

PEER REVIEW HISTORY

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ARTICLE DETAILS

TITLE (PROVISIONAL)	A population-based case-control study of hospitalisation due to head injuries among bicyclists and motorcyclists in Taiwan
AUTHORS	Pai, Chih-Wei; Chen, Yi-Chu; Lin, Hsiao-Yu; Chen, Ping-Ling

VERSION 1 – REVIEW

REVIEWER	Yinan Peng Centers for Disease Control and Prevention, US
REVIEW RETURNED	24-Jul-2017

GENERAL COMMENTS	<p>•Overall: Manuscript needs to be edited. Goal of the research: authors talked extensively of helmet laws, both the existing motorcycle helmet law and the possibility of a bicycle helmet law for the future. The data analysis, however, was broad and an extensive list of factors were tested. Results were not tightly tied to helmet use or helmet law.</p> <p>- If the aim was to promote the importance of helmet use and helmet laws, authors could consider modify manuscript to put more emphasis on that.</p> <p>- If the aim was to conduct a broad analysis of factors that might influence head injury-related morbidity and mortality for bicyclists, with some discussion about helmet use and helmet law, authors could consider modify the manuscript, especially in the introduction section, to emphasize a unifying theme.</p> <p>Research question: There doesn't seem to be a hypothesis for possible factors that could influence head injuries in bicyclists. The research aim was stated as a blanket expedition to test out all factors. If the authors already suspect helmet use will be an important factor, given previous research, but are still curious in learning other factors that could influence head injuries, the research aims could be stated as such.</p> <p>Motorcyclists vs. bicyclists:</p> <p>- I'm not quite clear on the purpose of including motorcyclists in this paper that's focused on bicyclists.</p> <p>- If the authors were trying to compare head injuries among motorcyclists when there is a universal helmet law to head injuries among bicyclists as a promotion for bicycle helmet law, it could be stated more clearly.</p>
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Data for electronic bicycles:

Authors stated that a helmet law covering electronic bicycles were passed in 2016. Has there been data available to examine the changes in helmet use and head injuries?

Abstract:

Objective of research: the authors didn't indicate why they are investigate the characteristics. Did the authors intent to answer question such as why there are more head injury-related deaths among bicyclists? To better inform possible policy changes to reduce such mortalities?

Methods and Results: unclear the data period used in this paper; it's stated in the main paper, but not in the abstract.

Conclusion: authors were using data to urge more helmet use; it perhaps would be better to have that theme throughout the abstract.

Introduction:

Authors discussed injuries and head-injuries associated with motorcyclists and bicyclists, and ways to mitigate these morbidity and mortality both in Taiwan and in other countries. If authors can group the discussion under examples from other countries/regions and Taiwan-specific, this section could be clearer in meaning.

Repetitive information provided.

The introduction section is discussing increased bicycle use in Taiwan and its association with increased head injury-related morbidity and mortality. Authors contrasted this to head injury-related morbidity and mortality to motorcyclists. Due to a universal helmet law for motorcyclists, their morbidity and mortality has been declining. The same is not true for bicyclists, since there is no such law. Authors then went on to state their research aim, which was not linked, or at least not obviously linked, to the rest of the introduction section.

Methods:

Statistical methods could be more clearly described. What factors were controlled for in the multivariate regression models?

Results:

Unclear what the adjusted OR adjusted for.

Tables: the percentages presented in the tables do not provide much information. Using helmet use as an example: for bicyclists suffering head injuries, 417 out of 6359 wore helmets. For bicyclists not having head injuries, 5133 out of 57486 wore helmets. It would be more useful to know that 6.6% of head injury bicyclists and 8.9% of non-head injury bicyclists were wearing helmets. The authors presented that of 5550 (417+5133) people wearing helmets, 7.5% had head injuries.

	<p>Discussion:</p> <p>Focus of the discussion: discussion section should reflect introduction section. With a more clear focus, either or both sections could be changed to provide a clearer theme.</p> <p>What's the difference between e-bike and electric bicycles? There is already a helmet use law for electronic bicycles, so e-bike is not part of that?</p> <p>Natural trend in declining head injuries:</p> <ul style="list-style-type: none"> - Has there been research done to explain the natural decline in head injuries? - Could this change influence the factors impacting head injuries for bicyclists?
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REVIEWER	Chiara Orsi University of Pavia, Italy
REVIEW RETURNED	26-Jul-2017

GENERAL COMMENTS	<p>The objective of this paper is to investigate the crash characteristics of hospitalised motorcyclists and cyclists with head injuries. Linked data of the National Traffic Accident Dataset and the National Health Insurance Research Database were analysed for the purpose. Head injury-related hospitalisation was used as the study outcome for both motorcyclists and cyclists to evaluate whether various factors (e.g. human attributes, road and weather conditions, and vehicle characteristics) are related to hospital admission of those who sustained serious injuries.</p> <p>The subject of the paper is worthy of investigation. However, the research has some flaws that need to be addressed.</p> <p>Introduction</p> <p>p.6 row 33. Explain the acronym AIA2, as it is the first time it appears in the text.</p> <p>p. 8 rows 21-30 "Following the increasing popularity of bicycle use in recent years in Taiwan, the number of bicycle accidents has steadily increased. In addition, the implementation of several bike-sharing programmes in metropolitan cities such as Taipei City and Taichuang City". This is already stated previously in the Introduction. p. 8-9, from row 39. The objectives are not clearly stated. This paragraph is, instead, a summary of methods and therefore it is not appropriate for an introduction section. Please clarify the objectives in a few sentences.</p> <p>p. 8 row 50. Explain the acronym MCV, even if its significance is known, as it is the first time it appears in the text.</p> <p>Material and methods</p> <p>p. 10 rows 39-47 "Our study was exempted from review by an institutional review board because the encryption of patients' identification information makes it impossible to identify individual patients or casualties (IRB #:201409033)". This sentence it is not clear to me, please explain it better.</p>
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p. 11 rows 34-42 "The current study investigates the effects of demographic variables, temporal factors, road and environment characteristics, and crash factors on head injuries among bicyclist and motorcyclist casualties." This sentence should be moved at the end of the Introduction as it explains the study objective.

