

## **Author's response to reviews**

**Title:** The impact of transportation infrastructure on bicycling injuries and crashes: a review of the literature

### **Authors:**

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**Author's response to reviews:** see over

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**Re: Manuscript #: 2000166937289161, “The impact of transportation infrastructure on bicycling injuries and crashes: A review of the literature” by Conor C. O. Reynolds, M. Anne Harris, Kay Teschke, Peter A. Cripton, and Meghan Winters**

Dear Prof. Ozonoff,

We are pleased to submit our revised manuscript to *Environmental Health*, entitled “The impact of transportation infrastructure on bicycling injuries and crashes: A review of the literature”. Please note that the manuscript title has been rephrased so that it complies with the journal style, according to your request.

We are grateful for the helpful reviews by Jennifer Dill, Luc Int Panis, Russell Lopez and Anne Lusk, which helped improve the final paper. We provide a point-by-point response to each of the reviewers’ comments below this letter. The manuscript has been formatted so that it conforms to *Environmental Health*’s style, and we have done our best to address all of your editorial requests – those changes have been documented below our response to reviewers.

Please do not hesitate to contact us if you have any questions regarding the revised manuscript.

Your sincerely,

Conor Reynolds

## **Authors' response to Referees' Comments**

We thank the referees for their perceptive comments, and we have endeavored to address each of the questions and suggestions that they have raised. Our response to each issue can be found in italicized text below the reviewers' comments. Where we have made significant revisions to the manuscript or the supporting information, we quote the original section of text as well as the revised version; (where necessary for clarity, changes within the revised section have been underlined).

Please note that the page/line numbers quoted below refer to the revised manuscript.

In addition minor issues identified by the EH editorial team have been addressed and are itemized at the end of this document.

### **REVIEWER: Russell Lopez**

This paper represents a comprehensive review of the literature on bike infrastructure and safety. As the authors report, bike riding represents a small but important segment of transport in North America and a larger but still limited segment in Europe. The paper focuses on the literature from Europe and North America. While bike riding is popular elsewhere, field conditions are so different in other parts of the globe that a less than global approach is appropriate here.

The primary limitation of the paper is the limitation of the field itself. The great lack of studies on bike-related infrastructure is a major challenge. Unfortunately, this is a situation that is not going to change anytime soon.

The paper is well organized and the glossary of terms is particularly helpful. A few minor revisions would strengthen the paper.

#### **Minor Revisions:**

1. Roundabouts are an extremely small portion of intersections and despite some limited efforts to increase their number, will probably never rise above less than .01% of total intersections in both Europe and North America. The authors should do a better and more explicit job of pointing this out.

*Authors' response: We have addressed this comment in the discussion (page 18-19), by revising the paragraph on roundabouts to read as follows: "Although roundabouts at intersections are not common in North America, they are relatively popular in many European countries. It is possible that they may see more widespread use in North America in the future because of evidence that conversion of intersections to roundabouts reduces crash risk for motor vehicle road users by 30-50% [77], especially when they replace intersections that were not previously signal-controlled."*

2. Given that cities are promoting bike use (the authors could cite bike sharing programs,

for example), the authors should strengthen the conclusions section by calling more strongly for more research and more forcefully point out some of the deficiencies that must be addressed.

*Authors' response: In the discussion section, we address a range of challenges and shortcomings with conducting this type of research, and offer our recommendations for how future studies on the topic could be conducted. We have strengthened the conclusions section (page 23) by adding the following to the first paragraph: "Although the effect of infrastructure design on cyclist safety was first studied more than three decades ago, the literature on the topic is remarkably sparse. This review (to our knowledge, the first of its kind) highlights many opportunities for more detailed and controlled studies of infrastructure and cycling injuries. However, the studies to date provide some guidance for improving cyclist safety.*

3. On page 11, why were studies that examined only conflicts between cyclists and other road users excluded? Perhaps the authors mean that these did not allow for examination of underlying road or street structure? This seems to be a fundamental result of infrastructure deficiencies. Or perhaps not. Please clarify.

