

## PEER REVIEW HISTORY

BMJ Paediatrics Open publishes all reviews undertaken for accepted manuscripts. Reviewers are asked to complete a checklist review form and are provided with free text boxes to elaborate on their assessment. These free text comments are reproduced below.

### ARTICLE DETAILS

<b>TITLE (PROVISIONAL)</b>	Emergency Department use by pediatric patients In the Lombardy Region, Italy: A population study
<b>AUTHORS</b>	Riva, Benedetta; Clavenna, Antonio; Cartabia, Massimo; Bortolotti, Angela; Fortino, Ida; Merlino, Luca; Biondi, Andrea; Bonati, Maurizio

### VERSION 1 – REVIEW

<b>REVIEWER</b>	Reviewer name Emmanouil Bagkeris Institution and Country University College London Competing interests No competing interest
<b>REVIEW RETURNED</b>	07-Jan-2018

<b>GENERAL COMMENTS</b>	<p>Dear Authors, this was a very interesting manuscript and I hope you find my comments below constructive.</p> <ol style="list-style-type: none"><li>1. Please give the number of patients included in the study at the results section of the abstract and also provide n/N for all percentages reported both in the abstract and the main text.</li><li>2. My recommendation is that you use Poisson regression models with robust standard errors to assess the characteristics associated with frequent non-urgent access. The outcome could be the number of non-urgent visits per patient. Poisson models with robust standard error provide estimates with narrower confidence intervals and the incidence risk ratios are easier to interpret compared to odds ratios.</li><li>3. In the abstract and the main text please provide regression estimates along with 95% confidence intervals to support the statement regarding the significant difference of the frequent non-urgent use.</li><li>4. What is the benefit of having two outcomes (non-urgent access (yes/no) and frequent non-urgent user (yes/no)), when they both convey the same message?</li><li>5. Consider not reporting X2M-H and X2 sine they do not add to the value of the findings.</li><li>6. On the third paragraph of the results section, correct the multivariate to multivatiabale. Multivariate regression is a technique that estimates a single regression model with more than one outcome variable. In your case you have one outcome variable at a time.</li><li>7. What is the IC in table 1? Is it a typo of CI? Please provide full description of ALL acronyms used on footnotes (even if they are obvious).</li></ol>
-------------------------	---

	8. Please indicate that the figure with the map is figure 2 (caption is currently missing) and also on footnote or legend, add a detailed name of the regions in order to make it easier for the readers.
<b>REVIEWER</b>	Reviewer name Niccolò Parri Institution and Country Meyer University Children's Hospital, Florence, Italy Competing interests None
<b>REVIEW RETURNED</b>	27-Jan-2018
<b>GENERAL COMMENTS</b>	<p>This is a study that aim to describe the rate of Emergency Department (ED) use by the pediatric population of Lombardy region and explore possible factors contributing to the use of the ED. The topic is relevant as the non-urgent use of the emergency department (ED) for pediatric patients is an increasing problem facing healthcare systems worldwide. Moreover the risk of an inappropriate use of ED by pediatrician patients is predominantly associated with organizational and cultural factors. For this reason the main scope of the study is relevant.</p> <p>There are several concerns with methodology and results report. Specifics</p> <p>Page 3, Line 14 The authors state that the growing rate of ED access determine consequences as “increase in costs, risk of infections, lenght of stay and dissatisfaction with ED service.” Please provide appropriate references for this statement.</p> <p>Page 3, Line 29 Non urgent visit are defined only by the triage code not by the diagnosis. The triage code is a priority code based on signs and symptoms that is managed by trained triage nurses and that establish the priority for access to the medical evaluation. Even the treatment and management provided in the ED or the outcome contribute to the definition of a non urgent visit. The rate provided of non urgent visits has a wide range (5-90%) could the author explain with a sentence the reason for lower and higher percentages of non urgent visit. Are these differences due to attendance in pediatric or general ED? Low-income or developing countries? Other reasons?</p> <p>Page 3, Line 41 Does these percentages refer to the general population or the pediatric population?</p> <p>Page 3, Line 51 Provide appropriate references for the sentence “few evaluated the determinants of the different patterns of ED utilization”</p> <p>Page 4 line 3: what inappropriate refers to? Inappropriate in term of RV? Inappropriate as non-urgent?</p> <p>Page 5 line 27: the population included consist of patient younger than 18 years of age but the authors said that in Lombardy region pediatric age is defined up to 14 years of age. Moreover in the data analysis the authors included all the 0-18 years of age populations of patients who presentend to the EDs of Lombardy region. This may not be fully representative of the pediatric population as it include the higher age group of 14-18 which has different reason to present to the ED compared to infants or pre-school age children.</p> <p>Page 5 line 36: provide references</p>

