructed graphs showing the residuals from the previous regression and their respective confidence intervals, ordered from smallest to largest (Figure 1 and Figure 2). It can be observed that there are no municipalities showing intervals completely above or completely below the zero reference line, indicating that there is no significant variability between the aggregation units (municipalities). These findings suggest that there is no evidence of clustering effects on the outcome when considering its distribution across municipalities, and therefore a multilevel analysis was not warranted.

Figure 1 - Absence of caries activity (d = 0)

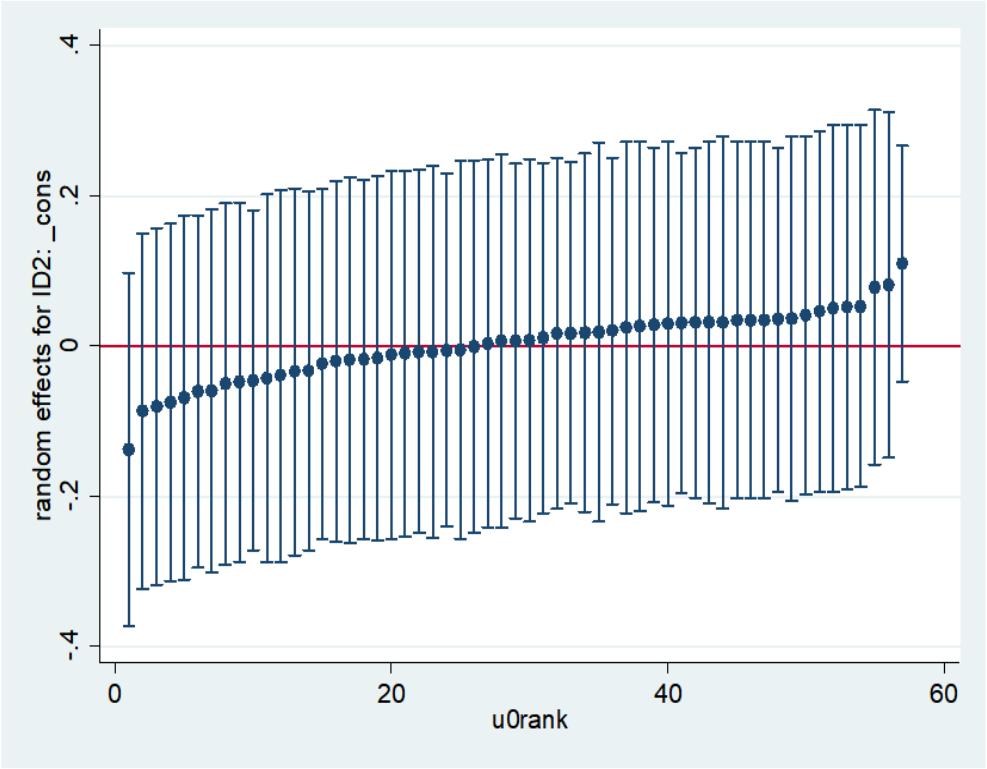
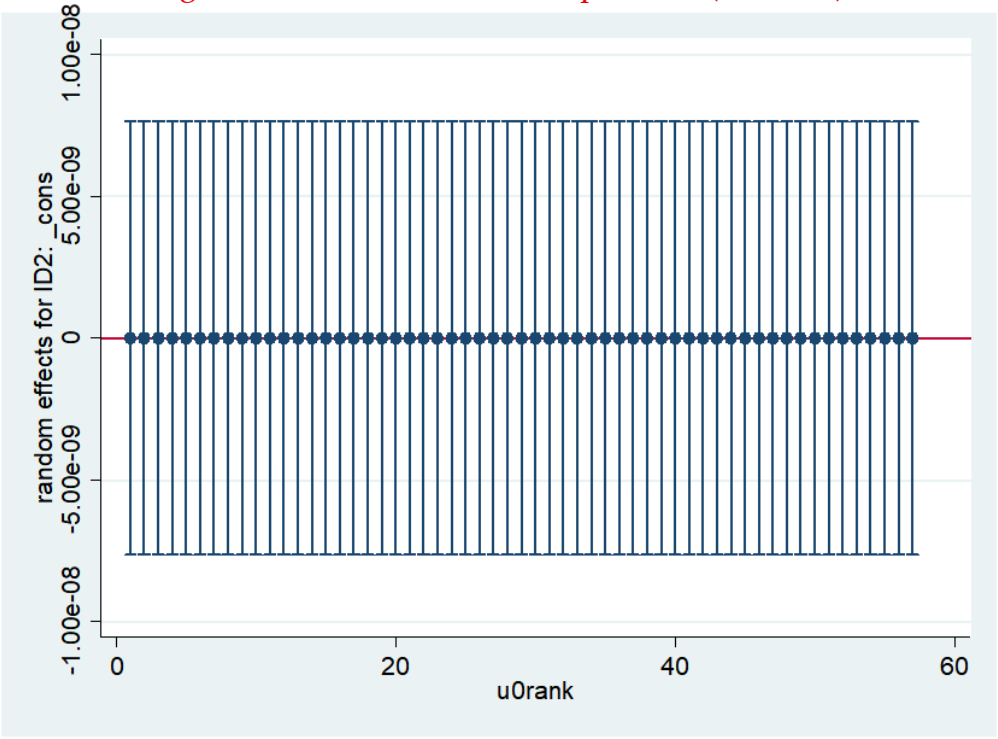