p. 11-12 paragraph "Variable definitions". In the variables description is not reported the variable 'License' shown in the table 2. Moreover, the variable 'Crash time', described in the text, is not reported in the tables 2, 3, 4, why? Finally, the variables 'Crash time' and 'Marriage' are not included in the logistic regression models, why?

Results

p. 13 row 39. Explain what N-code are (possibly in the Materials and methods section).

p. 25 rows 7-27. Also the AOR, not only the CI, should be mentioned.

p. 25 row 33. The word 'identical' is not appropriate, the word 'similar' would be better.

Tables

I suggest to add * for statistically significant results, in order to make simpler to read the tables.

Discussion

p. 27 rows 30-33 "the government should consider making helmet use mandatory for all bicyclists and not only for users of electric bicycles". A such kind of statement should be well argued, as there is a big debate in the scientific community on this topic.

p. 28 rows 30-48. Bibliographic references should be added.

p. 29 rows 45-57. Bibliographic references should be added.

p. 29 from row 45. Only one limitation of the study is mentioned. This study has, instead, several limitations that have all to be mentioned and discussed appropriately.

In general

There are some typos throughout which need corrections. Please, check carefully all the document.

VERSION 1 – AUTHOR RESPONSE

Reviewer: 1

Reviewer Name: Yinan Peng

Institution and Country: Centers for Disease Control and Prevention, US

Please state any competing interests: None declared.

Comment 1. The main issue is a lack of unifying theme throughout the manuscript. What do the authors hope to achieve through this paper? An examination of the current state of bicyclist head injuries in Taiwan? Factors influencing head injuries? Or focusing solely on helmet use? Promotion of helmet use and establishing a helmet law? The manuscript can benefit greatly from a more clearly articulated goal.

Authors' responses: We appreciate reviewer's comments, but feel sorry for causing confusion. In Taiwan there is currently helmet law for motorcyclists but not for cyclists. This leads to an important research question of whether cyclist casualties, compared with motorcyclists, have higher odds of head-injury related hospitalisation. This is our primary aim of research. Another important research hypothesis of the study is that risk factors that influence head-injury related hospitalisation among motorcyclists and bicyclists may include helmet use, alcohol consumption, or license status etc. This study, therefore, also aims to investigate the determinants of head-injury related hospitalisation among motorcyclists and cyclists, respectively.

To avoid confusion, the following statements have been added (please kindly see line 111, page 7):

“In Taiwan, helmet use is mandatory for motorcyclists but not cyclists. This leads to an important research question of whether cyclists involved in motor vehicle crashes (MVCs), compared with motorcyclists, are more likely to be hospitalised due to head injuries. The primary aim of this study was to determine whether cyclist casualties, compared with motorcyclists, have higher odds of head-related hospitalisation. Another important research hypothesis of the current research is that risk factors that influence head-injury related hospitalisation among motorcyclists and bicyclists may include helmet use, alcohol consumption, or license status etc. This study also aims to investigate the determinants of head-injury related hospitalisation among bicyclists and motorcyclists, respectively. ”

Comment 2. It's unclear how much the current manuscript can add to the field.

Authors' responses: We appreciate reviewer's comments on this. We believe that, coupled with past studies that mainly examined the effect of helmet use on discrete injury-severity data (e.g., fatal, serious, and slight injuries), injuries (e.g., head injury), or mortality, our research contributes to the field by uncovering important determinants of head-injury related hospitalisation among motorcyclists and cyclists. Also, our study contributes to the road-safety literature by finding that cyclists have higher odds of hospitalisation due to head injuries than motorcyclists in Taiwan. This is an important finding as currently in Taiwan helmet use is mandatory for motorcyclists but not for cyclists.

Overall:

3. Manuscript needs to be edited.

3.1 Goal of the research: authors talked extensively of helmet laws, both the existing motorcycle helmet law and the possibility of a bicycle helmet law for the future. The data analysis, however, was broad and an extensive list of factors were tested. Results were not tightly tied to helmet use or helmet law.

Authors' responses: We appreciate reviewer's comments, but feel sorry for causing confusion. Since the current research examines hospitalisation due to head injuries among motorcyclists and cyclists, the primary review of literature/relevant statistics is on helmet use. However, an important research hypothesis of the current research is that causes to head-injury hospitalisation can be complicated by presence of multiple factors such as helmet use, alcohol consumption, or license status etc. Data analysis and relevant discussions were therefore broad, with focuses on multiple factors such as helmet use, alcohol consumption, and unlicensed riding etc.

Comment 4. If the aim was to promote the importance of helmet use and helmet laws, authors could consider modify manuscript to put more emphasis on that.

