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Dear Dr. Li:

The research article entitled “The Color of Health: Residential Segregation, Light Rail Transit Developments and Gentrification in the United States” (IJERPH-589164) has undergone the suggested remaining revisions submitted by the reviewers. This accompanying letter explains the details of these revisions. Please note that for each comment/recommendation from Reviewer #1 (RE#1) and Reviewer #2 (RE#2) I have responded in blue text. The actual edits that were completed in the manuscript are indicated by red text, which have been outlined in this letter. The edits are also shown using “track changes” within the actual manuscript (Tehrani, Wu, Roberts- REVISED MARKED MANUSCRIPT – IJERPH-589164 - 9.24.2019).

**REVIEWER #1 (RE#1) COMMENTS**

**RE#1 (1)** –
“In this review of relevant literature, the authors dive into the often-puzzling relationship among such urban forces as recent public transportation investments in local communities, gentrification of neighborhoods, displacement from gentrifying neighborhoods and the health outcomes of residents of these areas, both those who leave and those who are able to stay behind. This is a thorough and mostly complete literature review, one that should be references and cited by scholars seeking to examine how political and economic forces like transportation policy and infrastructure affect our health and well-being. “

Thank you for reading this paper and your kinds words.

**RE#1 (2)** –
“In short, transportation policy may be color-blind when it is written on paper, but as the authors show, there is consensus in the field that where people live and what assets exist in their communities exerts a powerful effect on health outcomes. Given how historical zoning and planning policies created intense segregation over the 20th century in American cities, it is crucial to continue updating this field of research to understand how more recent urban development alters (or in some cases, does not alter) the very basic question of where we live, and why.”
We completely agree with your comment and wanted to share our inference in this manuscript.

RE# 1 (3) –
“The authors make an implicit claim that public transportation, such as light rail, can be conceptualized as a social determinant of health, and given the evidence they cite it is difficult to disagree. When once considers the importance of light rail and related transportation methods to 21st century urban development, when cities will only get larger and denser, public transportation must continue to exist. Therefore, the section on how much gentrification actually occurs as a result of light rail development and how much that gentrification actually connects to neighborhood transition and gentrification should be of special interest to readers. The overall conclusion may be a bit dissatisfying, but is by no means surprising. There simply isn’t any consensus as to whether displacement will occur and what is to blame for it. But, there are indeed health consequences for both those who must leave gentrifying areas and those who are able to hold the course. For researchers of chronic health concerns like hypertension, depression, anxiety, smoking and obesity, the citations offered by the authors will help produce an understanding of health outcomes that takes geographic place seriously.”

Thank you again for your comments.

RE#1 (4) –
“However, given that some published studies find displacement to be a serious issue and others do not, a bigger question remains, one that the authors or future researchers might consider addressing. The authors acknowledge very early on that transportation policy is a crucial element of preparing cities for the 21st century and addressing problems like inequality, sprawl, pollution and traffic congestion. One is left to wonder: if deindustrialization is bad, and white flight is bad, and vacancy is bad, and suburbanization is bad but reinvestment, gentrification and neighborhood transition is also bad – doesn’t that leave us paralyzed?”

By acknowledging that urban development, transportation policy and gentrification are matters needing careful consideration, we can then move forward in manner that is not so paralyzing.

REVIEWER #2 (RE#2) COMMENTS

RE#2 (1) –
“Dear authors of “The Color of Health: Residential Segregation, Light Rail Transit Developments and Gentrification in the United States”, I appreciate your paper. It is an interesting and important topic especially 4th section which described the impact of gentrification on health, and the manuscript is clear and well written. But I felt some minor changes are required.”

Thank you for reading. Your comments have greatly improved our paper.

RE#2 (2) –
“First, throughout the paper transit oriented developed are used as a synonym to transit station areas. I felt it needs to be modified, as all the transit station are not TODs. Most of the station areas are just
transit adjacent developments. For more details please refer: Renne, J. L., & Ewing, R. (2013). Transit-Oriented Development: An Examination of America’s Transit Precincts in 2000 & 2010. I appreciate if you can distinguish the stations area and TODs. I believe census tracts with improved transit accessibility has high probability of gentrification than the census tracts away from transit and if the census tracts have also had TOD policies in place, it further increases the probability of gentrification.”