Figure 2 - Absence of caries experience (dfmt = 0)



In Summary, we would like to present a summary of our null model (Table 3), which indicates whether it is appropriate to conduct a multilevel analysis. The LR test results for both the absence of caries activity and the absence of caries experience were above 0.05, indicating that performing a multilevel analysis was not

appropriate.

Table 3 - Summary

Model	Variance (IC95%)	LR test (χ2.p-value)
absence of caries activity (d = 0)	0.0168 (0.0011-0.2364)	1.00 (0.1592)
absence of caries experience (dfmt = 0)	0.0000 (0.0000-0.0000)	0.00 (1.0000)

Regarding the use of ICC, the Likelihood Ratio (LR) test and the ICC are used to assess cluster effects in multilevel models. We chose to use the estimates from the LR test.

Finally, we include detailed explanations in the manuscript. "To assess the presence of contextual variability, a null mixed-effects Poisson model was initially estimated, considering municipalities as the clustering unit. The variance of the random intercept was very small for both outcomes (absence of caries activity and absence of caries experience). Furthermore, the likelihood ratio test comparing the mixed-effects model with the single-level Poisson model was not statistically significant (p = 0.159 for absence of caries activity and p = 1.000 for absence of caries experience). These results indicate little variability among municipalities and suggest that the use of a multilevel model would not substantially improve the model fit. Thus, a hierarchical logistic regression model was used considering only variables on the individual level." (Materials and Methods, 8th paragraph, Page 4, Lines 173-181).

Comment 2: The association between white skin color and protection from caries is interpreted as socioeconomic rather than biological. While the discussion acknowledges structural inequities, the manuscript should avoid language that could be misinterpreted as biologically deterministic and more explicitly frame race/skin color as a social construct and proxy for structural disadvantage.

Response 2: We agree with this comment and have accordingly revised the paragraphs discussing the association between white skin color and protection from caries to more clearly frame race/skin color as a social construct. "In the present study, children identified as having white skin color were more likely to present absence of active dental caries and no experience of caries. This is in agreement with findings described in previous studies conducted in Brazil as well as in other countries [39–41], which found a greater proportion of white children free of caries. The association between skin color and indicators of caries is complex and should be interpreted within the context of race/skin color as a social construct, reflecting historical and structural inequities in Brazilian society [42,43]. Evidence suggests that these differences are largely explained by disparities in socioeconomic conditions and access to goods and services among racialized groups, rather than any biological mechanism [3,44,45].