	<p>Page 6 line 1:contributing factors to what?</p> <p>Page 7 line 25 to 31: The authors excluded as diagnosis that may define a FNU attendee those one of FP pertinence (poisoning and injuries, abdominal pain, acute lymphadenitis, asthma, seizures, rotavirus gastroenteritis, influenza, laryngitis, nephritis and pneumonia). It is debatable whether all these diagnosis should be considered out of the competence of FP.</p> <p>A FP can assess and take care of many undefined gastroenteritis as well as many rotavirus gastroenteritis. The same for cases of influenza or influenza like diseases. I'm wondering why rotavirus gastroenteritis and influenza which imply an etiological diagnosis which may be more difficult for a FP and that may be easy in an ED with rapid tests, should be out of the competences of a FP.</p> <p>Second, abdominal pain, acute lymphadenitis, laryngitis and pneumonia are commonly pathology who are managed by FP and that do not commonly require the ED management. The risk is that the authors may had under or over-estimated numbers based on this definition.</p> <p>Did the authors considered to identify chronic patients between those FNU users, as chronic disease may increase the use of ED even for non urgent conditions?</p> <p>Page 7 line 51-52 please clarify if the numbers refer to the pediatric population or the 0-18 years of age population. Results may be overinflated by the analysis of a mixed pediatric and adult population (figure 1A)</p> <p>Page 8 line 30. The most frequent diagnosis were traumatic injuries (26%), respiratory infections (22%) and gastrointestinal disorders (8%). What about the remaining 44% of diagnoses? With a highest prevalence of attendances between 10-24 months of age it seems really difficult believe that trauma was the leading cause of presentation in the ED. Is this due to a high number of patients over 14 or 16 year of age where the use of vehicles may increase the numbers of trauma?</p> <p>Page 8 line 48 "a total of 79% of accesses were non urgent". This means that these patients were triaged with a white code based on what the author described. In line 29 of the same page the white code represent the 14.6% of the cases described.</p> <p>In general, absolute number should be provided before the given percentages. This may allow the reader to understand better the results (e.g. a total of 39.447 (xx%) children)</p> <p>Page 8 line 48 and over + Table 1- clarify the meaning for acute disease category. What the "other" category include? What is the meaning of LHU of residence Highest vs lowest?</p> <p>Results of multinomial logistic regression in table 1: nationality was not associated with non urgent attendance (could the authors provide results and he level of significance as well? Could the authors provide level of significance for the other determinants described as important independent determinants?</p> <p>Page 9 line 35 [...] traumatic injuries were the second cause of attendance (15.6%) and accounted for 24.2% of visits in children 6-11 years old and 39.6% of adolescents accesses. Does the authors consider trauma as a non urgent cause of ED presentation? Does the triage system in use allow to prioritize as non urgent (white code) even trauma?</p>
--	---

	<p>Page 10 line 18-Discussion. Normally overcrowding refers to the condition where more patients are located in an emergency department than is considered tolerable from a safety and health perspective and depend on the environment and local norms. Based on the numbers given by the authors 1.6 million of population considered for the present report and the number of ED it may not be considered overcrowding everywhere. We don't know whether all the 110 EDs of the region, take care of pediatric patients or how many pediatric ED the Lombardy region are available. Considering that the aim of the authors was to describe the pattern of use of the ED by the pediatric population think to rephrase the sentence.</p> <p>Page 10 line 46 difficult in communication by whom?</p> <p>Conclusions: the author demonstrated that the rate of prescription in frequent uses is higher compared to controls. This is in contrast with other reports that the authors considered in their list of references (Neumann MI et al). Does this high rate of prescription comes from pediatric ED or from mixed ED? May the higher prescription and diagnostic test rate be induced by patients evaluated in general ED more than pediatric ED? This may constitute an area of intervention with educational programs for ED physicians who may not be used to evaluate children or even pediatrician who are not used to work in the ED.</p> <p>Apologize for being verbose - what I guess I am suggesting is to better explain the results. Provide a balanced discussion of results and try to explain differences or common points with previous research.</p>
--	---