*Authors' response: On page 9 (paragraph 2) we give examples of different types of conflict studies and explain why they are not included in the review. We state that: "Conflict studies may offer valuable insights into how cyclists and other road users behave during their interactions on various types of transportation infrastructure. However, it is not possible to determine whether the safety of the cyclists was compromised during the conflict events. In addition, the conflict studies we identified were generally based on a small number of observed events, which were made over a limited time period (usually several hours), and often in a single geographical location. Therefore, papers that use conflict as their sole outcome measure have not been included in this review." However, in order to make this more clear to the reader, we have reworded the sentence about excluding conflict studies on page 12. Revised text: "• studies that examined only "conflict" between cyclists and other road users (refer to the section above on "safety terminology"), but where crashes or injuries were not identified"*

## **REVIEWER: Luc Louis Rosa Int Panis**

### **Discretionary Revisions:**

This is a well written review paper but no meta-analysis was attempted.

A very good background of the field is given with plenty of references to back up the summary.

Table 1 holds detailed descriptions of different cycling infrastructure types. A lack of clear descriptions may hamper the comparison of results from different studies especially in different countries. The definitions provided in this paper are therefore very useful and may become a reference for future studies in the English language. Comparing

descriptions of infrastructure across different languages is an even more difficult task. In the future non-English papers can be included in the review and infrastructure types classified by using the examples in the European cycling dictionary (a list of words and photographs for cyclists and policy makers in all 23 official European languages (published by the European Economic and Social committee at the Vélocity 2009 conference in Brussels)).

*Authors' response: We agree that it is useful to have a common understanding of different types of infrastructure, and have endeavoured to ensure that our definitions reflect common use in the peer-reviewed literature. We have also attempted to harmonize this table with the EESC "European Cycling Lexicon", and have provided a reference to this document in a note at the end of the table, as follows: "The "European Cycling Lexicon" (published by the European Economic and Social Committee at the Vélocity 2009 conference in Brussels) gives a list of key cycling terms with corresponding photographs for cyclists and policy makers, in all 23 official European languages. It is freely available to download at: <http://www.eesc.europa.eu/sections/ten/european-cycling-lexicon>".*

Abstract (Page 1):

Other "potential" health benefits could be mentioned based on the review from Nick Cavill (see ref below) and related documents from the WHO (e.g. by Sonja Kahlmeier).

*Authors' response: we agree that it is important to mention the full range of health benefits from cycling, and have cited the following report (Cavill and Davis 2007) and a recent original research paper in the Background section:*

*Cavill and Davis. Cycling and Health; what's the evidence? Cycling England, UK Department of Transportation. 2007.*

*Gordon-Larsen et al. Active Commuting and Cardiovascular Disease Risk. Arch Intern Med. 2009 vol. 169 (13) pp. 1216-1223.*

*The third sentence in the background has been revised to reflect the broad scope of health benefits: "Cycling is associated with a range of individual and public health benefits such as improved physical and mental health, decreased obesity, and reduced risk of cardiovascular and other diseases [1-6], as well as ancillary benefits such as reduced emissions of noise, air pollutants and greenhouse gases [7,8]."*

A potential additional risk is the increased exposure to exhaust emissions. Some of the fractions in vehicle exhaust have been associated with increased health risks from exposure to general air pollution and "proximity to traffic" seems to be a factor that explains part of that health risk. In addition the physical activity leads to an increased exposure through increased ventilation, but 'stress' may also be a factor. (e.g. Annette Peters et.al Exposure to Traffic and the Onset of Myocardial Infarction, NEJM, Volume 351:1721-1730 October 21, 2004 Number 17)

*Authors' response: We agree that increased exposure to traffic emissions is associated with increased health risks. Although a detailed discussion of this topic is beyond the scope of this review, recent evidence suggests that car drivers may be exposed to higher particulate matter mass and particulate number concentration than cyclists. See ref: We have added a citation to the following reference [8] on page 3:*

*Boogaard et al. Exposure to ultrafine and fine particles and noise during cycling and driving in 11 Dutch cities. Atmospheric Environment (2009) vol. 43 (27) pp. 4234-4242*

Page 1:

Following discussions with cycling advocates it may be wise to include a statement saying that there is, at this point, no reason to assume that (on balance) the health risks outweigh the health benefits. In the past purely scientific statements on risks have later been misinterpreted in popular articles and in the press to suggest that cycling was dangerous and/or unhealthy.

*Authors' response: We have added the following sentence to the second paragraph of the Background (page 4): "It is clear that the health benefits of cycling are significant, and at this point there is no reason to assume that health risks outweigh those benefits. However, a full public health understanding requires..."*

Page 2:

Collisions and falls are very different incidents with a different injury outcome. Authors may consider to keep these two classes apart if data permits.

