PEER REVIEW HISTORY

BMJ Open publishes all reviews undertaken for accepted manuscripts. Reviewers are asked to complete a checklist review form (**http://bmjopen.bmj.com/site/about/resources/checklist.pdf**) and are provided with free text boxes to elaborate on their assessment. These free text comments are reproduced below.

ARTICLE DETAILS

TITLE (PROVISIONAL)	Assessing environmental injustice in Kansas City by linking pediatric asthma to local sources of pollution: a cross-sectional study
AUTHORS	Friedman, Elizabeth; Lee, Brian; Rahn, David; Lugo Martinez, Beto; Mena, Atenas

VERSION 1 – REVIEW

REVIEWER	Sharma, Rachit Drexel University
REVIEW RETURNED	14-Dec-2023

GENERAL COMMENTS	Thank you for the opportunity to review this manuscript. The authors, through their collaborative efforts with the study population, highlight the importance of working closely with environmental justice communities to better inform local environmental policies and actions. They conducted a proximity-based, census tract-level analysis to examine the relationships between residential proximity to polluting sources and pediatric asthma in Kansas City. While the analysis conducted and the findings shared are well presented and most of the manuscript is well written, I do have some concerns regarding some of the arguments made by the authors and the lack of discussion around what could be sources of bias in this study. This would require substantial revision in my humble opinion. My major concerns are as follows: 1. In the Background section lines 16-21, the authors criticize EPA's KC-TRAQS study without mentioning its objectives, approach, and findings. Moreover, the specific criticisms that the authors describe appear to be subjective to the authors' understanding and do not have any references. 2. In the Background section lines 22-23, the authors highlight that the community was interested in understanding the type and amount of air pollution being released in the neighborhoods. However, in the writing that follows, it is unclear whether it was an objective of the present study or not. 3. In the Background section lines 42-45, only one study has been cited (Reference #8) while referring to "previous analyses". Has

	only one such study been conducted in this population? What about the EPA KC-TRAQS study and any other studies? 4. In Background section lines 47-50, ‘we were not able to present the data in a way that prioritized certain neighborhoods for intervention over others; what was missing from previous analyses, according to community organizers, was applicability of the data for community organizers and decision makers.’, it is unclear why the authors were not able to present the data the prioritized neighborhoods for intervention? What specific information was lacking previously that this study promises to address? 5. In the Methods-Analysis section, it is mentioned that a multivariable Poisson regression was fit. Which multiple variables were fit as predictors of asthma rates here? 6. While the main findings presented are encouraging, these could be biased, and the authors have not discussed them at all. Sources of bias in this study could include ecological fallacy, potential confounding and/or effect modification by the individual- as well as -area/ census tract level socioeconomic status, exposure misclassification due to exposures at school and residential mobility, selection bias into the study etc. 7. Claims made in lines 55-57 on page 9 and lines 3-7 on page 10 are not supported with any references. 8. Ethical approval statement and conclusion statement are completely missing. My minor concerns/ suggested edits are as follows: 1. In Background section line 4, ‘It is known that mostly low income, minority populations live in the areas surrounding the transportation corridors and railyards’, does this generalization apply to Kansas City, the entire US, or globally? 2. In the Background section line 39, ‘it is demonstrative of health inequities through the US’, it is unclear what kind of inequalities are being implied. Are these inequalities based on geography, gender, socioeconomic status, or other factors? 3. Many acronyms are not spelled out when they first appear in text. For example, EHR, PM2.5, BC, etc. The numbers in pollutant abbreviations are also not accurately subscripted throughout the manuscript.

REVIEWER	Lu, Chan Central South University, XiangYa School of Public Health
REVIEW RETURNED	27-Jan-2024

GENERAL COMMENTS	This manuscript is relatively new and has a great meaning. This paper reports on a cross-sectional study conducted by the grassroots environmental justice organization CleanAirNow in Kansas City. The study investigates the disproportionate exposure of residents living near the largest classified railway yard in the United States to air pollution. This article is well-designed and written in a scientifically logical manner. However, there are some problems in this manuscript.