<b>REVIEWER</b>	<p>Reviewer name Silvia Bressan Institution and Country University of Padova, Italy Competing interests None</p>
<b>REVIEW RETURNED</b>	05-Feb-2018

<b>GENERAL COMMENTS</b>	<p>This regional population-based administrative database study by Dr Riva and colleagues describes the yearly prevalence of paediatric emergency department (ED) visits in the Lombardy Region, in Italy, and the factors contributing to the different patterns of use (categorized based on number of visits, triage code and outcome).</p> <p>The study has a particular focus on predictors of nonurgent visits in general as well as frequent nonurgent visits. In addition, a case-control substudy was carried out to assess the healthcare resource use by frequent nonurgent visits compared with matched randomly selected controls.</p> <p>The study addresses the relevant healthcare service issue of inappropriate utilization of ED services, common to many high-income countries.</p> <p>This study provides the first regional population-based data in Italy, where there is no common national surveillance database system in place to monitor health services use.</p> <p>The study design is appropriate for the research questions and is methodologically well conducted and described.</p> <p>I have a few minor comments and suggestions to improve the overall quality of the manuscript to be suitable for publication:</p>
-------------------------	---

	<p>Overall comments</p> <ul style="list-style-type: none"> <li>• Study aims – I suggest including the assessment of healthcare resource use in frequent nonurgent users in the study aims, otherwise the methods and results section on the case-control substudy seems somewhat disconnected</li> <li>• I suggest reducing the number of abbreviations to improve readability</li> <li>• English is of good quality but would benefit from some additional editing</li> </ul> <p>Section specific comments</p> <ul style="list-style-type: none"> <li>• Abstract – line 25, please specify that physician refers to primary care physician</li> <li>• Introduction – page 3, lines 12-16, please include a reference to support this statement; line 53 please provide relevant references at the end of the sentence</li> <li>• Methods – it would be useful to report the area and the total population of the Lombardy region for non Italian readers, page 4, lines 13-15; I suggest adding in the Methods, close to the sentence "All data were analyzed using an anonymous subject code" a statement on data management regarding consent obtained from the responsible regional authority for data analysis and the respect of the Italian policy on privacy and health data management</li> <li>• Results – page 8, line 53 when referring to the most important determinants it would be clearer to refer to LHU of Residence rather than residence setting for consistency with Table 1, so that to improve clarity; page 9, line 18 it looks like the words "was higher" are missing; page 7, line 53 –typo → 'a' to be removed; page 9, lines 44-50 FNU accesses instead of FNU use? There is some inconsistency between this statement and Table 2 and I suggest reporting here that adjustment for LHU of residence and average income per capita of the city of residence was performed; page 9, line 55, what do the authors mean by selected? Randomly selected or met the FNU user definition?</li> <li>• Discussion – page 10, line 33, rather than cite the references reporting authors names it would be more helpful to refer to the Italian regions data come from. Please specify the regions where data are from in reference 34; line 38 – "for the first time" – it is unclear whether this is the first study to report such information on Italian data or whether for the first time such a high prevalence of nonurgent visit was reported; page 11, lines 3-4 any explanation why the findings of the study are in contrast with international studies? page 11, line 11 sentence "consistently with other studies we observed a higher rate of FNU use in the metropolitan area of Milan" – it reads as other studies looked at the metropolitan area of Milan, but I assume the authors refer to the metropolitan area in general so it would be useful to clarify this; page 11, 39-52 could the authors report on the effectiveness of the different strategies listed and the reasons behind the choice of educational interventions for parents as a priority strategy based on their study results?</li> <li>• Conclusions – typo → an ED; conclusions are quite generic in their present form. I suggest reframing the paragraph to be more specific to the study overall objectives and to quantify the main findings (stating that the study showed an ED overuse is generic and does not emphasize the size of the findings)</li> <li>• Tables - Table 1 – LHU of residence "highest versus lowest" – does it stand for highest versus lowest number of citizens?</li> <li>• Figures - Please define abbreviations or do not use abbreviations in figure legends</li> </ul>
--	--

	<ul style="list-style-type: none"> <li>What this study adds – I suggest emphasizing more the novel findings of the study, putting them into context with respect to already available literature and Italian data</li> </ul>
--	--

## VERSION 1 – AUTHOR RESPONSE

Reviewer: 1

Comments to the Author

Dear Authors, this was a very interesting manuscript and I hope you find my comments below constructive.

1. Please give the number of patients included in the study at the results section of the abstract and also provide n/N for all percentages reported both in the abstract and the main text.