*Authors' response: We have changed "collision or fall" on this page to "crash", a term which encompasses both collisions and falls. The distinction between collision and fall are addressed later in the paper, in the "Safety Terminology" sub-section.*

Background:

Psychological benefits could be mentioned (de Geus, 2007 see reference below)

de Geus, B. (2007). Cycling to work: psychosocial and environmental factors associated with cycling and the effect of cycling on fitness and health indexes in an untrained working population. Doctoral Dissertation submitted in fulfilment of the requirements for the degree of Doctor in Physical Education. Vrije Universiteit Brussel (VUB), Brussels.

*Authors' response: We have reviewed the dissertation recommended by the reviewer (as well as a published journal paper arising from that work, reference below). We decided not to include them in the background section about benefits, since they are about factors that motivate/discourage people related to cycling, rather than psychological benefits arising from cycling.*

*Reference: de Geus et al. Psychosocial and environmental factors associated with cycling for transport among a working population. Health Education Research (2008) vol. 23 (4) pp. 697-708*

Page 4. A recent analysis of bicycling rates (and accident risks) in Belgium can be found in Vandenbulcke et al., 2009: Grégory Vandenbulcke, Isabelle Thomas, Bas de Geus, Bart Degraeuwe, Rudi Torfs, Romain Meeusen and Luc Int Panis, 2009. Mapping bicycle use and the risk of accidents for commuters who cycle to work in Belgium. Transport Policy, Volume 16, Issue 2, March 2009, Pages 77-87

*Authors' response: We thank the reviewer for alerting us to this interesting paper, which examines difference between different types of land-use, and city size (among other*

factors). We have cited it in the “Ridership and Safety” section, related to the “safety in numbers” concept, reference 38.

Page 5. It’s a bit strange that the two first tables to be mentioned in the text are numbered 2 & 3

*Authors’ response: We have added reference to Table 1 in the following sentence on Page 5: “Next we offer definitions of, and alternative terminology for, the transportation infrastructure used by cyclists that might be expected to influence their safety (Table 1).”*

Page 6 Average cycling trip percentages for Belgium should discriminate between Flanders and Wallonia, which are very different in this respect.

*Authors’ response: We have revised the sentence to read: “...an estimated 10% of trips in Switzerland, Germany, Austria, Sweden, Finland, and Belgium (Flanders)...”*

Page 7 1st paragraph line 3: explain whether this is a general statement or only about North America

*Authors’ response: This is a general statement, and that has been clarified in the text as follows “estimates from both continents suggest that...”*

Page 7 1st paragraph line 5: this has been shown to be true by Vandenbulcke et al., 2009.

*Authors’ response: This statement is supported in the subsequent sentences with 5 citations. We have made it more clear in the text that the statement is linked to the following (supporting) sentences.*

Page 8 1st paragraph last line: we have unpublished data from the SHAPES project that seems to confirm this assessment both for Flanders and for Wallonia:

Grégory Vandenbulcke, Claire Dujardin, Isabelle Thomas, Bas de Geus, Bart Degraeuwe, Rudi Torfs, Romain Meeusen, Luc Int Panis (in preparation) “Cycling to work: Modelling meso-scale spatial variations”.

*Authors’ response: We thank the reviewer for bringing this project to our attention, however we are unable to cite work that is not yet published/in press.*

Page 9 second paragraph. On the other hand it may be that it is the number of conflicts rather than the number of accidents that contributes to the perception of risk.

Nevertheless “conflicts” remain an “illusivive” concept that is difficult to handle and is therefore often excluded from studies or questionnaires.

*Authors’ response: We agree with the reviewer that the relationship between conflict and perception of risk is difficult to quantify. No changes were made.*

Page 11 This sentence is not really relevant for the paper.

“Those papers considered potentially relevant were collected from the University of British Columbia libraries, electronic databases maintained by the journals, or through inter-library loan.”

*Authors’ response: Most of the text of the sentence has been removed, and the remainder combined with the following sentence to read: “Those papers considered potentially*

*relevant were collected, and the full text versions were then further reviewed for relevance.”*

Page 11 I agree that studies outside the OECD may probably not be relevant to the goal of this review.