	Due to the great meaning and a possibility in an improvement after a major revision, I suggest the editor accept this manuscript with major revision. I have some comments and suggestions for this manuscript as follows: 1. Provide more detailed information about the steps and processes involved in the data collection at Children's Mercy Kansas City Hospital, including the time frame for data acquisition, the demographic scope involved, and how missing data is handled. 2. Elaborate on the specific method for calculating the distance from patient addresses to the nearest sources of pollution (TRI facilities, railway yards, and highways). This should include the formula used for distance calculation and the tools employed in the process. 3. The article mentions limitations such as data resolution and geographical range, but fails to delve into how these limitations might impact the study's conclusions. Reviewers suggest strengthening the discussion on the study's limitations and proposing recommendations for future research to address these constraints. 4. When introducing the data sources, the author mentions the use of data from Children's Mercy Kansas City Hospital but does not address the quality, completeness, and potential limitations of this data. Reviewers recommend providing more information about the data source in the article to enhance readers' understanding of the data's credibility. 5. In the discussion section, explore potential biases that could affect the results, including selective reporting, data gaps, or other systemic biases. 6. Review the language and writing style throughout the entire article, ensuring there are no ambiguous expressions, spelling errors, or grammar issues. Maintain the rigor and clarity expected in academic papers. 7. I recommend the authors citing the following references in your introduction and/or discussion sections to support the idea and findings: [1] Association between early life exposure to indoor environmental factors and childhood asthma[J]. Building and Environment, 2022, 226: 109740. [2] Impacts of intrauterine and postnatal exposure to air pollution on preschool children's asthma: A key role in cumulative exposure. Building and Environment, 2023, 245: 110874. [3] The role of meteorological parameters on childhood asthma: Identifying critical windows of susceptibility during pregnancy. Building and Environment, 2023, 243: 110668. [4] Effect of NO2 exposure on airway inflammation and oxidative stress in asthmatic mice. Journal of Hazardous Materials, 2023: 131787.

REVIEWER	nazario, Sylvette University of Puerto Rico, Medicine
REVIEW RETURNED	12-Feb-2024

GENERAL COMMENTS	The authors of the study conducted research to explore the potential correlation between pediatric asthma cases and visits to the nearby hospital and the exposure to various pollution sources such as railroads, highway traffic, and toxic industrial pollutants in residential areas. They used geocoding and appropriate methods to identify a statistically significant negative correlation between proximity to pollutant sources and asthma visits. The authors also noted the importance of local weather factors, such as wind direction. In the future, the study can explore the effect of other climatological factors like temperature, humidity, hour of the day, or season. Moreover, the authors conducted a thorough literature review and acknowledged the limitations of their study. Although the topic of this study is not novel, it was conducted in collaboration with local community members, which is a strength of this work. This ensured that the community had a say in the study without any evidence of biasing the reports of the results. Therefore, I recommend accepting the article without revision.

VERSION 1 – AUTHOR RESPONSE

Reviewer: 1
Dr. Rachit Sharma, Drexel University

Comments to the Author:
Thank you for the opportunity to review this manuscript.

The authors, through their collaborative efforts with the study population, highlight the importance of working closely with environmental justice communities to better inform local environmental policies and actions. They conducted a proximity-based, census tract-level analysis to examine the relationships between residential proximity to polluting sources and pediatric asthma in Kansas City.

While the analysis conducted and the findings shared are well presented and most of the manuscript is well written, I do have some concerns regarding some of the arguments made by the authors and the lack of discussion around what could be sources of bias in this study. This would require substantial revision in my humble opinion.