Response: Done

2. My recommendation is that you use Poisson regression models with robust standard errors to assess the characteristics associated with frequent non-urgent access. The outcome could be the number of non-urgent visits per patient. Poisson models with robust standard error provide estimates with narrower confidence intervals and the incidence risk ratios are easier to interpret compared to odds ratios.

Response: Thank you for the suggestion. We performed a Poisson regression model (please see attached table), and reported the main findings in the text of the results section. Results were similar to logistic regression with being a frequent non urgent user as dependent variable. However, the two endpoints (number of non urgent visits per patient versus being a frequent non urgent users) are a little bit different. In the latter case, with the logistic regression we tried to identify factors associated with the likelihood to attend ED several times and always for a potentially “inappropriate” reason, while in the first case we analysed factors associated with a greater number of non-urgent ED visits per patient (but some patients may have attended ED several times, e.g. vulnerable patients, both for urgent and non-urgent reasons). We would give our priority in reporting the results of the logistic regression, but we are also willing to report the table with Poisson regression findings, if you and the editors think they could be of interest for the readers.

3. In the abstract and the main text please provide regression estimates along with 95% confidence intervals to support the statement regarding the significant difference of the frequent non-urgent use.

Response: Done

4. What is the benefit of having two outcomes (non-urgent access (yes/no) and frequent non-urgent user (yes/no)), when they both convey the same message?

Response: As stated above, the message is a little bit different. The first analysis evaluated factors influencing non urgent versus urgent visits, while in the second one factors associated with a greater likelihood of being a frequent non urgent users (i.e. associated with parental attitude of attending ED instead of primary care physician) were evaluated. The second analysis has a greater relevance in order to design public health interventions.

Results were different, in particular concerning the impact of age: school-aged and adolescents had a greater likelihood to attend ED for a non urgent reason, while pre-schoolers had a greater likelihood of being frequent non urgent users.



5. Consider not reporting  $X^{2}_{M-H}$  and  $X^2$  since they do not add to the value of the findings.

Response: Done

6. On the third paragraph of the results section, correct the multivariate to multivariable. Multivariate regression is a technique that estimates a single regression model with more than one outcome variable. In your case you have one outcome variable at a time.

Response: Done (multivariate is often also used for models with one dependent/outcome variable and several independent variables)

7. What is the IC in table 1? Is it a typo of CI? Please provide full description of ALL acronyms used on footnotes (even if they are obvious).

Response: The typo error was fixed and full description of acronyms was added.

8. Please indicate that the figure with the map is figure 2 (caption is currently missing) and also on footnote or legend, add a detailed name of the regions in order to make it easier for the readers.

Response: Done

Reviewer: 2

This is a study that aim to describe the rate of Emergency Department (ED) use by the pediatric population of Lombardy region and explore possible factors contributing to the use of the ED. The topic is relevant as the non-urgent use of the emergency department (ED) for pediatric patients is an increasing problem facing healthcare systems worldwide. Moreover the risk of an inappropriate use of ED by pediatrician patients is predominantly associated with organizational and cultural factors. For this reason the main scope of the study is relevant.

There are several concerns with methodology and results report.

Specifics

Page 3, Line 14 The authors state that the growing rate of ED access determine consequences as "increase in costs, risk of infections, length of stay and dissatisfaction with ED service." Please provide appropriate references for this statement.

Response: A reference was added (reference #2, Hoot et al, 2008)

Page 3, Line 29 Non urgent visit are defined only by the triage code not by the diagnosis. The triage code is a priority code based on signs and symptoms that is managed by trained triage nurses and that establish the priority for access to the medical evaluation.

Response: In a few retrospective studies the diagnosis was also used as a criteria to discriminate urgent versus non urgent visits (e.g. Ben-Isaac et al Pediatr Emerg Care 2015).

Even the treatment and management provided in the ED or the outcome contribute to the definition of a non urgent visit. The rate provided of non urgent visits has a wide range (5-90%) could the author explain with a sentence the reason for lower and higher percentages of non urgent visit. Are these differences due to attendance in pediatric or general ED? Low-income or developing countries? Other reasons?

Response: The range cited in the para was reported in a review performed by Anne-Claire Durand et al published on the American Journal of Emergency Medicine in 2011. These authors found 51 different methods used in 39 articles to classify non urgent visits. The lower and higher values have been reported in the US, mainly because differences in the criteria used to define non urgent visits. The original sentence was rephrased in this way: "Non urgent visits can account for 5 to 90% of ED accesses; this wide range is mainly due to different criteria used for the definition of non urgency, generally based on triage code or diagnosis, treatment and management provided in the ED, and outcome."