Authors' responses: We appreciate reviewer's comments. In Taiwan there is currently helmet law for motorcyclists but not for cyclists. This leads to the first aim of research: the study aims to determine whether cyclist casualties, compared with motorcyclists, have higher odds of head-injury related hospitalisation.

The second research aim is to investigate the determinants of head-injury related hospitalisation among motorcyclists and bicyclists, respectively. It is hypothesized that the risk factors may include helmet use, alcohol consumption, or license status etc.

To avoid confusion, the following statements have been added under the section Introduction (please kindly see line 111, page 7):

"In Taiwan, helmet use is mandatory for motorcyclists but not cyclists. This leads to an important research question of whether cyclists involved in motor vehicle crashes (MVCs), compared with motorcyclists, are more likely to be hospitalised due to head injuries. The primary aim of this study was to determine whether cyclist casualties, compared with motorcyclists, have higher odds of head-related hospitalisation. Another important research hypothesis of the current research is that risk factors that influence head-injury related hospitalisation among motorcyclists and bicyclists may include helmet use, alcohol consumption, or license status etc. This study also aims to investigate the determinants of head-injury related hospitalisation among bicyclists and motorcyclists, respectively."

Comment 5. If the aim was to conduct a broad analysis of factors that might influence head injury-related morbidity and mortality for bicyclists, with some discussion about helmet use and helmet law, authors could consider modify the manuscript, especially in the introduction section, to emphasize a unifying theme.

Authors' responses: We appreciate reviewer's comments. As described in our responses to reviewer's comments above, our second research aim is to investigate the determinants of head-injury related hospitalisation among motorcyclists and bicyclists. To clarify this, the following statements have been added under the section Introduction (please also kindly see line 117, page 7):

"Another important research hypothesis of the current research is that risk factors that influence head-injury related hospitalisation among motorcyclists and bicyclists may include helmet use, alcohol consumption, or license status etc. This study also aims to investigate the determinants of head-injury related hospitalisation among bicyclists and motorcyclists, respectively."

Research question:

Comment 6. There doesn't seem to be a hypothesis for possible factors that could influence head injuries in bicyclists. The research aim was stated as a blanket expedition to test out all factors. If the authors already suspect helmet use will be an important factor, given previous research, but are still curious in learning other factors that could influence head injuries, the research aims could be stated as such.

Authors' responses: We appreciate reviewer for pointing this out. An important research hypothesis of the current research is that risk factors of head-injury hospitalisation among motorcyclists and bicyclists may include helmet use, alcohol consumption, or license status etc. This research hypothesis has been provided under the section Introduction as follows (please also kindly see line 117, page 7):

"Another important research hypothesis of the current research is that risk factors that influence head-injury hospitalisation among motorcyclists and bicyclists may include helmet use, alcohol consumption, or license status etc."

Motorcyclists vs. bicyclists:

Comment 7. I'm not quite clear on the purpose of including motorcyclists in this paper that's focused on bicyclists.

Authors' responses: We appreciate reviewer's comments.

By definition, two-wheeled vehicle users are comprised of motorcyclists and cyclists, and they are both vulnerable road users to all injuries, especially head injuries. To determine whether cyclist casualties, compared to motorcyclists, have higher odds of hospitalisation due to head injuries, motorcyclists are treated as the comparison group.

Our univariate analysis shows that compared with motorcyclists, bicyclists sustaining head injuries were 59% more likely to be hospitalised. We then conducted multivariate logistic models to adjust other cofounders, and the results show that compared with motorcyclists, bicyclists who sustained head injuries had an 18% decreased probability of being hospitalised. It is evident from our multivariate analyses that safety device (i.e., helmet) plays a role in affecting head-injury related hospitalisation for cyclists.

We appreciate reviewer's comments on this, and we suppose that including motorcyclists in this paper is a sensible approach to investigate head-injury related hospitalisation among motorcyclists and bicyclists.

Comment 8. If the authors were trying to compare head injuries among motorcyclists when there is a universal helmet law to head injuries among bicyclists as a promotion for bicycle helmet law, it could be stated more clearly.

Authors' responses: We appreciate reviewer for pointing this out.

In Taiwan, helmet use is mandatory for motorcyclists but not for cyclists. An important research question of the current research is whether bicyclist casualties have higher odds of head-injury related hospitalisation than compared with motorcyclist casualties.

To state this more clearly, the following statements have been added under the section Introduction: (please also kindly see line 111, page 7):

“In Taiwan, helmet use is mandatory for motorcyclists but not cyclists. This leads to an important research question of whether cyclists involved in motor vehicle crashes (MVCs), compared with motorcyclists, are more likely to be hospitalised due to head injuries. The primary aim of this study was to determine whether cyclist casualties, compared with motorcyclists, have higher odds of head-related hospitalisation.”

Data for electronic bicycles:

Comment 9. Authors stated that a helmet law covering electronic bicycles were passed in 2016. Has there been data available to examine the changes in helmet use and head injuries?

Authors' responses: We appreciate reviewer's comments. The data for the year 2016 are not available from the National Traffic Accident Dataset or the NHIRD data.

Abstract:

Comment 0. Objective of research: the authors didn't indicate why they are investigate the characteristics. Did the authors intent to answer question such as why there are more head injury-related deaths among bicyclists? To better inform possible policy changes to reduce such mortalities?