*Authors' response: Thank you. No changes made.*

Page 21 Bias in the data and underreporting cfr. Unpublished results from the survey in the SHAPES project suggests that underreporting of cycling accidents is probably even worse than assumed here.

*Authors' response: We look forward to seeing the results of this study. No changes made.*

Page 21 first paragraph. It is true that surveys cannot capture the most serious (e.g. lethal) accidents, but at prevailing risk levels, the chances of a lethal accident occurring to one of the participants during the survey are negligible.

*Authors' response: We have revised the sentence to include the reviewer's observation: "However, survey data will not capture events that resulted in fatalities (though these are extremely rare) or catastrophic incapacitating brain, spinal cord or other injuries and, depending on the method of survey administration, may not capture individuals who no longer cycle following a crash [29, 69]."*

Page 22 I agree that there are difficulties associated in controlling for the exposure to risk (few studies (e.g. see paper by Vandenbulcke et al., 2009) quantify both the risk and the exposure to that risk.)

*Authors' response: This paper gives cycle commuting rates in different regions of Belgium, and investigates the relationship between bicycle use and the risk of being seriously injured or killed in a road accident. It is indeed a good example of a study that controls for exposure to risk at a "macro" scale (e.g. urban vs. rural). However, it does not deal with exposure to risk at the "micro" scale of individual cyclists, nor does it deal with risk related to specific transportation infrastructure, so we felt that it was not appropriate to cite it in this section of our paper. Note that we have cited it in the "Ridership and Safety" section, (page 7, paragraph 2).*

## **REVIEWER: Anne Lusk**

### **Major Compulsory Revisions:**

The title of the article, “Impact of transportation infrastructure on bicycling safety,” is broad and the framework of making bicycling safer and increasing rates of bicycling to improve health extremely inclusive. The relevant papers investigated transportation infrastructure and a metric of bicyclist safety. Articles are from research conducted in Europe and non-European countries. The transportation infrastructure is reviewed based on two categories – straightaways and intersections. For straightaways, roads, lanes, and paths were included from North America with one conducted in Europe on lighting. The roundabouts studies were conducted, except for one study, on European facilities. The

conclusion suggested improvements to bicycling-related infrastructure in North America could reduce injuries and that evidence is beginning to accumulate for guidelines to be adopted for cyclists' safety. This text would suggest that all of the bicycle facility designs available in North America and Europe would have been included in the review.

Though transportation infrastructure and safety is the framework, the authors state that they included no studies on bicycle "tracks." This exclusion is further revealed in Table 1 under the definitions of the facilities. Here, an asterisk indicates that cycle tracks (called bicycle tracks in the article) are not included in this review. Based on the above information, the safety, popularity, and rate of construction of cycle tracks in Europe, and that the paths on roundabouts in Europe are indeed barrier-separated bicycle-exclusive cycle tracks, this omission should be corrected for the review on straightaways. Cycle tracks on straightaways should be included, in particular, because cycle tracks would then connect to the cycle tracks discussed as safer on the European roundabouts.

*Authors' response: This is not an omission. In fact we could identify no papers that examine the safety effect of straightaways in Europe. Regarding bicycle facilities at roundabouts: in this review, we have followed the convention in the literature, whereby roundabouts (with and without cycle tracks) are treated as intersection-related rather than straightaway-related infrastructure. We appreciate the reviewer's insight that barrier-separated and bicycle-exclusive cycle track are similar to tracks on straightaways in many ways. However, we believe that it is more appropriate to include them in the intersection category, since cyclist safety is highly influenced by the points at which the tracks cross roadways and sidewalks.*

Also, if only straightaways are described in studies in the U.S. and the lack of safety in North America is compared to the higher safety in bicycling in Europe, then the bicycle facilities which are so much safer in Europe should be included in the review. This section states, "If cycling is safer in European cities, it can be made safer in North America." Therefore, the safest facilities in Europe should be included and studied as a network of connected straightaways and roundabouts.