My major concerns are as follows:

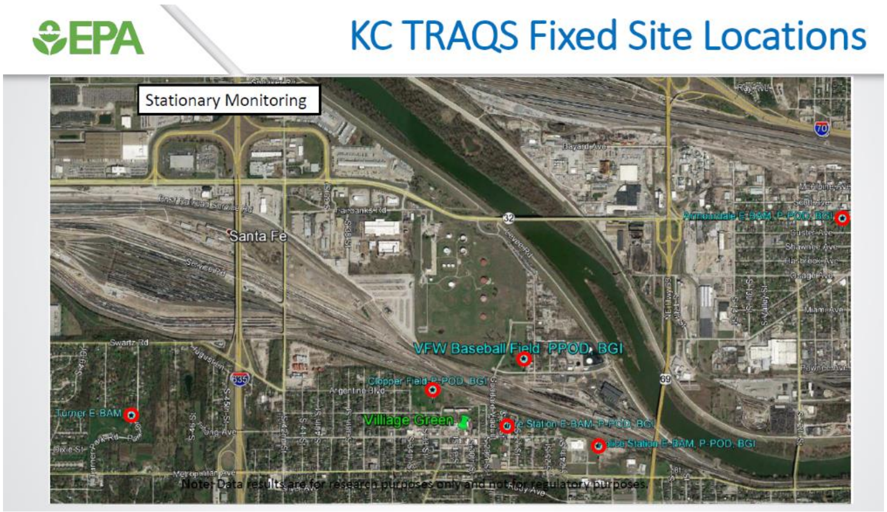
1. In the Background section lines 16-21, the authors criticize EPA's KC-TRAQS study without mentioning its objectives, approach, and findings. Moreover, the specific criticisms that the authors describe appear to be subjective to the authors' understanding and do not have any references.

> *You make a good point, and this may be work in gray space. KC TRAQS started because of a request by community activists (The Good Neighbor Committee) who had done their own air monitoring. The intentions of the asking community members was to understand better the correlation between local air pollution and health for the community living adjacent to the railyard and nearby industrial parks. They wanted to know both measures of exposure and also health correlates. This is not documented in any formal literature but has been passed down, by those community members. We had hoped this coming from community perspective was clear in stating, "according to CANKC leadership and members… …" The objectives of*

the KCTRAQS study was to measure air quality near the railyard of concern. Taken from their publication, KCTRAQS was a one year air quality study that utilizes several measurement instrument approaches and multiple locations in the study area and the purpose was to characterize the impact of local air pollution sources (PM2.5) in and around the Argentine community including the neighborhoods of Turner and Armourdale. Secondarily it would compare different technologies to monitor PM2.5 with additional opportunities for "citizen science".

The objectives of the EPA research team were not aligned with those of the community and its request.

While beyond the scope of this article, and while it is from unpublished work, included is a graphic showing the EPA's stationary air monitor placement for the KC TRAQS study.


EPA
KC TRAQS Fixed Site Locations
Stationary Monitoring
Santa Fe
Armourdale E-BAM, P-POD, BGI
VFW Baseball Field PPOD, BGI
Clopper Field P-POD, BGI
Turner E-BAM
Village Green
Fire Station E-BAM, P-POD, BGI
Police Station E-BAM, P-POD, BGI
Note: Data results are for research purposes only and not for regulatory purposes.

You can see from the image that most of the monitors are southeast of the railyard. Wind in this part of the city tends to flow northeast, so the downwind effects and exposures from the railyard of concern were effectively not measured. Additionally, the air monitor placement did not involve community members and monitors were not placed in residential areas. This was referred to as short sighted by our community partners – simply in the context of the importance of community engagement.

We have made some adjustments to the Background section to address the reviewer's concerns, including improving our description of limitations of prior research. We hope these changes provides a stronger and clearer premise for the report overall.

2. In the Background section lines 22-23, the authors highlight that the community was interested in understanding the type and amount of air pollution being released in the neighborhoods. However, in the writing that follows, it is unclear whether it was an objective of the present study or not.

We agree with your observation. We have adjusted to the text to address this lack of clarity in the manuscript. The following paragraphs explain in more detail the challenges we faced in achieving the objectives set by community members.

