Author’s response to reviews

Title: Association among house infestation index, dengue incidence, and sociodemographic indicators: Surveillance using geographic information system.

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Author’s response to reviews: see over
Response to reviewer: An Dao

All changes / alterations to the manuscript are written in red and strikethrough yellow.

1. Is the question posed by the authors well defined?  
Background: para 3

Research question was not presented clearly. In the introduction, author presented that previous studies indicated that correlation between HI and BI with dengue incidence is weak most of the time. However the objective of the current paper still identify transmission areas of dengue considering the association between the house infestation index (HI) and dengue incidence. This is not convinced and logical approach.

We agree with the reviewer's comment. Thus, the paragraph was modified on page three (3) of article revised:

The entomologic indicators that are traditionally used to monitor the populations of *Ae. Aegypti* are based on the presence and/or absence of immature forms of *Ae. Aegypti*. Among these, the house infestation index (HI) and the Breteau index (BI) stand out as approximate measures for dengue transmission risk. However, it is not always possible to observe strong associations with the incidence of dengue fever, which is possibly due to the inadequate quality of the entomological data collection and measures of vector infestation as well as the incidence data, which are based primarily on clinical diagnostics of asymptomatic or subclinical infections.\(^1,14\).

2. Are the methods appropriate and well described?  
Methods are well described But the Bayesian rate should be explained more regarding is it popular used and why?  

We agree with the reviewer's comment. Thus, the second paragraph was modified on pages eight (8) of article revised:

To minimize the instability problem of the incidence rate calculated for small areas, we used the local empirical Bayesian approach.\(^23,24\). This approach
includes spatial proximity effects by using the information from the regions that neighbor the geographical area to estimate the incidence rate. Empirical Bayesian procedures yield more reliable estimates because they use information from other areas to estimate the rates in a given region. In general, this procedure produces a set of incidence rates that, when they are presented on a thematic map, yield a less heterogeneous visual appearance than that produced by uncorrected incidence rates. Therefore, this pattern is usually referred to as smoothed.

3. Are the data sound?

Epidemiology data: para 1

This ecological study utilized dengue cases notified by the National Disease Surveillance Data System (SINAN). To understand whether data from this surveillance represented occurrence cases, author should have more description on how the National Diseases Surveillance conducted in which how was a dengue case reported and recorded. How was a mild cases without hospital admission identified and recorded to the SINAN

We agree with the reviewer’s comment. Thus, we change the paragraph on page five (5) of article revised to:

The SINAN is a system that contains the records of notifiable diseases from throughout the national territory, including suspected cases of dengue that are later confirmed by laboratory and/or epidemiological criteria. A suspected case of dengue constitutes a “person who lives or has traveled in the last 14 days to the area where dengue is being transmitted or where the presence of Ae. Aegypti, which features fever, usually between 2 and 7 days and present two or more of the following manifestations: nausea, vomiting, rash, myalgia, arthralgia, headache, retro-orbital pain, petechiae or positive tourniquet test and leukopenia”

The social economic data extracted from 2010 Demographic Census while cases were extracted from 2007 and 2008 NDSD. These two data sets seem not get along with each other regarding period of time for analysis.

Response to Reviewer: Socio-demographic data were obtained from a national reference base containing information on household level, from the Demographic Census conducted every ten years. Thus, we consider the period used in the analysis (2010) suitable for portraying, approximately, the living conditions of the population, and is closer to the information about the occurrence of the disease in the range studied (2007-2008).

Data analysis: para 1

The BI was mentioned as low completion in paragraph which discussed about entomologic data but in the Data analysis part, author still present that they were observed. Should check and have more explanation

We agree with the reviewer's comment. Thus, we change the second paragraph on page five (5) of article revised to:

To analyze the risk associated with the HI, we used the Health Department recommended classification as follows: Low-risk or satisfactory (HI<1%); Mid-risk or alert (HI <1-3.9%); and high-risk or dengue outbreak (HI>3.9%). The HI was calculated for the entire research period, but for our analysis, we used the period from October 2007-March 2008. This was the interval in which the highest $Ae. aegypti$ density occurred, which preceded the epidemic in 2008. Due to irregularities in monitoring, which resulted in a low completion rate of the Breteau Index (BI), we opted to exclude this index from the analysis.