*Authors' response: We agree with the reviewer's assessment of the situation, and reiterate that the only reason that we have not reviewed any quantitative studies of how separated cycling tracks influence safety, is because we have not found any. Therefore in the conclusions section we call for more research. The following sentence has been added to the first paragraph of the conclusions (page 23): "Although the studies published to date have provided important insights, additional research that controls for exposure to risk and potential confounders is needed."*

In more detail, the authors should try to be consistent with all of the names for bicycle facilities. In the abstract, a roundabout was said to be safer if a separated bike path is included. In the U.S., a separated bike path would be a shared-use path whereas for the articles from Europe, this path is a cycle track and bicycle-exclusive. Marked bicycle lanes are referenced and yet, in the U.S., these can be painted extremely close to parallel parked cars, and thus make the rider vulnerable to being doored, or they can be painted adjacent to a curb cut for a sidewalk in a less vulnerable location in relation to car doors. The authors are correct in that much U.S. safety emphasis has been placed on helmet

wearing while, in contrast, the Dutch and Danes provide safer bicycle-exclusive facilities and the Dutch and Danes do not wear helmets. John Pucher's research is discussed but Pucher and colleagues also included cycle tracks in their discussions. In the conclusion, the authors suggest that purpose-built bicycle-only facilities (e.g., bike lanes and paved off-road paths) reduce risk but in only a very few instances are there bicycle-only facilities in the U.S. A bicycle lane is shared with cars, trucks, and buses while a paved off-road path is shared with dog walkers, joggers, and baby carriage pushers. In Europe, these paths, called cycle tracks or green cycle tracks if they pass through park lands, are bicycle-exclusive and a parallel path or sidewalk is available for the other users including pedestrians.

*Authors' response: We have carefully reviewed the terminology and definitions in Table 1, and checked that it is consistent with the European Cycling Lexicon. Please refer to the response to Int Panis' first comment, about Table 1.*

The Ridership and Safety section starts to describe the safety differences between North American and Europe without mentioning that it is extremely difficult to build the European bicycle facilities in the U.S. That is why there are no studies on cycle tracks in the U.S. The American Association of State Highway and Transportation Officials "Guide for the Development of Bicycle Facilities" does not include any guidance for cycle tracks and lists 9 reasons why sidepaths are discouraged from being built. In contrast, the Quebec design guidelines include cycle tracks. Because cycle tracks exist in Toronto and Vancouver, it is assumed that cycle tracks are also in other Canadian design guidelines. In sum, the U.S. has extremely few cycle tracks but it does have bike lanes beside parallel parked cars or beside curbs. The U.S. also has shared-use paths. Canada has the same bicycle facilities but it also has cycle tracks though not as extensive a network system as in the Netherlands and Denmark.

*Authors' response. A detailed discussion of whether it is possible to build certain types of transportation infrastructure in certain jurisdictions is beyond the scope of this paper. However, we have added the following sentence in the first paragraph of the "Ridership and Safety" section: "North Americans remain less likely than Europeans to choose bicycle transport for either short or long trips. In part, this may be due to substantial differences between the urban form in North American and European cities, particularly density and interconnectedness [25], but perceived and actual injury risks are also important."*

Roundabouts with separated bicycle facilities (really cycle tracks) are suggested as safer but North America would want to have cycle tracks leading to these roundabout cycle tracks and not road facilities or share-use paths leading to these roundabout cycle tracks. If on-road facilities lead to the roundabout cycle tracks, only on-road users would be on the roundabout cycle tracks. Safe bicycling facilities need to have a network of the same types of facilities to increase ride share in under-served bicycling populations (women, children, seniors). If safety is the focus of this article on infrastructure, articles on cycle tracks should be discussed and in detail.

*Authors' response: In this review, we have not attempted to address the question of how new and/or different types of infrastructure might be implemented in North America. Articles on cycle tracks have not been discussed in detail because they have not been*

*found in our search of the literature, but we have discussed the evidence for the safety effect of related types of infrastructure (namely bike-exclusive lanes and multi-use off-road paths).*

This is a highly contributory article, which is extremely valuable for addressing safety but also obesity, global warming, and pollution. This article needs to be published and the suggested inclusions and changes are manageable in a short amount of time. The suggestions are offered to ensure that North America, and other countries, are able to build networks of bicycle facilities on which all populations can safely bicycle, as in the Netherlands, Denmark, and certain cities in Germany. It is imperative that this article be published but also be clear on the definitions of facilities and inclusive of the range of facilities if bicycling is to be made safer in North America.

Minor Essential Revisions:

The authors state that bicycle facilities need to be clearly defined. In the article, every effort should be made to also use exactly the correct terms.