Authors' responses: We appreciate reviewer's comments. The Objectives in the Abstract have been re-written as follows (please also kindly see line 24, page 2):

“Objectives

The primary aim of this study was to determine whether cyclist casualties, compared with motorcyclists, have higher odds of head-related hospitalisation. This study also aims to investigate the determinants of head-injury related hospitalisation among bicyclists and motorcyclists, respectively.”

Comment 11. Methods and Results: unclear the data period used in this paper; it's stated in the main paper, but not in the abstract.

Authors' responses: We appreciate reviewer's comments. Data period has been added as follows (please also kindly see line 29, page 2):

“Using linked data of the National Traffic Accident Dataset and the National Health Insurance Research Database for the period between 2003 and 2012...”

Comment 12. Conclusion: authors were using data to urge more helmet use; it perhaps would be better to have that theme throughout the abstract.

Authors' responses: We appreciate reviewer's comments. To accentuate research focus, the Introduction and Objectives in the Abstract have been re-written as follows (please also kindly see line 19, page 2):

“Introduction

According to official statistics in Taiwan, the main body region of injury causing bicyclist deaths was the head, and bicyclists were 2.6 times more likely to be fatally injured than motorcyclists were. There is currently a national helmet law for motorcyclists but not for cyclists.

Objectives

The primary aim of this study was to determine whether cyclist casualties, compared with motorcyclists, have higher odds of head-related hospitalisation. This study also aims to investigate the determinants of head-injury related hospitalisation among bicyclists and motorcyclists, respectively.”

Introduction:

Comment 13. Authors discussed injuries and head-injuries associated with motorcyclists and bicyclists, and ways to mitigate these morbidity and mortality both in Taiwan and in other countries. If authors can group the discussion under examples from other countries/regions and Taiwan-specific, this section could be clearer in meaning.

Authors' responses: We appreciate reviewer's comments. The discussion has been re-grouped in the order of other countries/regions and then Taiwan-specific, as reported below (please also kindly see line 74, page 5).

“According to official accident statistics (the National Traffic Accident Dataset), the number of motorcycle accidents has been steadily decreasing; however, the number of bicycle accidents has been stably increasing. This is primarily attributable to the increasing popularity of bicycle use. For instance, several bike sharing programmes have been implemented in several metropolitan cities such as Taipei City, Taoyuan City, Tainan City, and Taichuang City. In addition, the use of electric bicycles and racing bikes, which are widely used for recreational purposes and travelling between cities, has been increasing.

Studies conducted mainly in Asian countries on helmet use and motorcyclist injuries have reported that helmet use and related laws have successfully reduced head injuries, thus reducing fatalities among motorcyclists. Ichiwaka et al. (2003) reported a 41% reduction in head injuries in Thailand 2 years after the implementation of a mandatory helmet use law⁷. A similar reduction in head injuries and fatalities has been reported in Malaysia⁸, Vietnam⁹, the United States³, and Italy¹⁰ after the implementation of helmet use laws. Bicycle helmet use is a means of reducing morbidity and mortality among bike users. Several case-controlled studies have reported an association of helmet use with a decreased rate of head injury and mortality among riders of all ages, with bicycle helmets reducing the risk of head and brain injury by 65%-88%¹¹. Moreover, Attewell et al. (2001)¹² conducted a meta-analysis of 16 observational studies and reported that bicycle helmets can significantly reduce the risks of head injury by approximately 60%.

Chiu et al. (2011) investigated motorcycle head injuries one year after the enforcement of the national helmet use law in Taiwan and reported a 33% reduction in head injuries⁶. Helmet use became mandatory for users of electric bicycles in 2016, but not for conventional bicycles.

Current efforts to increase helmet use in order to prevent head injuries in accidents include campaigns to increase awareness regarding the importance of helmet use, along with advocating helmet use laws. Over the last decades, mandatory bicycle helmet use laws have been implemented in several countries including Australia, New Zealand, Sweden, and Canada. A study indicated that helmet use laws act as a deterrent to cycling¹³. Other studies have supported this decline in cycling^{14 15}. In general, a positive effect of mandatory cycle helmet use laws on bicyclist head injuries has been observed in Australia^{16 17}, Sweden^{18 19}, and New Zealand^{20 21}.”

Comment 14 Repetitive information provided.

Authors' responses: We appreciate reviewer's comments. The statements “Following the increasing popularity of bicycle use in recent years in Taiwan, the number of bicycle accidents has steadily increased. In addition, the implementation of several bike-sharing programmes in metropolitan cities such as Taipei City and Taichuang City where bicycle helmets are not provided has presented a safety concern among bicyclists.” have been removed.

Comment 15. The introduction section is discussing increased bicycle use in Taiwan and its association with increased head injury-related morbidity and mortality. Authors contrasted this to head injury-related morbidity and mortality to motorcyclists. Due to a universal helmet law for motorcyclists, their morbidity and mortality has been declining. The same is not true for bicyclists, since there is no such law. Authors then went on to state their research aim, which was not linked, or at least not obviously linked, to the rest of the introduction section.

Authors' responses: We appreciate reviewer's comments. To link the Introduction with the objectives, the aim has been re-written as following (please kindly see line 111, page 7):

"In Taiwan, helmet use is mandatory for motorcyclists but not cyclists. This leads to an important research question of whether cyclists involved in motor vehicle crashes (MVCs), compared with motorcyclists, are more likely to be hospitalised due to head injuries. The primary aim of this study was to determine whether cyclist casualties, compared with motorcyclists, have higher odds of head-related hospitalisation."