Results

Para 4

The pending rates were high in 2007 and 2008, so more information about to what extent that those closed/refusals houses differed from participating houses and need be more discussed in the discussion session. Should analyze deeply regarding interaction among HI, geographical issues, and water supply and hygiene issues.

We agree with the reviewer's comment. Thus, the paragraph was modified on page six (6) of article revised:
The pending rate was also analyzed. **The pending rate is the number of pending closed houses/buildings, abandoned properties, and locations where there was a refusal to inspect the endemic control agents (ECA).** In addition, commercial properties that were considered unsuitable from a health point of view and that were not inspected by the agents were included. It is noteworthy that the outstanding properties are a major problem in combating viral vectors due to the lack of information about the existence of potential breeding sites. According to the National Health Department Guidelines for Prevention and Control of Dengue Epidemics, a high rate is considered to be 10 to 20% of pending cases and is grave when the pending ratio is above 20%. This represents a critical situation in which *Ae. aegypti* control requires urgent measures for to reduce its ratio.

6. Are the discussion and conclusions well balanced and adequately supported by the data? Conclusion lacks of information regarding association between incidence rate and HI, social economic factors

Response to Reviewer: Were brought in discussing aspects of the association between the incidence rate of dengue, HI and some sociodemographic indicators, highlighted, particularly in paragraphs on page thirteen, fourteen and fifteen (13, 14 and 15):

Regarding the correlation observed between the HI and the dengue Bayesian rate, the interval analyzed must be observed (January to August 2008) because it coincides with the reintroduction of the serotype 2 (DENV-2) in Rio de Janeiro State. When a virus that differs from those that are already circulating in the population is introduced, the presence of susceptible individuals can intensify the transmission process of the disease. Related to this fact is the increase in the *Ae. aegypti* population density that occurred due to the elevated temperature and humidity, which increases during summer and autumn.** It is possible to emphasize in this study that the highest infestation rates were observed predominantly in the summer, which is the season that had the highest temperatures and periods of rain.

Another aspect is the presence of the petrochemical enterprise (Comperj) in the Itaboraí municipality, which began construction in 2006. The arrival of large population contingents, the increase in the circulation of
susceptible individuals in areas of precarious basic sanitation conditions, the high population densities, and the increment in the population mobility all favor the possibility of vector density elevation and the increase in the vulnerability to the endemic in all of the areas that have been influenced by the industry. **It is worth noting that the current vector control measures will persist.** That is, if dengue transmission depends predominantly on population immunity, new epidemics will occur, as has occurred in other municipalities in the state of Rio de Janeiro, regardless of the presence of Comperj. However, the construction of this project certainly favored/amplified the occurrence of the 2007-2008 epidemic in Itaboraí. Therefore, it is important that continuous monitoring be conducted for subsidizing control actions and monitoring the disease in the city.

Associations were identified among the HI, the dengue incidence rate, and the sociodemographic indicators. We observed a positive association between the HI and the proportion of properties that were connected to the piped water supply. It is important to understand that only 27% of the properties have access to this service. However, the proportion of properties with wells, which are a possible alternative to the lack of piped water, is not associated with either the HI or the dengue incidence rate. This finding may be related to the irregularity of this service because this population also uses contained water storage, which facilitates the presence of potential breeding sites in the home and its surroundings. In contrast, the proportion of properties with adequate garbage collection was positively associated with both of these variables.

The observed association between the RSEX and HI indicators suggests that the presence of man (people) is strongly associated with the observed values of the vector infestation index in UVLs. Although we do not show the result of the calculation of this indicator in the manuscript, it was observed that among the 19 UVLs in the municipality of Itaboraí, five (5) have more men than women, and 14 have more women, though in 13 of the latter, the difference is very small. It should also be noted that in seven (UVLs 8,9,13,14,15 18 and 19) of the 13 UVLs in which there was a small difference between the numbers of men and women, the population density was very high. This situation shows that the REX indicator can function as a proxy for population density in the study area.
The urban infrastructure indicators should not be interpreted as risk factors for the disease, which should instead be associated with the magnitude or the house infestation indices in a linear pattern. The indicators should be interpreted as indirect markers of the occupation process and of the urban soil use, which indicates areas with distinct conditions of endemic receptivity. Receptivity is the "set of environmental, social, and behavioral characteristics that allow the reproduction of parasites and their maintenance in communities".