For clarity, we have added a section that more clearly delineates transit-oriented development (TOD), transit-adjacent development (TAD) and the TAD-TOD hybrid using the suggested Renne and Ewing (2013) citation. For the purpose of this review, “TOD” will be used, unless otherwise noted, as either a conceptual term referencing its early definition – community development centered on transit facilities – or as a defined transit precinct with high density and grid-street patterned residential and commercial centers designed to maximize walking, biking and public transit. Please see the response to RE#2 6B for additional explanation.

**On page 5 the following section title was edited:**

**Original Version** –

“LRT station areas, serving as transit-oriented developments, are strategic targets for developers to build condominiums and upscale housing, which is likely to increase property values and rents in the neighborhoods[40]. Emerging as a popular and influential planning concept, transit-oriented developments include a mix of commercial, residential, and entertainment properties centered around or located near a transit station[41].”

**Edited Version** –

“LRT station areas, serving as TODs, are strategic targets for developers to build condominiums and upscale housing, which is likely to increase property values and rents in the neighborhoods[40]. Emerging as a popular and influential planning concept and coined as a concept by Peter Calthrope, TODs include a mix of commercial, residential, and entertainment properties centered or located near a transit station[31,48]. Beyond this conceptual definition, TODs are characterized by pedestrian-focused built environments with grid street patterns; high population density; designated parking; bicycle access and storage; and multi-family homes, office and retail spaces that are vertically and horizontally oriented. Conversely, transit-adjacent developments (TADs) or the TOD-TAD hybrids are much more auto-dominated, industrial and/or segregated with respect to land use area. For example, when compared to TODs, TADs have been found to be nearly four times further away from central business districts and considerably less walkable due to block length and intersection density. While TODs, TADs and TOD-TAD hybrids fall within a built environment spectrum, all of these fixed transit precincts encompass varying social environment features as well. Research has found that approximately 75% of TOD households are renters as compared to less than 50% of TAD households [48]. Furthermore, TOD households had a median income of $17,000 less than TAD households based on available 2010 data [48]. Among the 4,399 transit stations in the United States, 31.8%, 37.3%, and 30.9% were categorized as TADs, TODs and TOD-TAD hybrids, respectively [48]. As previously defined, both built and social environment features describe a typology of all fixed transit precincts.”

**RE#2 (3)** –

“2.1: Suburbanization and Neighborhood Design: The section is mostly about suburbanization and laws which encouraged racial segregation. Not much about design. I think titles of the section needs to be changed to match the content. Sorry, not able to relate title with the content.”

For clarity, this suggested revision has been accepted.
“Suburbanization and Neighborhood Design”

*Edited Version* –
“Suburbanization in the 20th Century”

**RE#2 (4)** –

“2.3. Urban Planning and Residential Zoning

It would be clearer, if you can define exclusionary zoning ordinance and how it is responsible for current American neighborhood social upgradation briefly. I did not understand quite well, how the transit deserts are the function of TODS. I really appreciate if you can explain it a bit more.”

We have provided a clear explanation of exclusionary zoning ordinance and its relationship to residential segregation in the United States. Furthermore, we have added additional text to clarify our example of transit deserts as an example of inadequate TOD or poor zoning.

**On page 3 the following section title was edited:**

*Original Version* –
“Urban planners initially proposed zoning as a remedy to the problems triggered by industrialization. Some of the main zoning objectives are to promote the health, safety, and quality of life for communities, encourage the most appropriate use of the land, and regulate residential density. However, exclusionary zoning ordinances contributed to the historical and contemporary patterns of profound racial segregation that characterize American neighborhoods today. Zoning is employed continuously in the United States, and through these practices, the pattern of political geography exacerbates social inequities and ultimately limits the spatial distribution and accessibility of quality public goods and services. For example transit deserts, a concept similar to food deserts, occur when the demand for public transportation exceeds supply.”

*Edited Version* –
“Urban planners initially proposed zoning as a remedy to the problems triggered by industrialization. Some of the main zoning objectives are to promote the health, safety, and quality of life for communities, encourage the most appropriate use of the land, and regulate residential density. However, exclusionary zoning ordinances contributed to the historical and contemporary patterns of profound racial segregation that characterize American neighborhoods today. Exclusionary zoning has been defined as “local land-use controls that have the effect of excluding most low-income and many moderate-income households from suburban communities and, indirectly excluding most members of undesirable populations (e.g., people of color, poor people, immigrants) [26, 27]. In practice, zoning tended to preserve the status quo through exclusionary zoning and deed restrictions, or restrictive covenants, both acting to eternize Jim Crow segregation [28]. Discriminatory planning and exclusionary zoning contributed to unequal development within metropolitan areas, thus, limiting access of all citizens to affordable housing, public transportation, thriving school systems, and economic infrastructure. As a result, the formation of segregated communities along race and class lines and the creation of an urban underclass that was denied access to mainstream opportunities were reinforced [5, 29, 30].