Methods:

Comment 16. Statistical methods could be more clearly described. What factors were controlled for in the multivariate regression models?

Authors' responses: We appreciate reviewer's comment on this. To describe this more clearly, the following statements has been added (please kindly see line 187, page 11):

"Trend of head-related injuries among two-wheeler riders due to MVCs is compared and the difference in hospitalisation percentages is tested with the Mann-Kendall trend test. Distribution of head-injury related hospitalisation and non head-injury related hospitalisation by a set of variables (e.g., human attributes, environmental factors, and vehicle characteristics) is reported. Chi-square tests are conducted for comparing hospitalised patients (for head-related injuries) with hospitalised ones (for other injuries). Because the dependent variable is binary (hospitalisation for head injuries vs. emergency treatment or hospitalisation for other injury types), a logistic regression model was estimated to examine the determinants of hospitalisation for head injuries. A pooled logistic regression model was estimated: the first model of hospitalisation for head injuries included casualty type (bicyclists vs. motorcyclists) as one of the variables. In estimating the models, the variables that have significance level ($p < 0.2$) in the univariate logistic regression models were then incorporated into the multivariate logistic regression models. VIF (variance inflation factor) was conducted to assess multicollinearity among the variables. Only confounding variables were included in the models..."

• Results:

Comment 17. Unclear what the adjusted OR adjusted for.

Authors' responses: We appreciate reviewer's comments. The non-adjusted ORs are firstly estimated in the univariate analysis. The ORs are adjusted in the multivariate analysis for the confounders such as human attributes, road and weather conditions, and vehicle characteristics.

Comment 18. Tables: the percentages presented in the tables do not provide much information. Using helmet use as an example: for bicyclists suffering head injuries, 417 out of 6359 wore helmets. For bicyclists not having head injuries, 5133 out of 57486 wore helmets. It would be more useful to know that 6.6% of head injury bicyclists and 8.9% of non-head injury bicyclists were wearing helmets. The authors presented that of 5550 (417+5133) people wearing helmets, 7.5% had head injuries.

Authors' responses: We appreciate reviewer's comments. We actually attempt to examine how many casualties were hospitalised due to head injuries. For example, we are curious about whether unhelmeted cyclists had a higher risk of hospitalisation due to head injuries.

To do so, we have to compare " $417/(417+5133)$ " with " $5942/(5942+52353)$ ". It is that 10.2% of unhelmeted cyclists were hospitalised due to head injuries, which is higher than 7.5% of helmeted cyclists being hospitalised due to head injuries. With these percentages calculated, we then can interpret by indicating that unhelmeted cyclists had a higher risk of hospitalisation due to head injuries than helmeted ones.

We appreciate reviewer's suggestion on this, but we decide to retain the percentages calculated, which can be more informative.

Discussion:

19. Focus of the discussion: discussion section should reflect introduction section. With a more clear focus, either or both sections could be changed to provide a clearer theme.

Authors' responses: We appreciate reviewer's comments. To avoid confusion and provide a clearer theme throughout the manuscript, the following statements have been added under the section Introduction (please also kindly see line 111, page 7):

"In Taiwan, helmet use is mandatory for motorcyclists but not cyclists. This leads to an important research question of whether cyclists involved in motor vehicle crashes (MVCs), compared with motorcyclists, are more likely to be hospitalised due to head injuries. The primary aim of this study was to determine whether cyclist casualties, compared with motorcyclists, have higher odds of head-related hospitalisation. Another important research hypothesis of the current research is that risk factors that influence head-injury related hospitalisation among motorcyclists and bicyclists may include helmet use, alcohol consumption, or license status etc. This study also aims to investigate the determinants of head-injury related hospitalisation among bicyclists and motorcyclists, respectively."

Then in the section "Discussions", in order to reflect what has been stated in Introduction, the following statements have been added (please also kindly see line 333, page 26):

"To ascertain the research hypotheses, the univariate results suggest that compared with motorcyclists, bicyclists sustaining head injuries were 59% more likely to be hospitalised. However, the results of multivariate logistic models revealed that compared with motorcyclists, bicyclists who sustained head injuries had an 18% decreased probability of being hospitalised. After the adjustment of this result for other factors, helmet use appeared to be beneficial in reducing the risks of hospitalisation for head injuries among bicyclists."

Comment 20. What's the difference between e-bike and electric bicycles? There is already a helmet use law for electronic bicycles, so e-bike is not part of that?

Authors' responses: We appreciate reviewer's comments, but are sorry for the confusion. E-bike is electric bicycle, and for consistency, electric bicycle/bike has been used throughout the manuscript.

Natural trend in declining head injuries:

Comment 21. Has there been research done to explain the natural decline in head injuries?

Authors' responses: We appreciate reviewer's comments. We suppose that reviewer was talking about the natural decline in motorcyclist head injuries. A well-known work (Chiu et al., 2011) published in JAMA investigated motorcyclist head injuries one year after the enforcement of the helmet use law in Taiwan. Chiu et al. concluded that helmet law was beneficial in a 33% reduction in head injuries.

Comment 22. Could this change influence the factors impacting head injuries for bicyclists?

Authors' responses: We appreciate reviewer's comments. It is indeed an important research question. With the linked dataset available, it cannot be ascertained in this current research whether the natural decline in motorcyclist head injuries would influence the factors on cyclist head injuries. Further research is needed to investigate whether the mandatory helmet use for motorcycle would also affect helmet-use pattern for cyclists, and consequently affect the factors impacting head injuries for bicyclists.