When our team began meeting at the beginning of the pandemic, our first aim was "to collect, characterize, and evaluate the quality of available environmental exposure data for use in a *local air quality and health study." We requested the EPA's air pollution data and also utilized the regulatory monitors in place unrelated to the KCTRAQS study as well as several low-cost air sensors placed by CleanAirNow members at their homes.*

Our climate scientist, Dr Rahn, using the datasets developed models whereby we could assess the ranges of measures of ozone, PM2.5, SOx, NOx and Black Carbon (BC) over both space (geographically) and time. What we found was that the range of ozone levels was not great enough to indicate differences in high resolution geographical parts of the community. This was expected. Unfortunately, we found the same to be true for BC, which was a top interest of community members. Ultimately, we were able to use PM2.5 distribution as an exposure measure – for a geospatial study of the area. We were not, however, able to complete a time-lag series as hoped, because the collected measurements of pollution did not lend themselves to this type of analysis and because our patient data, specific to the timeframe of the air quality dataset, was too small.

Please see next response for continuation of this explanation.

3. In the Background section lines 42-45, only one study has been cited (Reference #8) while referring to "previous analyses". Has only one such study been conducted in this population? What about the EPA KC-TRAQS study and any other studies?

The previous study referenced was our team's previous publication and research (some unpublished) and the work and discussions mentioned above. We did several analyses and documented the most relevant in that previous publication. Yes, this is the only study that has correlated pediatric patient asthma data in Kansas City with air pollution exposure. Census data. Other national datasets were used to develop a report called "Racism in the Heartland," a collaborative project between CleanAirNow and Union of Concerned Scientists. The data scientist for this report did look at adult asthma rates and proximity to highways, railroads and TRI facilities, but did not have access to the high-resolution Electronic Health Record (EHR) hospital data provided by Children's Mercy, Kansas City. That said, this document has been added as a reference elsewhere in the article. I have not been able to identify similar research reports from our city, specific to the community adjacent to the BNSF Classification railyard and nearby industrial parks.

4. In Background section lines 47-50, 'we were not able to present the data in a way that prioritized certain neighborhoods for intervention over others; what was missing from previous analyses, according to community organizers, was applicability of the data for community organizers and decision makers.', it is unclear why the authors were not able to present the data the prioritized neighborhoods for intervention? What specific information was lacking previously that this study promises to address?

This is such an important issue. We have made some adjustments to the language of this section, and hope it addresses the reviewer's concern. Following is a more detailed explanation. We worked with several geospatial analysts throughout our process. People left for personal reasons (pregnancy, new job). One of our partners had the skillset to overlay census data with neighborhood boundaries defined by various local government offices (i.e. city halls). We were able to display our data in the context of neighborhoods (as defined by local community members, i.e. Argentine, Armourdale, and Turner, KS, each of which have school districts and public libraries but are combined in congressional regions and not reflected in census datasets) at various stages of our work together. Referring to neighborhoods as both local community members and local politicians do, we believe, gives *the data and narrative more strength – especially when being reported to local decision makers on land use and regulation enforcement.*

Unfortunately, when the time came to combine the datasets that included our very local regional boundaries (neighborhood boundaries) we were able to obtain neither the datasets nor the coding from our former analyst who relocated geographically and professionally. Because our community partners had a timeframe in which they needed this report completed, we agreed to complete this phase of our work using Census tracts.

5. In the Methods-Analysis section, it is mentioned that a multivariable Poisson regression was fit. Which multiple variables were fit as predictors of asthma rates here?

We thank the reviewer for pointing that out. To make the model specification clear to the reader, we have inserted a footnote to Table 3 which states: "Note: adjusted incidence rate ratios (IRR) are based on Poisson models that included railyard directionality, railyard distance, TRI distance, and highway distance"

6. While the main findings presented are encouraging, these could be biased, and the authors have not discussed them at all. Sources of bias in this study could include ecological fallacy, potential confounding and/or effect modification by the individual- as well as -area/ census tract level socioeconomic status, exposure misclassification due to exposures at school and residential mobility, selection bias into the study etc.