Zoning is employed continuously in the United States, and through these practices, the pattern of political geography exacerbates social inequities and ultimately limits the spatial distribution and accessibility of quality public goods and services. For example transit deserts, a concept similar to food deserts, occur when the demand for public transportation exceeds supply. Due to inequitable spatial distribution of transportation services, some regions may be well endowed with transit options while others may not. These transit deserts are generally characterized by poor public transit planning, a function of inadequate TOD and poor zoning (e.g., mass transit dead zones).”

**RE#2 (5)** –

“3.2. Transit-Oriented Development and Light Rail Transit

The title needs to be changed. Mostly talking about land premiums around station area. So, I think It
would be appropriate to rename it as LRT and real estate market trends or land value uplift something.”

For clarity, this suggested revision has been accepted.

On page 4 the following section title was edited:

**Original Version**

“Transit-Oriented Development and Light Rail Transit”

**Edited Version**

“Land Value Uplift and Light Rail Transit”

On page 6 the following section title was edited:

**Original Version**

“The term “gentrification” was first coined in 1964 by British sociologist Ruth Glass as a way to describe “one by one, many of the working class quarters of London hav[ing] been invaded by the middle classes - upper and lower…. once this process of “gentrification” starts in a district it goes on rapidly until all or most of the original working class occupiers are displaced and the social character of the district is changed” [58]. Glass further made a distinction between gentrification and redevelopment by stating that that unlike gentrification, “the process by which working class residential neighbourhoods are rehabilitated by middle class homebuyers, landlords and professional developers”, redevelopment “involves not rehabilitation of old structures but the construction of new buildings on previously developed land” [58]. Interestingly, this latter portion of the Glass definition conflicts with the present day images of gentrification. While pinning down a contemporary characterization for gentrification has been challenging over the past several decades, it has commonly defaulted to the Glass definition. However, considering that the gentrification process has evolved with 21st...”
century influences, an extended interpretation, which acknowledges a much larger phenomenon, the class remake and new building of urban residential landscapes, is unavoidable. As such, a wider representation that focuses on four core elements of gentrification has been offered [59]. It has been suggested that a contemporary characterization of gentrification, which concentrates on the four core elements ((1) capital reinvestment; (2) social upgrading of locale by incoming high-income groups; (3) landscape change; and (4) direct or indirect (exclusionary) displacement of low-income groups), and disassociation from particular landscapes or contexts can be a significant way to conceptualize and analyze urban change in the 21st century [59]. Even with this augmented annotation, the central focus of gentrification debates pertains to the impacts on new and existing neighborhood residents and the question of who can benefit the most from new developments. A considerable amount of work portrayed gentrification as “a class-based process of capital reinvestment through which middle-class individuals and interests stake claims to urban communities after a period of economic disinvestment and alter the physical and social milieus to suit their preferences”[51]. Cultural preferences, political orientations, and economic development are the basis of gentrification.

The main agents of urban renewal in the United States and elsewhere typically are White, middle-class, urban professionals, real estate and government [52, 53]. Furthermore, the role of government serves through housing and infrastructure investment at the local and state levels while the private sector tends to manage land-use and city development to accumulate capital [54, 55].”

RE#2 (6B) –

“Impoverished neighborhoods and communities of color often bear the brunt of unintended transit-oriented development impacts”. I think it should be improved transit accessibility impact rather than TOD, as I said previously all stations are not TODs. “negative impacts of transit-oriented development, specifically the introduction of LRT stations”. I assume you are referring to Pollack study. But, in his study also he clearly mentioned transit rich neighborhoods. Please modify.”

Please see the response to RE#2 (2). In addition to this modification, we have also clarified our use of transit-oriented development (TOD) at the beginning of the manuscript to set an understanding for our nomenclature. However, with respect to the request of changing “transit-oriented development impacts” to “improved transit accessibility impacts” in the statement beginning with “Impoverished neighborhoods and communities of color often bear the brunt…”, we respectfully dissent. While we agree with the intent of your suggested revision, this statement was referenced from work that used “transit-oriented development” and we would like to preserve the integrity of the original authors’ annotation(s).

On page 1 the following section title was edited:

Original Version –
“Transit induced gentrification (TIG), as a result of transit-oriented development (TOD) investments, is an example of this residential segregating process.