8. Do the authors clearly acknowledge any work upon which they are building, both published and unpublished?
Not yet

Response to Reviewer: We recognize, is cited in the number 1, 2 e 34 references.


9. Do the title and abstract accurately convey what has been found?
The title lacked the second part of the study that was the association of dengue cases and related factors.

We agree with the reviewer's comment. Thus, we modified the title of article revised to:

Association among house infestation index, dengue incidence, and sociodemographic indicators: Surveillance using geographic information system.
Response to reviewer: Matthew Eastin

All changes / alterations to the manuscript are written in red and strikethrough yellow.

Major Compulsory Revisions: None

Minor Essential Revisions and Recommendations:

1. Entire Manuscript: There are numerous English grammar errors and an excessive use of sequential prepositional phrases throughout the manuscript – several are listed below as examples but there are too many to list individually. The primary errors are related to (1) verb tense, (2) misplaced adjectives, (3) sequential prepositional phrases that could be replaced using adjectives, and (4) a few locations where the authors briefly switched to Latin language (presumably Portuguese). The authors are encouraged to carefully address these issues before re-submission – having a native English speaker review the manuscript may help.

Response ao reviewer: We conducted a review with rigor in the language, accordance with to the reviewer’s recommendations.

2. Page 2, Abstract – Results: By how much time did the HI peak precede the dengue occurrence peak?

Response ao reviewer: In the previous six months (October/2007 to March/2008) to the peak of the epidemic (January/08 to August/08).

3. Page 2, Abstract – Results: I am not convinced that proximity to the major highways was necessarily more important than local population density when identifying the four major risk regions. To make such a conclusion, evidence demonstrating that the source vectors and/or human hosts that initiated the local 2007-2008 dengue outbreak was the result or travel from other parts of Rio de Janeiro state. Rather your results seem to demonstrate that the dengue occurrence peaks were located in the UVLs with the highest population densities – which just so happen to be located along major highways.
Response ao reviewer: We agree with the reviewer's comment. Thus, in the paragraph of results was modified on page two (2) and page twelve (12) of article revised:

**Page one:** The dengue transmission pattern in Itaboraí showed that the increase in the vector density preceded the increase in incidence. The HI was positively correlated to the Bayesian dengue incidence rate ($r=0.641; p=0.01$). The higher risk areas were those that were close to the main highways. In the Kernel density estimation analysis, we observed that the regions that were at a higher risk of dengue were those that were located in the UVLs and had the highest population densities; these locations were typically located along major highways. Four nuclei were identified as epicenters of high risk.

**Page twelve:** In the Kernel estimate analysis, we observed that the highest dengue risk regions were located in the UVLs that had the highest population densities; these regions also happen to be located along major highways.

4. **Page 3, Background:** At several points in your Results and Discussion sections, you mentioned relationships between local climate (temperature, humidity, rainfall, etc.) and both mosquito density and dengue occurrence, but no background information regarding common climatic conditions favorable for Aedes aegypti survival are discussed. I would recommend adding a short paragraph to the Background section highlighting such information – restricting the literature review to Brazilian and/or South American studies would keep it simple but sufficient.

We agree with the reviewer's comment. Thus, we paragraph modified on page three (3) of article revised:

Another aspect that is emphasized in the epidemiologic surveillance of dengue is the geographic scale that is used in control strategies for and research into the disease. The transmission dynamic is strongly related to the local environmental characteristics, which makes it possible to identify differences in the spatial and temporal distributions of the disease.$^{15,16}$ The
transmission dynamic is also related to the climatic conditions that are favorable for the production of *Ae. aegypti*\textsuperscript{17}, such as precipitation and temperature\textsuperscript{18}.


5. Page 3, Background, second paragraph: What is “solid residue” – household garbage?

Response to reviewer: Exactly. Solid residue is what generally is called garbage, such as solid materials generated by human activity.