We agree with the reviewer that residual confounding and all potential biases can not be entirely removed. We have attempted to highlight the errors and biases we consider as having the greatest impact on our findings in the Limitations paragraph. We do specify the possibility of selection biases by not having asthma data from other healthcare providers. That said, with 50-75% of asthma encounters in the KC metro area seen by our healthcare system (Methods section), our hope is this may lessen the potential for bias. We certainly recognize the reviewer's point that the data do not support any causal claims about which exposure(s) proceeded the asthma patient decision to seek medical care. We have added additional sentences to the Limitations paragraph.

1) *Our aggregated asthma rates and proximity to pollution sources do not support causal claims that pollution was the cause for asthma seeking patterns*
2) *We make the assumption that pollution exposure was ubiquitous within each community*
3) *These findings are specific to one Midwestern metropolitan area and therefore may not generalize to other regions*

Please note that as a team, we were mindful to use as much plain language as possible, so that the content could be understood beyond academic circles.

7. Claims made in lines 55-57 on page 9 and lines 3-7 on page 10 are not supported with any references.

References have been added. Thank you for pointing this out.

8. Ethical approval statement and conclusion statement are completely missing.

Our COI statements are included under Statements and Declarations and our IRB exemption status is mentioned in the Methods section (page 5/19, line 8). A conclusion has been added.

My minor concerns/ suggested edits are as follows:

1. In Background section line 4, 'It is known that mostly low income, minority populations live in the areas surrounding the transportation corridors and railyards', does this generalization apply to Kansas City, the entire US, or globally?

Though, I believe it is an acceptable statement for the United States, we have addressed this with a reference that highlights this situation specifically in Kansas City.

2. In the Background section line 39, 'it is demonstrative of health inequities through the US', it is unclear what kind of inequalities are being implied. Are these inequalities based on geography, gender, socioeconomic status, or other factors?

We have added some language to this section by referring simply to several demographic factors – as this language fits the national surveillance studies referenced.

3. Many acronyms are not spelled out when they first appear in text. For example, EHR, PM2.5, BC, etc. The numbers in pollutant abbreviations are also not accurately subscripted throughout the manuscript.

These matters have been corrected. Thank you.

Reviewer: 2
Dr. Chan Lu, Central South University

Comments to the Author:
This manuscript is relatively new and has a great meaning. This paper reports on a cross-sectional study conducted by the grassroots environmental justice organization CleanAirNow in Kansas City. The study investigates the disproportionate exposure of residents living near the largest classified railway yard in the United States to air pollution. This article is well-designed and written in a scientifically logical manner. However, there are some problems in this manuscript.

Due to the great meaning and a possibility in an improvement after a major revision, I suggest the editor accept this manuscript with major revision.

I have some comments and suggestions for this manuscript as follows:

1. Provide more detailed information about the steps and processes involved in the data collection at Children's Mercy Kansas City Hospital, including the time frame for data acquisition, the demographic scope involved, and how missing data is handled.

For our study we utilized Business Intelligence to generate a cohort of patient encounters who had at least one of the ICD asthma codes documented. The age restriction (0-19 years) and county of residence were inserted as filters on the EHR report. The data were not filtered on any additional demographic factors. The list of records was then downloaded and the additional exclusion criteria was applied – patients with only one asthma encounter during the study time period were excluded.

> *Essential variables in our cohort included patient age, household address, encounter date, and encounter type (i.e., outpatient, emergency department, urgent care, or inpatient). Extracting additional demographic/clinical characteristics of the patients was not necessary for this study. We had no missing data. Much of this content was not included in the manuscript due to limited space and several other priorities highlighted by our community partners. The timeframe selected for data acquisition is now explained in the Population data section of the Methods section.*

2. Elaborate on the specific method for calculating the distance from patient addresses to the nearest sources of pollution (TRI facilities, railway yards, and highways). This should include the formula used for distance calculation and the tools employed in the process.

> *We thank the reviewer for the suggestion. For clarification and reproducibility purposes we have modified the Methods section to indicate: "The sp R package (Pebesma and Bivand) was utilized to project our spatial files onto a common coordinate reference system. Euclidean distances between centroids were calculated using the regeos R Package (Bivand and Rundel)."*

3. The article mentions limitations such as data resolution and geographical range but fails to delve into how these limitations might impact the study's conclusions. Reviewers suggest strengthening the discussion on the study's limitations and proposing recommendations for future research to address these constraints.