Edited Version –
“Transit-induced gentrification (TIG), as a result of transit-oriented development (TOD), also referred to as transit-supportive development or transit-friendly development, is an example of this residential segregating process[2].

On page 3 the following section title was edited:

Original Version –
“For example transit deserts, a concept similar to food deserts, occur when the demand for public transportation exceeds supply, which is generally characterized by poor public transit options, a function of TOD and zoning. Zoning policies not only influence housing and rental values or public transit options, but these policies can also instigate changes in neighborhood demographic patterns, the share of each land from local services, and the appearance of a community.”
Edited Version –
“For example transit deserts, a concept similar to food deserts, occur when the demand for public transportation exceeds supply, which is generally characterized by poor public transit options, a function of TOD and zoning. TODs, which are designed in varying shapes, sizes, formations and environmental composition, possess the common element of transportation interface. As described later in section 3.2, a sophisticated typology of fixed transit precincts, born from the TOD concept, has been developed. However, for the purpose of this review “TOD” will be used, unless otherwise noted, as either a conceptual term referencing its early definition – community development centered on transit facilities – or as a defined transit precinct with high density and grid-street patterned residential and commercial centers designed to maximize walking, biking and public transit [31]. As such, TOD along with zoning policies not only influence housing and rental values or public transit options, but both can also instigate changes in neighborhood demographic patterns, the share of each land from local services, and the appearance of a community.

RE#2 (7A) –

This suggested revision has been accepted.

On page 7 the following section title was edited:
Original Version –
“Recent studies have utilized changes in household income, house values, and educational levels of the community surrounding a transit center as measures of TIG[68, 77].”

Edited Version –
“Recent studies have utilized changes in household income, house values, new house construction and educational levels of the community surrounding a transit center as measures of TIG [73, 82, 84]. A systematic review of 35 research studies presenting evidence on TIG outcomes resulting from transit-based interventions concluded that proximity to transit may contribute to TIG [84].”

RE#2 (7B) –

This suggested revision has been accepted.

On page 7 the following section title was edited:
Original Version –
“For example, the analysis of 14 urbanized areas within the United States, measured the change in the socioeconomic status of residents before and after building LRT stations [85]. In Denver and San Francisco, the rise in the percentage of White, wealthier and highly-educated residents near LRT stations was a key sign of the gentrification process. The presence of LRT had a great impact on gentrification in Denver’s station-tract neighborhoods, which experienced a 4% relative increase in the White population compared to non-station tract neighborhoods [85]. Also, there was pronounced gentrification and TOD related changes in San Francisco between 1980 and 2010. LRT station neighborhoods saw a 4% rise in the White population, 31% increases in income and a decrease in poverty [85]. Yet, another study found that neighborhoods in close proximity to LRT stations in Portland, Los Angeles, and Buffalo were occupied by lower-income residents and that these census tracts revealed a relatively higher poverty rate than other districts[85].”

**Edited Version –**

“For example, the analysis of 14 urbanized areas within the United States, measured socioeconomic status change in residents before and after building LRT stations [92]. These urbanized areas were selected because their LRT systems started operations by or before 2000. In Denver, CO and San Francisco, CA, the rise in the percentage of White, wealthier and highly-educated residents near LRT stations was a key sign of the gentrification process. The presence of LRT had a great impact on gentrification in Denver’s station-tract neighborhoods, which experienced a 4% relative increase in the White population compared to non-station tract neighborhoods [92]. Moreover, there was a 26% relative increase in the neighborhood change index in LRT station neighborhoods as compared to non-station area neighborhoods. These combined results could indicate that Denver’s LRT station areas experience gentrification related neighborhood change in the absence of sustainable transportation promotion by way of TOD. There was also pronounced gentrification and TOD related changes in San Francisco between 1980 and 2010. Even with the positive TOD effects of retaining commute mode shares by public transit and non-POV (Non–Privately Operated Vehicle) mode, station tracts in San Francisco exhibited a significant relative increase in income (+31%), neighborhood change index (+9%), White population (+4%), and a decrease in poverty (-3%) [85]. Conversely, Portland exhibited counter-gentrification with a decrease in neighborhood change index (-28%) and increase in poverty (+4%). It was inferred that the counter-gentrification in Portland’s LRT station areas was due to more residents with high transit need being able to occupy LRT station areas. In Los Angeles and Buffalo, it was also found that lower-income residents were occupying neighborhoods in close proximity to LRT stations and that these census tracts revealed a relatively higher poverty rate than other districts [92]. However, unlike Portland where improved transit access largely benefited the low-income residents, this was not observed in Buffalo or Los Angeles due to the declining station neighborhoods.”