Reviewer: 2

Reviewer Name: Chiara Orsi

Institution and Country: University of Pavia, Italy

Please state any competing interests: None declared

Comment 1. The objective of this paper is to investigate the crash characteristics of hospitalised motorcyclists and cyclists with head injuries. Linked data of the National Traffic Accident Dataset and the National Health Insurance Research Database were analysed for the purpose. Head injury-related hospitalisation was used as the study outcome for both motorcyclists and cyclists to evaluate whether various factors (e.g. human attributes, road and weather conditions, and vehicle characteristics) are related to hospital admission of those who sustained serious injuries. The subject of the paper is worthy of investigation. However, the research has some flaws that need to be addressed.

Authors' responses: We appreciate reviewer's valuable comments and suggestions that have resulted in significant improvements to the paper. We have revised our manuscripts in response to reviewer's comments. Please kindly see our responses below.

Introduction

Comment 2. p.6 row 33. Explain the acronym AIA2, as it is the first time it appears in the text.

Authors' responses: We appreciate reviewer's comments. To avoid any ambiguity, the acronym "A1A2" has been re-worded as "the National Traffic Accident Dataset" throughout the manuscript.

Comment 3. p. 8 rows 21-30 "Following the increasing popularity of bicycle use in recent years in Taiwan, the number of bicycle accidents has steadily increased. In addition, the implementation of several bike-sharing programmes in metropolitan cities such as Taipei City and Taichuang City". This is already stated previously in the Introduction.

Authors' responses: We appreciate reviewer's comments. The statements have been removed.

Comment 4. p. 8-9, from row 39. The objectives are not clearly stated. This paragraph is, instead, a summary of methods and therefore it is not appropriate for an introduction section. Please clarify the objectives in a few sentences.

Authors' responses: We appreciate reviewer's comments. We have re-written the sentences as (please also kindly see line 115, page 7):

"The primary aim of this study was to determine whether cyclist casualties, compared with motorcyclists, have higher odds of head-related hospitalisation...This study also aims to investigate the determinants of head-injury related hospitalisation among bicyclists and motorcyclists, respectively."

Comment 5. p. 8 row 50. Explain the acronym MCV, even if its significance is known, as it is the first time it appears in the text.

Authors' responses: We appreciate reviewer's comments. To clarify this, the following statements have been added (please also kindly see line 113, page 7):

"...(MVCs: a crash occurs when a vehicle collides with other road users, or other stationary objects such as a tree, telegraphy, or traffic island)..."

Material and methods

Comment 6. p. 10 rows 39-47 "Our study was exempted from review by an institutional review board because the encryption of patients' identification information makes it impossible to identify individual patients or casualties (IRB #:201409033)". This sentence it is not clear to me, please explain it better.

Authors' responses: We appreciate reviewer's comments. To clarify this, the original statement has been re-written this as (please also kindly see line 152, page 9):

"Patients' identification information that is used for linking the two datasets is encrypted by the Health and Welfare Data Science Center, Taiwan. No individual patient or casualty can be identified and therefore, our study was exempted from review by an institutional review board (IRB #:201409033)."

Comment 7. p. 11 rows 34-42 "The current study investigates the effects of demographic variables, temporal factors, road and environment characteristics, and crash factors on head injuries among bicyclist and motorcyclist casualties." This sentence should be moved at the end of the Introduction as it explains the study objective.

Authors' responses: We appreciate reviewer's comments. The sentence has been deleted because, in response to reviewer #1, we have re-written our objectives as follows:

"In Taiwan, helmet use is mandatory for motorcyclists but not cyclists. This leads to an important research question of whether cyclists involved in motor vehicle crashes (MVCs), compared with motorcyclists, are more likely to be hospitalised due to head injuries. The primary aim of this study was to determine whether cyclist casualties, compared with motorcyclists, have higher odds of head-related hospitalisation. Another important research hypothesis of the current research is that risk factors that influence head-injury related hospitalisation among motorcyclists and bicyclists may include helmet use, alcohol consumption, or license status etc. This study also aims to investigate the determinants of head-injury related hospitalisation among bicyclists and motorcyclists, respectively. "

Comment 8. p. 11-12 paragraph "Variable definitions". In the variables description is not reported the variable 'License' shown in the table 2. Moreover, the variable 'Crash time', described in the text, is not reported in the tables 2, 3, 4, why? Finally, the variables 'Crash time' and 'Marriage' are not included in the logistic regression models, why?

Authors' responses: We appreciate reviewer's comments.

Regarding the variable “license”, we have added “...license status (yes: with a valid license, or no: without a valid license)...” in the text (please kindly see line 174, page 10).

Regarding the variable “crash time”, the mention on crash time in the text has been removed as the variable was not used/analysed in the study.

Regarding the variable “marriage status”, the mention on marriage status in the text and table has been removed as the variable was not used/analysed in the study.

Results

Comment 9. p. 13 row 39. Explain what N-code are (possibly in the Materials and methods section).

Authors' responses: We appreciate reviewer's comments. The following statements have been added in the section “Methods” (please also kindly see line 147, page 9):

“ICD-9-CM N-codes ranging from 800 to 999 that report injury diagnoses were used for extracting injury data.”