6. Page 3, Background, Second paragraph: Here, and throughout the subsequent manuscript, the authors refer to “control strategies” regarding mosquito density and dengue transmission – please describe what specific strategies are used by local authorities in the Itaborai municipality and/or the Rio de Janeiro state?

We agree with the reviewer's comment. Thus, in the second paragraph was modified on page three (3) of article revised:

The control strategies that are currently used include municipal sanitary surveillance to support surveillance and vector control actions, conducting entomological survey indicators, and monitoring the activity of the resistance of *Aedes* to insecticides using traps, but they have not been able to contain the endemic-epidemic process of the disease, which has reached the greater part of Brazilian municipalities situated in urban areas\textsuperscript{11}. In this context, entomologic surveillance is a fundamental instrument for the evaluation and operationalization of the control program indicators for this arbovirus\textsuperscript{12}. One of the challenges, however, is detecting the trustworthy entomologic indicators, which can estimate and correlate the density levels of *Ae. Aegypti* with dengue occurrence in a determined population\textsuperscript{13}.

7. Page 3, Area of Study: Reference the suggested new Figure 1 (see below) in this section.
We agree with the reviewer's comment. Thus, in the item Area of Study (page four) and Geographic data (page seven) was included to reference a new figure 1, respectively:

The Itaboraí municipality (latitude 22° 44’ 51” South, longitude 42° 51’ 21” West) is situated in the metropolitan region of Rio de Janeiro and has an area of 430.373 km², which corresponds to 8.08% of the region (Figure 1).

Using the information from the Census tracts (CT) of IBGE, from the Department of Planning and Coordination of Itaboraí, and from SISFAD sketches referent to the Itaboraí municipality, we built a territorial basis in which we considered 19 Local Surveillance Units, or UVLS (Figure 1).

![Figure 1. Map of location of UVLS the municipality of Itaboraí, State Rio de Janeiro, Brazil.](image)

8. Page 5, Study Design, second paragraph: Describe the surveillance activities in greater detail. What happens during a site survey? Are non-residential sites surveyed? How frequent are the sites surveyed? Are all sites surveyed, or only a randomly-selected subset of sites? What types of vector control programs are being evaluated?
Response reviewer: It is important to clarify that it was not specifically conducted a local survey for this study, but were obtained data on entomological indicators of an information system (SISFAD) in which is powered by endemics control Routine collection is recommended by the Ministry of Health It is carried out as follows:

**Entomological surveillance** - routine activities have as their main function to reduce mosquito breeding sites, using preferably mechanical methods. The larvicides, when displayed, should be used only in containers which can not be removed, destroyed, discarded, covered or manipulated so that they become incapable of allowing the reproduction vector. Routine actions, besides contributing to the reduction of infestation by Aedes aegypti, can prevent its reintroduction in other areas.

**Determining and/or monitoring of vector infestation levels** - the entomological surveillance activities should be performed routinely throughout the urban area of the municipality, in order to raise the indexes (building, Breteau, containers, etc.) to monitor the action taken and possible necessary redirects. Endemic circulation periods constitute ideal time to adopt measures to prevent future outbreaks.

**Intensifying the fight against vector** - the emergency activities should be taken in case of outbreaks and epidemics. In these situations, insecticide applications to ultra low volume are used to interrupt transmission (removal of infected females) and must be programmed for weekly repeats. The routine actions (visit house to house, population mobilization, clean-ups) should be reassessed and restarted immediately. In those situations where the epidemiological situation (outbreak or epidemic) indicate actions that may exceed the operational capacity of the municipality shall be asked to support state level.
9. Page 6, Entomologic Data: If significant irregularities in monitoring occurred such that the BI was not analyzed, then the (likely unrepresentative) BI values should not be shown in Table 1 nor discussed further in the Results and Discussion sections.

Response to reviewer: Dear reviewer, we consider important to present this index (BI) so we can bring a question of relevance for entomological surveillance, which is the lack of consistency of this index in some places. This is because good quality index will impact on the effectiveness of control measures and dengue surveillance at the local level as well as in the actions and state of planning for their municipalities.

10. Page 6, Epidemiological Data: Were the “notified cases” based on a diagnosis of common symptoms or were the cases laboratory confirmed? If laboratory confirmed, what test was used and were distinct serotypes identified?