**RE#2 (7C) –**

“also Conclusions: “Ensure that existing residents remain intact”. I think there is a need to ensure to reduce exclusionary displacement by encouraging mixed-income new developments. Please include reference to the best practices you emphasized in the conclusion section. (Refer Reconnecting America; Center for Community Innovation; Non-Profit Housing Association of Northern California. Transit-Oriented for All: The Case for Mixed-Income Transit-Oriented Communities in the Bay Area; Center for Community Innovation: Berkeley, CA, USA, 2007. and Chava J and Newman P (2016) Stakeholder Deliberation on Developing Affordable Housing Strategies: Towards Inclusive and Sustainable Transit Oriented Developments. *Sustainability*, 8(10).) Looking forwarded to the final version.

This suggested revision has been accepted with the addition of our supporting references along with the suggested citations.

**On page 11 the following section title was edited:**

**Original Version –**

“Another government strategy is to reserve low-priced land at an early stage of gentrification in order to provide the grounds for the construction of affordable housing. Reserving and protecting land before gentrification occurs can assure affordable housing units for low-income households when land and housing prices begin to rise. Careful regulations such as inclusionary zoning, mixed-rate, or mixed-use housing policies, can encourage for-profit developers to finance
affordable housing. Also, property tax relief programs and rent subsidies based on income assessments are two other strategies. Property tax relief programs support owner occupied units while rent subsidies support renters in managing daily costs.

Local communities, by announcing their involvement in neighborhood projects, can also employ actions to support smart growth development. Community stakeholders and local councilmembers need to actively participate in neighborhood planning and understand their rights in order for appropriate and well-informed negotiation to occur with developers. Programs such as homeownership and Individual Development Accounts (IDAs) can provide education and economic resources to lower-income residents, thus improving their ability to purchase a home in their current neighborhood. Moreover, developing vacant or under-used parcels within existing neighborhood areas through infill development can offer economic opportunities, expand homeownership, mixed-use development, and encourage investment in infrastructure and amenities. However, regulatory policies should be in place to control the private housing market. Stabilization policies such as zoning, land use, and rent control are a set of measures to reduce the volatility of the market and encourage welfare-enhancing growth.

Edited Version –

“Another government strategy is to reserve low-priced land at an early stage of gentrification in order to provide the grounds for the construction of affordable housing [143]. Reserving and protecting land before gentrification occurs can assure affordable housing units for low-income households when land and housing prices begin to rise. Careful regulations such as inclusionary zoning, mixed-rate, or mixed-use housing policies, can encourage for-profit developers to finance affordable and mixed-income housing. Also, property tax relief programs and rent subsidies based on income assessments are two other strategies. Property tax relief programs support owner occupied units while rent subsidies support renters in managing daily costs [143]. Overall, governmental and non-governmental policies, programs and financing tools that support the creation of mixed-income communities surrounding transit stations are essential to ensure that the benefit of new transit investments are distributed equitably and efficiently [144].

Local communities, by announcing their involvement in neighborhood projects, can also employ actions to support smart growth development. Community stakeholders and local councilmembers need to actively participate in neighborhood planning and understand their rights in order for appropriate and well-informed negotiation to occur with developers. Using a three-level deliberation framework ((1) inform; (2) involve; and (3) collaborate), stakeholders can establish inclusive housing strategies for equitable and sustainable TODs [145]. At the first level, planners need to inform stakeholders about existing affordable housing policies and strategies and how provide examples for how these initiatives have been developed in other areas. Stakeholders must then be involved in the deliberation of identifying challenges to inclusive TODs at the second level, which is then followed by the third level of collaboration to identify solutions. For example, one solution presents itself in the form of Individual Development Accounts (IDAs) programs. IDAs, a vehicle for homeownership, can provide education and economic resources to lower-income residents, thus improving their ability to purchase a home in their current neighborhood [146]. Other solutions, such as developing vacant or under-used parcels within existing neighborhood areas through infill development can offer economic opportunities, expand homeownership, mixed-use development, and encourage investment in infrastructure and amenities [147]. To ensure the success of these solutions, regulatory policies should be in place to control the private housing market. Finally, stabilization policies such as zoning, land use, and rent control are a set of measures to reduce the volatility of the market and encourage welfare-enhancing growth [148].

I thank you for your time and thoughtful review of our manuscript.

Sincerely,

Jennifer D. Roberts, DrPH, MPH