Page 3, Line 41 Does these percentages refer to the general population or the pediatric population?

Response: Percentages refer to children less than 15 years of age (we clarified it in the text)

Page 3, Line 51 Provide appropriate references for the sentence "few evaluated the determinants of the different patterns of ED utilization"

Response: References were added

Page 4 line 3: what inappropriate refers to? Inappropriate in term of RV? Inappropriate as non-urgent?

Response: The first para on page 4 was modified in "Our study aimed to estimate the yearly prevalence of ED attendance in the Lombardy Region and to determine the factors contributing to the different patterns of use, and to assess if frequent non urgent use, a proxy of inappropriate ED use, is associated with a higher healthcare resource consumption"

Page 5 line 27: the population included consist of patient younger than 18 years of age but the authors said that in Lombardy region pediatric age is defined up to 14 years of age. Moreover in the data analysis the authors included all the 0-18 years of age populations of patients who presentend to the EDs of Lombardy region. This may not be fully representative of the pediatric population as it include the higher age group of 14-18 which has different reason to present to the ED compared to infants or pre-school age children.

Response: We agree that adolescents have different reasons to access ED compared to infants, but our target population (as done, in Italy, by Vedovetto et al and Grassino et al) was composed by children and adolescents less than 18 years old. This is commonly considered the "pediatric age". In the methods section we explained that in Lombardy Region subjects  $\geq 14$  years old should pay a fee if access ED for a non urgent reason (white triage code), but in our opinion this should not be a criteria to select only children 0-13 years old.

Page 5 line 36: provide references

Response: Done

Page 6 line 1:contributing factors to what?

Response: We rephrased the sentence: "... to assess factors influencing the pattern of ED use:..."

Page 7 line 25 to 31: The authors excluded as diagnosis that may define a FNU attendee those one of FP pertinence (poisoning and injuries, abdominal pain, acute lymphadenitis, asthma, seizures, rotavirus gastroenteritis, influenza, laryngitis, nephritis and pneumonia). It is debatable whether all these diagnosis should be considered out of the competence of FP.



A FP can assess and take care of many undefined gastroenteritis as well as many rotavirus gastroenteritis. The same for cases of influenza or influenza like diseases. I'm wondering why rotavirus gastroenteritis and influenza which imply an etiological diagnosis which may be more difficult for a FP and that may be easy in an ED with rapid tests, should be out of the competences of a FP. Second, abdominal pain, acute lymphadenitis, laryngitis and pneumonia are commonly pathology who are managed by FP and that do not commonly require the ED management. The risk is that the authors may had under or over-estimated numbers based on this definition.

Response: We agree that these diseases can be managed by family pediatricians, but in some instances it can be appropriate that children with rotavirus gastroenteritis, flu etc... attend the emergency department.

The above criteria were applied only in the case-control study, and not for the definition of frequent non urgent users. For the case-control study we preferred to identify children with the highest likelihood of inappropriate use, since they accessed several times ED for diseases that could and should be managed by their family pediatricians.

The above points were clarified in the methods section ("FNU users' healthcare resource utilization"): "... - all accesses during 2012 occurred for diseases that could be managed almost exclusively by FP.

Response: We therefore excluded cases of children attending the ED at least once for the following conditions, that may justify an ED access: poisoning and injuries, abdominal pain, acute lymphadenitis, asthma, seizures, rotavirus gastroenteritis, influenza, laryngitis, nephritis, and pneumonia. These criteria, adopted only for the case-control study, was applied with the aim to identify children with the highest likelihood of inappropriate ED use.

Comment: Did the authors considered to identify chronic patients between those FNU users, as chronic disease may increase the use of ED even for non urgent conditions?

Response: We think this is a very helpful suggestion, but it is not an easy task to accurately identify patients with chronic diseases by using administrative healthcare databases, so we will take it into account for a future study. However, we do not expect that chronic patients may be at a greater risk to be frequent non urgent users, since this group included only subjects who accessed ED always for non urgent reasons (no access during 2012 with a yellow/red triage code and/or with hospitalization).

Page 7 line 51-52 please clarify if the numbers refer to the pediatric population or the 0-18 years of age population. Results may be overinflated by the analysis of a mixed pediatric and adult population (figure 1A)

Response: Numbers refer to children and adolescents less than 18 years old. We clarified it in the text.