10. p. 25 rows 7-27. Also the AOR, not only the CI, should be mentioned.

Authors' responses: We appreciate reviewer's comments. AORs have been added as follows (please also kindly see lines 304-309, page 25):

“...Moreover, factors such as the female (AOR=1.08, CI=1.07-1.10), age 65 or above (AOR=1.23, CI=1.19-1.28), rural areas (AOR=2.74, CI=2.66-2.83), BAC level>0.03% (AOR=2.80, CI=2.73-2.87), no use of a helmet (AOR=1.77, CI=1.74-1.81), darkness (AOR=1.08, CI=1.03-1.12), no separator of divided traffic direction (AOR=1.21, CI=1.19-1.24), and single-vehicle crash (AOR=1.75, CI=1.71-1.79) were found to be the most significantly associated with hospitalisation for head injuries.”

Comment 11. p. 25 row 33. The word ‘identical’ is not appropriate, the word ‘similar’ would be better.

Authors' responses: We appreciate reviewer's comments. The word “identical” has been replaced as “similar”.

Tables

Comment 12. I suggest to add * for statistically significant results, in order to make simpler to read the tables.

Authors' responses: We appreciate reviewer's suggestions. The symbol “*” has been added in the tables.

Discussion

Comment 13. p. 27 rows 30-33 “the government should consider making helmet use mandatory for all bicyclists and not only for users of electric bicycles”. A such kind of statement should be well argued, as there is a big debate in the scientific community on this topic.

Authors' responses: We appreciate reviewer's suggestions. We totally agree with reviewer that there is a big debate on this topic. The original statements have therefore been modified (please also kindly see line 359, page 27):

“..the government should consider encouraging helmet use. Further research can therefore be conducted once bicycle helmet use becomes more popular.”

Comment 14. p. 28 rows 30-48. Bibliographic references should be added.

Authors' responses: We appreciate reviewer's suggestions. Several references have been added, as reported below (please also kindly see line 378, page 28).

"This finding may be attributable to higher crash velocities being common in single-vehicle crashes (Clabaux et al., 2012), and helmet use being less common in rural areas where single-vehicle crashes usually occur (Russo et al., 2017)."

Clabaux N., Brenac, T., Perrin C., Magnin, J., Canu, B., Van Elslande, P., 2012. Motorcyclists' speed and "looked but failed to see" accidents. *Accident Analysis and Prevention* 49, 73–77.
Russo, BJ., Barrette, TP., Morden, J., Savolainen, P., Gates, T., 2017. Examination of factors associated with use rates after transition from a universal to partial motorcycle helmet use law. *Traffic Injury Prevention* 18(1), 95–101.

Comment 15. p. 29 rows 45-57. Bibliographic references should be added.

Authors' responses: We appreciate reviewer's suggestions. We suppose that reviewer meant "p. 28 rows 45-57". One reference has been added, as reported below (please also kindly see line 381, page 29):

"(e.g., electric bicycles that now in general may travel at more than 25 km/h (Langford et al, 2015))"

Langford, B., Chen, J., Cherry, C., 2015. Risky riding: naturalistic methods comparing safety behaviour from conventional bicycle riders and electric bike riders. *Accident Analysis and Prevention* 82, 220–226.

Comment 16. p. 29 from row 45. Only one limitation of the study is mentioned. This study has, instead, several limitations that have all to be mentioned and discussed appropriately.

Authors' responses: We appreciate reviewer's suggestions. Other limitations such as death data that are not available from NHIRD have now been mentioned (please also see line 345, page 27):

"The current research is limited by the fact that death data are not explicitly recorded in the NHIRD. Patients would die even if they are hospitalised. Unfortunately no such data is available from the NHIRD – these patients are recorded as "hospitalisation" instead of "deaths". Future research may attempt to obtain death data from other sources, which would open up additional analysis possibilities and allow more precise model estimation."

In general

Comment 17. There are some typos throughout which need corrections. Please, check carefully all the document.

Authors' responses: We appreciate reviewer's suggestions. All typos throughout the manuscript have been amended.

VERSION 2 – REVIEW

REVIEWER	Yinan Peng Centers for Disease Control and Prevention, US
REVIEW RETURNED	22-Sep-2017

GENERAL COMMENTS	<p>Overall:</p> <p>Editing:</p> <ul style="list-style-type: none">- Manuscript still needs editing.- Please use the same term to refer to bicyclists throughout the manuscript. Both bicyclists and cyclists are used. Even though the meaning is understandable, just use one term would be better for manuscript's accuracy.- Manuscript talks about both bicyclists and motorcyclists. In the abstract, the sequence is always bicyclists then motorcyclists. However, in the main text body, this sequence changed many times. To enhance the manuscript's readability, it would be best to always talk first about bicyclists, and then talk about motorcyclists. <p>Reference: the only issue is the citation for U.S.; citations for other countries seem to be countrywide surveys, but the one for U.S. is only for Connecticut, a small state. Perhaps authors can find a U.S. wide survey of motorcyclist head injuries</p> <p>Introduction:</p> <p>Line 104-105: is reducing cycling altogether one of the authors' aims?</p> <p>This section can be streamlined; a few ideas were repeated</p> <p>Results:</p> <p>Table 1: items in each column do not add to 100%. Was there something excluded? Consider either adding a note that not all data are presented, or adding an "Other" category.</p> <p>Table 2: there is interesting data in helmet use among injured bicyclists and motorcyclists, confirming what was stated in introduction, bicyclists are less likely to wear helmets since there is no law requiring helmet wearing for bicyclists; perhaps state that in the text</p>
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REVIEWER	Chiara Orsi Centre of Study and Research on Road Safety (CIRSS), Section of Biostatistics and Clinical Epidemiology, Department of Public Health, Experimental and Forensic Medicine, University of Pavia, Italy
REVIEW RETURNED	19-Sep-2017

GENERAL COMMENTS	I am satisfied with the revised paper.
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VERSION 2 – AUTHOR RESPONSE

Reviewer: 1

Reviewer Name: Yinan Peng

Institution and Country: Centers for Disease Control and Prevention, US

Please state any competing interests: None declared.