*Authors' response: We have endeavored to ensure that the terminology and definitions we use are clear, and consistent with the literature and government usage (please refer to our response to Int Panis' first comment, regarding Table 1).*

A) In the description of separated bicycle paths at roundabouts, because these were based on European articles, these paths would be barrier-separated bicycle-exclusive cycle tracks. In the U.S., a separated bicycle path is shared with pedestrians, dog walkers, joggers, baby-carriage pushers, and in-line skaters.

*Authors' response: The definition of a "Separated Bicycle Path (Bicycle Track)" and "Off-road Path" are distinct in Table 1:*

*"Bicycle track / separated bicycle lane: Type of bicycle lane (exclusively for bicycle use) next to a major city street but separated by a curb or other physical barrier.*

*Off-road path: Paved or unpaved path or trail, which may be for bicycle-use only or shared with other non-motorized users (e.g. pedestrians, runners, or in-line skaters). The classification may include a wide variety of path types and designs, which may not be directly comparable each other."*

B) The bicycle track under definitions needs to have added to the definition the clarification that a bicycle or cycle track is also "bicycle exclusive." This is what distinguishes a cycle track from a separated bicycle path.

*Authors' response: We have endeavored to make the definitions of infrastructure more clear, according to the reviewers' suggestions. The relevant revised definitions in Table 1 are as follows:*

*"Marked bicycle lane: Part of the roadway marked with painted lines or a colored surface, to designate that they are reserved exclusively for cyclists. Bicycle lanes may terminate before an intersection, or continue through it."*

C) The straightaway list should include roads, lanes, paths, and cycle tracks.

*Authors' response: The definition of a cycle track is a type of bicycle lane, so "lanes" includes "tracks". We are concerned that if cycle tracks are specifically cited in this more general list, the reader may expect the review to cover cycle tracks, but we identified no studies investigating injuries or crashes on cycle tracks in the English language literature.*

D) The definition of bike lanes should differentiate between the two types of on-road bicycle lanes. Both are painted with no separation between cars (can double park) but some are beside parallel parked cars (can be doored) while others are beside sidewalk curbs with no parallel parked cars (can't be doored but can find cars double parked in the bike lane).

*Authors' response: The issue of parked cars applies not only to marked bike lanes, but also to on-road cycling, on-road bike routes, sharrows, and wide curb lanes. Therefore no change has been made to the definitions. The effect of parked cars on safety was not investigated in any of the studies identified for review. We do mention the importance of this issue in the Discussion on page 20, paragraph 2, last sentence.*

E) The bicycle infrastructure studied in Europe on roundabouts would mean the bicycle component is a barrier-separated and bicycle-exclusive cycle track and not a separated bike path.

*Authors' response: We have endeavored to ensure that our definitions are as clear as possible, and consistent with the literature – we have made several edits that are responsive to this comment. Please refer to our responses above.*

### **REVIEWER: Jenifer Dill**

Overall, a very strong, informative, and well-written article.

#### **Major Compulsory Revisions:**

None

#### **Minor Essential Revisions:**

1. Page 2 (abstract) and page 15: The statements about classifying different facility types together is unclear. An example would help (at least on page 15), as appears in the Discussion.

*We have revised the sentence in the abstract to provide more detail: "The results were tabulated within two categories of infrastructure, namely that at intersections (e.g., roundabouts, traffic lights) or between intersections on "straightaways" (e.g. bicycle lanes or paths)."*

*We hope this clarifies the terminology early on.*

2. Page 4: There is a statement that cyclists in many North American jurisdictions are required by law to use helmets. I know of many jurisdictions that require children to wear

helmets. I think laws requiring helmet use for adults are rare. Please check on this and clarify in the article, if necessary.

*Authors' response: We have checked this point and agree with the reviewer. The sentence has been revised to read: "In many North American jurisdictions children who cycle (and sometimes also adult cyclists) are required by law to use helmets, although this is not the case in most European countries."*

3. Page 5: "The built environment has been implicated as a major determinant of bicycling rate." There is some conflicting evidence of this, along with other supporting studies not cited, such as:

Dill, J., Carr, T., 2003. Bicycle commuting and facilities in major U.S. cities: If you build them, commuters will use them. *Transportation Research Record*. 1828, 116-123.

Moudon, AV, Lee, C., Cheadle, AD, Collier, CW, Johnson, D., Schmid, TL, Weather, RD, 2005. Cycling and the built environment, a US perspective. *Transportation Research Part D*. 10, 245-261.