Dear reviewer, the following paragraph was included in the item Study Design of article revised:

The SINAN is a system that contains the records of notifiable diseases from throughout the national territory, including suspected cases of dengue that are later confirmed by laboratory and/or epidemiological criteria. A suspected case of dengue constitutes a "person who lives or has traveled in the last 14 days to the area where dengue is being transmitted or where the presence of Ae. Aegypti, which features fever, usually between 2 and 7 days and present two or more of the following manifestations: nausea, vomiting, rash, myalgia, arthralgia, headache, retro-orbital pain, petechiae or positive tourniquet test and leukopenia".

11. Page 6, Epidemiological Data: Reference the suggested new Figure 2 (see below) in this section. Also, the data implies a regular annual cycle of HI and dengue occurrence – in what season are the peaks and what are
the typical climatic conditions (max/min temperatures, mean humidity, rainfall, etc.) compared to other seasons.

Response to reviewer: Figure 2 has been reworked to better understanding of vector infestation peaks (BI) and dengue incidence rate. Nevertheless, we do not use data on climate conditions, but the period before the occurrence of dengue cases relates to in a period of very hot and precipitation.

12. Page 6, Sociodemographic Data: Why are these specific variables selected? What aspects of Aedes aegypti behavior are you targeting through these variables? In particular, the mosquitoes use stagnant water sources to lay their eggs – which water supply variables implies open sources of stagnant water? Are these sources located inside the physical residence or outside but on the property?

Response to reviewer: The underlying idea was to use indicators that could represent a favorable context for production of dengue, based on the knowledge about disease transmission. Thus, variables were selected for certain elements involved in the process of transmission, for example socioedemográfico the population level.

13. Page 9, Second paragraph: What climatic conditions (temperature, humidity, and rainfall) prevailed during the three particular months of the HI peaks?

Response to reviewer: Although the data on climate conditions relevant to the epidemiological study of dengue, as already mentioned by other authors (Viana and Ignotti, 2013), this information was not used in this study because they are not available to the local level, in Itaboraí.

14. Page 11, last paragraph regarding the kernel estimates: As noted above, I am not convinced that proximity to the major highways was
necessarily more important than local population density when identifying the four major risk regions. To make such a conclusion, evidence demonstrating that the source vectors and/or human hosts that initiated the local 2007-2008 dengue outbreak was the result of travel from other parts of Rio de Janeiro state. Rather your results seem to demonstrate that the dengue occurrence peaks were located in the UVLs with the highest population densities – which just so happen to be located along major highways.

Response ao reviewer: We agree with the reviewer's comment. Thus, in the paragraph of results was modified on page one (1) and page eleven (11) of article revised:

**Page one:** The dengue transmission pattern in Itaboraí showed that the increase in the vector density preceded the increase in incidence. The HI was positively correlated to the Bayesian dengue incidence rate \(r=0.641; p=0.01\). The higher risk areas were those that were close to the main highways. In the Kernel density estimation analysis, we observed that the regions that were at a higher risk of dengue were those that were located in the UVLs and had the highest population densities; these locations were typically located along major highways. Four nuclei were identified as epicenters of high risk.

**Page eleven:** In the Kernel estimate analysis, we observed that the highest dengue risk regions were located in the UVLs that had the highest population densities; these regions also happen to be located along major highways. Four nuclei were identified as high risk.

**15. Page 13, discussion of the entomological indicators:** What stage of the *Aedes aegypti* lifecycle is the HI index designed to monitor? Is this stage ideal for the current study?

Response to reviewer: The stage of *Aedes aegypti* life cycle used for monitoring was the larval, as recommended by the Ministry of Health\(^6\). This study aimed to use the information from the health services, since this is the methodology used in vector control and surveillance activities.

