Reviewer's report

Title: Public water supply fluoridation and oral health inequalities in Brazil: an ecological study

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Reviewer: Jason Armfield

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General

This study looks at the associations between water fluoridation and area-level socio-economic status (SES), geographic region and population size. The title of the paper is a misnomer as oral health inequalities are in fact not measured. In multivariate analyses it is found that geographic region and population size are independent predictors of the implementation of water fluoridation, but not area-level SES as measured by the Human Development Index (HDI).

The paper is generally well written and the level of English is good, although not perfect. The paper is reasonably interesting but suffers from some major problems. I believe this paper could be salvaged if a fair bit of work is put in to rewrite it. Currently it is not acceptable for publication, however. I have provided some general comments below and I would encourage the authors to, at a minimum, address these concerns prior to any resubmission. Please note, there are numerous other specific problems and issues with the paper, in terms of both written and technical aspects (e.g., references 29-36 are missing in text, tables are poorly formatted and presented, linear regression is described as a use of logistic regression, page numbers not included, the expression of associations as causative, etc. etc.), which I will not itemise but I would also strongly encourage the authors to look in more detail at.

Major Compulsory Revisions

The paper’s stated emphasis on inequalities is misleading. The abstract conclusion that “treating water with fluoride...to reduce inequalities...may not be being adequately achieved” is not supported by the data. For a start, although the HDI shows a bivariate association with water fluoridation implementation, this is not significant in multivariate analyses. Second, the HDI is an area-level measure, yet you do not qualify your statements regarding inequalities. You must be referring to geographic inequalities yet the way you talk about inequalities would imply inequalities at an individual level. When we talk about oral health inequalities we normally refer to differences between population groups as defined by some characteristic such as SES. But you are not measuring individual SES characteristics. The introduction to the paper states the purpose of the study to “verify the impact of the fluoridation of the public water supply on
the reduction of socio-economic inequalities” yet you do not state what these inequalities relate to. Inequalities in what? Presumably oral health based on your manuscript title, yet this is not measured. The whole emphasis on inequalities needs to be looked at and you need to understand exactly what you are analysing and what this means.

One can only assume that your independent variables are related and some information should be provided on these associations. In addition, there is no justification for using the different sub-indices of the HDI. The results at the bivariate level are similar (presumably because they’re so related) and you can’t even use them in the multivariate, so why use the sub-indices at all?

Interestingly, in your introduction you state that areas in Brazil’s North and Northeast regions have higher caries experience and prevalence and that these regions have less fluoridated water and “greater social deprivation”. Your study then finds an association between water fluoridation and macro region, so one can’t help but wonder why statistical analyses and a journal paper are needed to confirm this. What does this add to the knowledge already there? In your abstract, in the Background section, you somewhat strangely conclude that the study “adds knowledge to the Brazilian historical and structural phenomenon of the chronic privation of water..” (leaving aside the phraseology here!) but I’m not sure if it does.

Your two dependent variables (DVs) are obviously linked so I am not sure why you didn’t just use the second (Pre 90, Post 90, Never). Certainly, the two sets of analyses for each DV not necessary and it is no surprise that the pattern of results is similar.

In summary, the general issues you need to look at are your IVs, your DVs, the justification for the paper (and all the IVs), your central hypothesis and your conclusions based on the analyses. More specifically, the presentation of the paper and the writing require some attention. I should note, that it is not done lightly that I find this paper unacceptable for publication and I have spent some degree of time vacillating over the decision. I really do hope that the authors spend the time to tighten up this manuscript and that it finds a home somewhere in the not too distant future. I strongly support the publication of good research on water fluoridation, it's role in reducing dental caries and it's association with reducing (or otherwise) socioeconomic inequalities.

What next?: Reject because scientifically unsound

Level of interest: An article of limited interest

Quality of written English: Needs some language corrections before being published

Statistical review: No, the manuscript does not need to be seen by a
statistician.

**Declaration of competing interests:**

I declare that I have no competing interests.