Comment 1. Please see attached document for comments. The main issue is that some editing is still needed to streamline the language, remove grammatical errors, and to ensure this theme runs through the entire manuscript: helmet use is important for reducing head-related injuries and hospitalization in bicyclists; there are other factors that also influence injuries; importance of a helmet law for bicyclists; however, other factors do exist to influence injuries, so perhaps additional interventions to increase riders' awareness of these factors; together with helmet law, can further reduce injuries, not only for bicyclists, but also for motorcyclists.

Authors' responses: We appreciate reviewer's suggestion. To remove grammatical errors, the manuscript has been edited by a proofreader.

We have added some statements in DISCUSSIONS, emphasising the importance of helmet use in reducing head-injury related hospitalisation among bicyclists. Also, additional interventions such as education and campaigns should aim to increase riders' awareness of other factors that were found to influence head-injury related hospitalisations. Together with helmet law, these additional interventions can further reduce head-injury related hospitalisation not only for bicyclists but also for motorcyclists. The following statements have been added in Discussions (please kindly see line 295, page 27):

“Our finding underscores the importance of helmet use in reducing hospitalisation due to head injuries among bicyclists while current helmet use is relatively low. Also, additional interventions such as education and campaigns should aim to increase riders' awareness of other factors that were found to influence head-injury related hospitalisations. Together with helmet law, these additional interventions can further reduce head-injury related hospitalisation not only for bicyclists but also for motorcyclists.”

Comment 2. Overall:

• Editing:

- Manuscript still needs editing.
- Please use the same term to refer to bicyclists throughout the manuscript. Both bicyclists and cyclists are used. Even though the meaning is understandable, just use one term would be better for manuscript's accuracy.
- Manuscript talks about both bicyclists and motorcyclists. In the abstract, the sequence is always bicyclists then motorcyclists. However, in the main text body, this sequence changed many times. To enhance the manuscript's readability, it would be best to always talk first about bicyclists, and then talk about motorcyclists.

Authors' responses: We appreciate reviewer's suggestion. The term “cyclist” throughout the manuscript has now been changed to “bicyclist”. Also, the sequence now has been consistent: bicyclist first and then motorcyclist.

Comment 3. Reference: the only issue is the citation for U.S.; citations for other countries seem to be nationwide surveys, but the one for U.S. is only for Connecticut, a small state. Perhaps authors can find a U.S. wide survey of motorcyclist head injuries .

Authors' responses: We appreciate editor's suggestion. The original reference has now been replaced as a review article by Pan et al. (2017) that examines the effectiveness of motorcycle helmet laws in increasing helmet use and reducing motorcycle-related deaths and injuries in U.S.

Peng Y, Vaidya N, Finnie R, et al. Universal motorcycle helmet laws to reduce injuries: A community guide systematic review. *American Journal of Preventive Medicine* 2017; 52(6):820-832.

Introduction:

Comment 4. Line 104-105: is reducing cycling altogether one of the authors' aims?

Authors' responses: We appreciate reviewer's suggestion. To avoid misleading readers, the original statement "Others studies have supported this decline in cycling" has been modified as "Other studies have similarly reported a decline in cycling due to helmet-use law." (please kindly see line 108, page 7).

Comment 5. This section can be streamlined; a few ideas were repeated

Authors' responses: We appreciate reviewer's suggestion. The original statements in lines 96-99 (Chiu et al. (2011) investigated motorcycle head injuries ...) have been moved to 1st paragraph of Introduction. We suppose that this would increase the readability (please kindly see line 75, page 5).

Also, the statements for lines 110-112 "In addition, the implementation of several bike-sharing programmes in metropolitan cities such as Taipei City and Taichuang City where bicycle helmets are not provided has presented a safety concern among bicyclists.." has been removed, as this was repeated.

Results:

Comment 6. Table 1: items in each column do not add to 100%. Was there something excluded? Consider either adding a note that not all data are presented, or adding an "Other" category.

Authors' responses: We appreciate reviewer's suggestion. An "Other injuries" category has been added (please kindly see the revised Table 1 in the manuscript).

7. Table 2: there is interesting data in helmet use among injured bicyclists and motorcyclists, confirming what was stated in introduction, bicyclists are less likely to wear helmets since there is no law requiring helmet wearing for bicyclists; perhaps state that in the text

Authors' responses: We appreciate reviewer's suggestion. The following statements have been added in the text (please kindly see line 238, page 15):

"As reported in Table 2, there are interesting data on helmet use among injured bicyclists and motorcyclists, confirming what was stated in Introduction: compared to the injured motorcyclists that had much higher helmet-use rate (91.57%), the injured bicyclists were less likely to wear helmet (8.93%) since there is no law requiring helmet use for bicyclists."