**16. Page 14, top two lines:** Here is another location that would benefit from some discussion of the annual/seasonal cycle of climate factors (temperatures, humidity, and rainfall).
It was added to the paragraph (page 13 and 14) in which they are the two lines mentioned by the reviewer the sentence below:

Regarding the correlation observed between the HI and the dengue Bayesian rate, the interval analyzed must be observed (January to August 2008) because it coincides with the reintroduction of the serotype 2 (DENV-2) in Rio de Janeiro State. When a virus that differs from those that are already circulating in the population is introduced, the presence of susceptible individuals can intensify the transmission process of the disease. Related to this fact is the increase in the *Ae. aegypti* population density that occurred due to the elevated temperature and humidity, which increases during summer and autumn. It is possible to emphasize in this study that the highest infestation rates were observed predominantly in the summer, which is the season that had the highest temperatures and periods of rain.

17. Page 14, discussion of sociodemographic indicators: Please provide some discussion as the how the RSEX and HI variables are related at the 1% level (shown in Table 2).

We agree with the reviewer’s comment. Thus, was included a paragraph in discussion item at the bottom fifteen of article revised:

The observed association between the RSEX and HI indicators suggests that the presence of man (people) is strongly associated with the observed values of the vector infestation index in UVLs. Although we do not show the result of the calculation of this indicator in the manuscript, it was observed that among the 19 UVLs in the municipality of Itaboraí, five (5) have more men than women, and 14 have more women, though in 13 of the latter, the difference is very small. It should also be noted that in seven (UVLs 8,9,13,14,15 18 and 19) of the 13 UVLs in which there was a small difference between the numbers of men and women, the population density was very high. This situation shows that the REX indicator can function as a proxy for population density in the study area.
18. Page 14, discussion of sociodemographic indicators: Are homes with piped water more likely to have indoor water storage containers (e.g., indoor mosquito breeding sites) to supply water during periods of interrupted service, compared to homes with wells located outside (e.g., outdoor mosquito breeding sites)? Discussion of this topic may provide some additional insight to your results.

We agree with the reviewer’s comment. Thus, the paragraph has been changed of article revised:

Associations were identified among the HI, the dengue incidence rate, and the sociodemographic indicators. We observed a positive association between the HI and the proportion of properties that were connected to the piped water supply. It is important to understand that only 27% of the properties have access to this service. However, the proportion of properties with wells, which are a possible alternative to the lack of piped water, is not associated with either the HI or the dengue incidence rate. This finding may be related to the irregularity of this service \(^{35,36}\) because this population also uses contained water storage, which facilitates the presence of potential breeding sites in the home and its surroundings. In contrast, the proportion of properties with adequate garbage collection was positively associated with both of these variables.

19. Page 14, third full paragraph: Please clarify the phrases “occupation process” and “urban soil use”. How do these topics relate to endemic susceptibility?

We agree with the reviewer’s comment. Thus, the paragraph has been changed of article revised. The word susceptibility was replaced by receptivity in the first paragraph of sixteen page and added the phrase to explain the concept of receptivity:

The urban infrastructure indicators should not be interpreted as risk factors for the disease, which should instead be associated with the magnitude or the house infestation indices in a linear pattern. The indicators should be interpreted as indirect markers of the occupation process and of the urban soil use, which indicates areas with distinct conditions of endemic receptivity. Receptivity is the “set of environmental, social, and behavioral characteristics
that allow the reproduction of parasites and their maintenance in communities."


20. Table 1: Given the significant irregularities in monitoring BI (and thus the reported BI values may be unrepresentative) it would be wise to remove this data from the table.

As mentioned in question 9 of this opinion, we consider important to introduce these data in the BI function of being an index established by the Ministry of Health to support the surveillance activities and vector control at the local level. Although present a certain fragility, we chose to keep it to indicate to managers of health services the need for the index enhancement.

Suggestions for a revised set of figures:

Figure 1: The information currently provided in Figure 2a
Figure 2: The current Figure 1, but with two particular changes: (1) on the horizontal axis replace the numbers with the first letter of each month (J = January, etc.) and the years; (2) add color-coordinated vertical lines and/or vertical shading that highlight the peak HI and dengue occurrence periods that are used to construct the maps show in the current Figure 2 b and 2c.
Figure 3: The current Figures 2b and 2c, but add a third panel showing population density for each UVL in the study area.
Figure 4: The current Figure 3, but flip the color scale so small values are light yellow and large values are orange.
Figure 5: The current Figure 4 – no changes – it looks great.