> *Please see our responses to the 6th point raised by Reviewer #1. We have modified the Discussion section to include additional limitations.*
>
> *Regarding future research, in the discussion section we state:*
>
> *"Further research is needed to better identify thresholds for exposure and background pollution levels as well as differentiating between pollution types whilst still acknowledging cumulative exposure. In this case, next steps may include conducting similar studies but adding sufficient, hyper-localized, measures of pollution currently being gathered by community members."*

4. When introducing the data sources, the author mentions the use of data from Children's Mercy Kansas City Hospital but does not address the quality, completeness, and potential limitations of this data. Reviewers recommend providing more information about the data source in the article to enhance readers' understanding of the data's credibility.

> *See our earlier response regarding the process on how data were collected. We have modified the Methods section to add additional detail on how the data were ascertained. We recognize the electronic information collected from the EHR is there for clinical documentation, not solely for research purposes. We did limit the amount variables extracted from the EHR partly to avoid missing data. Asthma cases were identified using standardized ICD-9/10 codes, rather than relying solely on provider notes.*

5. In the discussion section, explore potential biases that could affect the results, including selective reporting, data gaps, or other systemic biases.

> *Please see our responses to the 6th point raised by Reviewer #1. We have modified the Discussion section to include additional limitations. Two key factors are us mentioning a possible influence from selection bias as well as our inability to draw causal claims.*

6. Review the language and writing style throughout the entire article, ensuring there are no ambiguous expressions, spelling errors, or grammar issues. Maintain the rigor and clarity expected in academic papers.

> *We thank the reviewer and have updated the writing, including defining acronyms, removing some redundancies, and moving select sentences.*

7. I recommend the authors citing the following references in your introduction and/or discussion sections to support the idea and findings:

> [1] Association between early life exposure to indoor environmental factors and childhood asthma[J]. Building and Environment, 2022, 226: 109740.
> [2] Impacts of intrauterine and postnatal exposure to air pollution on preschool children's asthma: A key role in cumulative exposure. Building and Environment, 2023, 245: 110874.
> [3] The role of meteorological parameters on childhood asthma: Identifying critical windows of susceptibility during pregnancy. Building and Environment, 2023, 243: 110668.
> [4] Effect of NO2 exposure on airway inflammation and oxidative stress in asthmatic mice. Journal of Hazardous Materials, 2023: 131787.

Reviewer: 3
Dr. Sylvette nazario, University of Puerto Rico

Comments to the Author:
The authors of the study conducted research to explore the potential correlation between pediatric asthma cases and visits to the nearby hospital and the exposure to various pollution sources such as railroads, highway traffic, and toxic industrial pollutants in residential areas. They used geocoding and appropriate methods to identify a statistically significant negative correlation between proximity to pollutant sources and asthma visits. The authors also noted the importance of local weather factors, such as wind direction. In the future, the study can explore the effect of other climatological factors like temperature, humidity, hour of the day, or season. Moreover, the authors conducted a thorough literature review and acknowledged the limitations of their study. Although the topic of this study is not novel, it was conducted in collaboration with local community members, which is a strength of this work. This ensured that the community had a say in the study without any evidence of biasing the reports of the results. Therefore, I recommend accepting the article without revision.

Reviewer: 1
Competing interests of Reviewer: None.

Reviewer: 2
Competing interests of Reviewer: None

Reviewer: 3
Competing interests of Reviewer: I do not have competing interests.

VERSION 2 – REVIEW

REVIEWER	Sharma, Rachit Drexel University
REVIEW RETURNED	10-Apr-2024

GENERAL COMMENTS	My concerns and comments have been adequately addressed. Thank you and best wishes.

REVIEWER	Lu, Chan Central South University, XiangYa School of Public Health
REVIEW RETURNED	24-Mar-2024

GENERAL COMMENTS	Many thanks for the authors' revision. The authors have addressed most of my comments.

VERSION 2 – AUTHOR RESPONSE