Cervero, R, Sarmiento, O., Jacoby, E., Gomez, L., Neiman, A., 2009. Influences of Built Environment on Walking and Cycling: Lessons from Bogota. *International Journal of Sustainable Transportation* 3(4): 203-226.

*Authors' response: The references suggested by the reviewer have been added, and the sentence modified to read: "The built environment has been implicated as an important determinant of bicycling rate [20-23], but these relationships are complex and a positive correlation has not always been found [24]. It is equally important to understand how the built environment affects bicycling safety because there may be an opportunity to prevent injuries by modifying transportation infrastructure."*

4. I may have missed it, but were the studies limited to those that were peer reviewed?

*Authors' response: Papers that were not peer-reviewed were eligible (page 11-12), but we did not find any non-peer-reviewed studies that met all inclusion criteria; therefore all papers included in this review were peer-reviewed articles.*

5. Page 17: delete "this includes" before bike boxes

*Authors' response: Thank you. Done.*

6. For Table 1, bike boxes are also known as Advanced Stop Lines in some countries, including Great Britain.

*Authors' response: This term has been added to Table 1.*

7. The two Moritz studies cited (58 and 59) were not random samples and rely on self-report. There may also be issues with how the facilities and amount of cycling on different facilities were reported. These items should be considered when using the studies.

*Authors' response: In Tables 2 and 3, we have clearly identified all studies – including both by Moritz – that use self-reporting (via a survey) as the methodology for data collection. In the discussion (page 19) we have included a comment about the issue raised by the reviewer: "Definitions of terminology are especially important in questionnaire-based studies to ensure that study participants are all answering with the*

*same infrastructure in mind; photos can be helpful in this regard [33].” We hope that this will call attention to our discussion of these issues on page 21, which provides examples of methods used to address exposure to risk and confounding, and why they are necessary.*

8. The authors make several good points in the discussion about the limitations of the studies reviewed. Please highlight some specific recommendations for future research, perhaps in the conclusions section.

*Authors’ response: We have included the following sentence in the Conclusions: “Although the studies published to date have provided important insights, additional research that controls for exposure to risk and potential confounders is needed.”*

9. There is one new "safety in numbers" article:

Elvik, R., 2009. The non-linearity of risk and the promotion of environmentally sustainable transport. *Accident Analysis and Prevention* 41: 849-855.

*Authors’ response: Thank you for this reference. It has been cited in the “safety in numbers” paragraph, within the Ridership and Safety section.*

#### Discretionary Revisions:

1. Did any of the studies address the role of alcohol?

*Authors’ response: Alcohol use does appear to increase risk of cycling injury in other studies of individual risk factors for injury, but an in-depth discussion of such behavioral risk factors (unrelated to infrastructure) was beyond the scope of our review. It would be interesting for future studies to examine the interaction between behavioral risk factors and a potential protective benefit of cycling infrastructure. To our knowledge, no such studies yet exist.*

#### **Editorial Issues**

Please also ensure that your revised manuscript conforms to the journal style (<http://www.ehjournal.net/info/instructions/> ). It is important that your files are correctly formatted.

*Authors’ response: The manuscript has been formatted using the Environmental Health template, according to the instructions on the EH website.*

Please rephrase the manuscript title (both on the server record and on the electronic file) so that it complies with the journal style.

*Authors’ response: We have changed the title to “The impact of transportation infrastructure on bicycling injuries and crashes: A review of the literature”.*

On the title page Reynolds et al. Infrastructure and Bicycling Safety should be removed from the upper right corner and the page structured authors names - first and last name; the authors' institutes of affiliation preceded by sequential superscript numbers which should also be placed after the authors' last names; the phrase Corresponding author

followed by a symbol e.g. asterisk to also be placed after the superscript number of the corresponding author; and lastly the heading email addresses with the authors' email addresses listed initials:email; in sentence format. Please compare with a recently accepted manuscript for guidance.

*Authors' response: Done*

Please remove the bold and italics font as well as the page numbering throughout the text.

*Authors' response: Done*

Numbers 0-9 should be written out e.g. page 2, (eight that examines...).

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Please remove the commas on page 5 after e.g. and North America as they are not necessary.

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A list of abbreviations section should be inserted at the top of page 24 followed by the Competing interests section, etc. - see instructions.

*Authors' response: An abbreviations section has been added.*