Response to reviewer: Based on the suggestions given by the reviewer figures have been modified / changed for the better reader's understanding.
Discretionary Revisions and Recommendations

We agree with the reviewer’s comment. Thus, the paragraphs below have been changed in the revised article:

1. Page 2, Abstract – Background: Add the following text to the last sentence “…sociodemographic indicators during a prominent dengue outbreak in 2007 and 2008.”

We identified dengue transmission areas using the Geographic Information System at the local surveillance units of the Itaboraí municipality in Rio de Janeiro state. We considered the association among the house infestation index, disease incidence, and sociodemographic indicators during a prominent dengue outbreak in 2007 and 2008.

2. Page 2, Abstract – Methods: Remove “in 2007 and 2008” from the first sentence and “of the” from the second sentence. Also, in the fourth sentence, replace “average” with “mean”. Lastly, the final two sentences could be condensed to “The higher risk areas for dengue occurrence were detected through kernel density estimation” and yet provide sufficient information for the abstract – the details about the specific kernel and bandwidth filter can be left for the reader to find in the full Methods section.

In this ecological research the Local Surveillance Units (UVLs) of the municipality were used as spatial pattern units. For the house analysis we used the period of higher vector density previous to the larger magnitude epidemic range of dengue cases. The average dengue incidence rates calculated in this epidemic range were smoothed through the Bayesian method. The association between the House Infestation Index (HI), the Bayesian rate of the average dengue incidence, and the socio demographic indicators was evaluated using Pearson’s correlation coefficient. The higher risk areas for dengue occurrence were detected using kernel density estimation, by means of the kernel quartic function.
Dengue is the most important arbovirus that affects humans. It is transmitted by the sting of infected *Ae. aegypti* females. This species exhibits endophilic and anthropophilic behavior\(^1,2,3\) and has ample distribution in urban and suburban environments, where there is a high population density. According to the World Health Organization, dengue puts approximately 2.5 to 3 billion people in more than 100 endemic countries at risk, especially in the **Tropical and Subtropical areas**\(^4\). Over the last two decades, dengue incidence has significantly increased in endemic areas, particularly in the **Americas**, where there is a co-circulation of four serotypes\(^5\). In Brazil, the number of notified cases between 2007 and 2012 was 3,730,507, and the Rio de Janeiro State and the Itaboraí municipality registered 628,708 and 16,383 cases, respectively\(^6\).

The Itaboraí municipality (latitude 22° 44’ 51” South, longitude 42° 51’ 21” West) is situated in the metropolitan region of Rio de Janeiro and has an area of 430.373 km\(^2\), which corresponds to 8.08% of the region (Figure 1). The population is 218,008 inhabitants, and the demographic density is 506.56/km\(^2\). Itaboraí is 17 m above sea level and is located 40 km from the municipality of Rio de Janeiro and 75.57 Km from the coastline and the Eastern region of the state. It has 79 neighborhoods (Ibge 2010) that are divided into 8 districts: Centro (thirty-three neighborhoods), Porto de Caixas (two neighborhoods), Itambi (eight neighborhoods), Sambaetiba (six neighborhoods), Visconde de Itaboraí (seven neighborhoods), Cabuçu (seven neighborhoods), Manilha
(thirteen neighborhoods), and Pacheco (three neighborhoods). The districts of Cabuçu and Pachecos are predominantly rural with small urban nuclei and are characterized as rural-urban areas.

6. Page 5, Area of Study: When is the construction of the petrochemical complex expected to be completed?

Response to reviewer: The initial forecast is August 2016, however, the works are delayed.

7. Page 5, Methods, Study Design, second paragraph: Replace “…it is in place…” with “…it has been in place…”

SISFAD is a system that allows for the computerization of data related to the control activities for the dengue vector of the National Dengue Control Program (PNCD). It has been in place since 1997. This system registers entomologic surveillance activities, which allows us to evaluate the effectiveness of the vector control programs.