Another important aspect is that the measurement of ethnicity is quite fluid in studies that assess health disparities, as skin color may be self-declared or determined by an observer. Self-declarations are normally based on predetermined categories and reproduce personal associations with shared cultures and modes of living [46,47]. In contrast, skin color/ethnicity attributed by an observer may better capture differences in how individuals are socially perceived and treated, which may reflect

processes related to discrimination and unequal access to social and health resources [48,49]. In the 2012 Minas Gerais Oral Health Survey, skin color was self-declared using the criteria defined by the Brazilian Institute of Geography and Statistics, which may represent cultural behaviors aggregated to the racial group. In this context, race/skin color should be interpreted as a proxy for social and structural disadvantage, rather than a biological determinant of oral health outcomes [50]." (Discussion, Page 7-8, Lines 252-273).

Comment 3: The conclusion that contextual factors are less important may be overstated. Four oral health service variables were excluded due to low response rates (~50%). This is a significant limitation, as it weakens interpretation regarding service utilization. The manuscript should report whether missingness was random and any sensitivity analysis performed.

Response 3: Dear reviewer, we have revised the conclusion on the abstract and conclusion section to make it more consistent with the points raised during the evaluation of the manuscript. Regarding the sensitivity analysis, we present below the frequency distribution of the variables that were excluded. Conducting a sensitivity analysis would require re-estimating the model including all these variables; however, only individuals with complete data would be considered in the final model (i.e., approximately 500 to 600 children out of a total sample of 1,193 five-year-old children). We believe that restricting the analysis to respondents with complete information for all variables (around 500 to 600 participants, compared with the total sample of 1,193 five-year-old children) would be more problematic than excluding these variables, because it would reduce the contribution of the analytical sample, could generate selection bias, and reduce statistical power. This is because the low response rate was mainly due to the fact that these questions depended on parents or guardians completing the SB Minas questionnaire, and it is well recognized that achieving high response rates is one of the major challenges in survey-based studies.

Variable	No active caries			Active caries		
	n	%	95%CI	n	%	95%CI
Reason for seeking care						
Prevention	240	75,6	(69,8-80,6)	76	24,4	(19,4-30,2)
Treatment	110	34,4	(28,7-40,6)	238	65,6	(59,4-71,3)
Frequency of seeking care						
Less than 1 year	259	54,0	(48,9-59,0)	243	46,0	(41,0-51,1)
Greater than or equal to 1 year	85	58,6	(49,2-67,4)	66	41,4	(32,6-50,8)
Type of service used						
Public	181	48,8	(43,2-54,5)	221	51,2	(45,5-56,8)
Private and other	168	64,3	(57,4-70,7)	93	35,7	(29,3-42,6)
Evaluation of the service						
Positive	339	55,5	(51,0-59,8)	300	44,5	(40,2-49,0)
Negative	5	29,9	(11,3-59,0)	8	70,1	(41,0-70,1)

Variable	Absence of dental caries experience			Presence of dental caries experience		
	n	%	95%CI	n	%	95%CI
Reason for seeking care						
Prevention	210	66,2	(60,1-71,8)	106	33,8	(28,2-39,9)
Treatment	71	21,8	(17,1-27,4)	277	78,2	(72,6-82,9)
Frequency of seeking care						
Less than 1 year	198	40,7	(35,9-45,8)	304	59,3	(54,2-64,1)
Greater than or equal to 1 year	77	54,1	(44,6-63,2)	74	45,9	(36,8-55,4)
Type of service used						
Public	143	38,3	(32,9-44,1)	259	61,7	(55,9-67,1)
Private and other	137	52,5	(45,7-59,3)	124	47,5	(40,7-54,3)
Evaluation of the service						
Positive	272	44,4	(40,1-48,9)	367	55,6	(51,1-59,9)
Negative	4	22,8	(7,5-51,5)	9	77,2	(48,5-92,5)

4. Response to Comments on the Quality of English Language

Point 1: The English is fine and does not require any improvement.