8. Page 8, Data Analysis, second paragraph: Replace “…for this approach includes de spatial…” with “…which includes spatial…”

For each UVL, we calculated the mean incidence ratio of dengue by dividing the new case numbers registered in the period from January to August 2008 by the estimate resident population during 2008. To minimize the instability problem of the incidence rate calculated for small areas, we used the local empirical Bayesian approach. This approach includes spatial proximity effects by using the information from the regions that neighbor the geographical area to estimate the incidence rate. Empirical Bayesian procedures yield more reliable estimates because they use information from other areas to estimate the rates in a given region. In general, this procedure produces a set of incidence rates that, when they are presented on a thematic map, yield a less heterogeneous visual appearance than that produced by uncorrected incidence rates. Therefore, this pattern is usually referred to as smoothed.
9. Page 9, Second paragraph: Move “a peak” to before the parenthetical statement.

In Figure 3, we can observe that the dengue incidence rates increased in the months of February and March, but the differences were small. In April 2008, however, a peak (65.94 per ten thousand inhabitants) can be observed in the incidence rate during the researched period, which was preceded by increases in the house infestation indices during November 2007 (1.02%), decreasing between December and February, and increasing again in March and April 2008 (0.99%).

10. Page 10, First paragraph after Table 1: Replace the first sentence with the following condensed version, “Figure 3 contains mean dengue incidence during the January to August 2008 epidemic period and the HI during its peak period (October 2007 to March 2008) immediately prior to the epidemic period.”

Figure 3 shows the mean dengue incidence rates during the January to August 2008 epidemic period and the HI during its peak period (October 2007 to March 2008) immediately prior to the epidemic period. Most of the UVLs’ HI were below 0.99% and were considered low risk. Although UVLs ita15 and ita19 (which were completely urban) had the highest HI (which was situated in the mid-risk range) in the time frame researched, the UVLs had dengue incidence indices of 80 to 120 notified dengue cases per 10 thousand inhabitants and 40 to 80 cases per 10 thousand inhabitants, respectively.

11. Page 11, second paragraph: Attach this sentence to the end of the last paragraph on the previous page.

By mapping the water supplies according to the UVLs, we can observe the precarious water supply on an intra-municipal scale where most UVLs, in which houses are linked to the piped supply, do not surpass the second interval of the class distribution (0.01 to 20.0). However, almost all of these UVLs contain houses that use wells as their water supply (Figure 4). Considering the municipality as a whole, it can be observed that only 27.9% of the properties are linked to the piped water supply and that approximately 80% of the houses use a well to obtain their water.
12. Page 13, fifth line from the bottom: Begin a new paragraph with “Regarding...”

Response to reviewer: Changes in the manuscript.

13. Page 14, second paragraph: It would be interesting to speculate (or at least offer as an item of future work) as to whether the completion of the petrochemical site construction will lead to a decrease in dengue occurrence (implying a primary vector source outside the Itaborai municipality) or similar dengue occurrences (implying the primary vector source is local).

We agree with the reviewer's comment. Thus, we include a paragraph in the fifteen page.

Another aspect is the presence of the petrochemical enterprise (Comperj) in the Itaborai municipality, which began construction in 2006. The arrival of large population contingents, the increase in the circulation of susceptible individuals in areas of precarious basic sanitation conditions, the high population densities, and the increment in the population mobility all favor the possibility of vector density elevation and the increase in the vulnerability to the endemic in all of the areas that have been influenced by the industry. It is worth noting that the current vector control measures will persist. That is, if dengue transmission depends predominantly on population immunity, new epidemics will occur, as has occurred in other municipalities in the state of Rio de Janeiro, regardless of the presence of Comperj. However, the construction of this project certainly favored/amplified the occurrence of the 2007-2008 epidemic in Itaborai. Therefore, it is important that continuous monitoring be conducted for subsidizing control actions and monitoring the disease in the city.

14. Page 15: The second and third paragraphs could be combined.

For the HI analysis, the number of pending cases (closed houses or refusals) was high, which gave the false impression that the entire area that was inspected was inspected by the municipal agents of endemic control. It is understood that 100% of the properties must be treated, which has evident implications for the control strategies adopted in the municipality, because
closed properties might have vector focuses that cannot be identified in time. Regarding the SISFAD, aside from the restrictions regarding data reliability, we believe that the information obtained will be important for analyzing the dengue transmission dynamics in Itaboraí.