The trend of the prevalence by gender and age was reported in figure 1A, and in the main text we reported a few details (page 8, lines 3-7).

When calculating the prevalence on 0-13 years instead of 0-17 years old the estimates were not so different (28.5% versus 26.8%, respectively), so there is a slight underestimation of the rate of attendance, but not relevant.

Page 8 line 30. The most frequent diagnosis were traumatic injuries (26%), respiratory infections (22%) and gastrointestinal disorders (8%). What about the remaining 44% of diagnoses? With a highest prevalence of attendances between 10-24 months of age it seems really difficult believe that

trauma was the leading cause of presentation in the ED. Is this due to a high number of patients over 14 or 16 year of age where the use of vehicles may increase the numbers of trauma?  
The remaining 44% of diagnoses concerned diseases or symptoms covering (each one) less than 5% of the visits. E.g. generalized pain (4%), fever (3%), urticaria/dermatitis (3%), conjunctivitis (2%), epistaxis (2%), etc...

We categorized as “traumatic injuries” mainly conditions with ICD9 codes comprised between 800 and 939. As partially reported in the results (page 8, lines 33-36), injuries accounted for 15% of visits in preschoolers, 32% in school-aged children and 47% in adolescents. In the latter two age groups injuries were the leading cause of presentation, in children 1-5 years old the second most common one (after upper respiratory tract infections).

Page 8 line 48 “a total of 79% of accesses were non urgent”. This means that these patients were triaged with a white code based on what the author described. In line 29 of the same page the white code represent the 14.6% of the cases described.

The criteria to define non urgent access were reported in the methods section on page 5, line 40-51

“1. Non urgent access: defined by white or green triage codes and patient’s discharge as the outcome (including if the patient declined admission or left the ED before/during the medical examination)” Similar criteria were previously adopted in the studies by Vedovetto et al, and by Grassino et al.

In general, absolute number should be provided before the given percentages. This may allow the reader to understand better the results (e.g. a total of 39.447 (xx%) children)

Done

Page 8 line 48 and over + Table 1- clarify the meaning for acute disease category. What the “other” category include? What is the meaning of LHM of residence Highest vs lowest?

Acute disease category groups mainly acute infections that could be managed by primary care physicians, (we clarified in the text and in the footnotes of table). We also explained the meaning of “highest versus lowest” in the footnotes (“LHM with the highest value of prevalence of emergency department access versus LHM with the lowest value”)

Results of multinomial logistic regression in table 1: nationality was not associated with non urgent attendance (could the authors provide results and the level of significance as well? Could the authors provide level of significance for the other determinants described as important independent determinants?

As reported in the methods section (page 6, lines 46-48), a stepwise selection with a level of significance  $\alpha = 0.05$  was applied when performing logistic regressions; therefore variables with a level of significance  $> 0.05$  were not included in the model. We carried out logistic regression models including all the variables, and the p-value for nationality was 0.90 (table 1) and 0.61 (table 2). A p-value  $< 0.001$  was estimated for all the independent variables associated with the outcome variables (non-urgent access and being a frequent non urgent user); this detail was reported in the footnotes of table 1 and table 2. The level of significance for nationality was reported in the text (page 9)

Page 9 line 35 [...] traumatic injuries were the second cause of attendance (15.6%) and accounted for 24.2% of visits in children 6-11 years old and 39.6% of adolescents accesses. Does the authors consider trauma as a non urgent cause of ED presentation? Does the triage system in use allow to prioritize as non urgent (white code) even trauma?

Please see above for the definition of non urgent attendances (not represented only by white code).  
Page 10 line 18-Discussion.

Normally overcrowding refers to the condition where more patients are located in an emergency department than is considered tolerable from a safety and health perspective and depend on the environment and local norms. Based on the numbers given by the authors 1.6 million of population considered for the present report and the number of ED it may not be considered overcrowding everywhere. We don't know whether all the 110 EDs of the region, take care of pediatric patients or how many pediatric ED the Lombardy region are available. Considering that the aim of the authors was to describe the pattern of use of the ED by the pediatric population think to rephrase the sentence.

We rephrased the sentence: "Our study showed that the over-utilisation of EDs is a problem that affects the Lombardy Region and that is associated with a general overuse of healthcare resources in a small, but well-defined, group of ED users."

Page 10 line 46 difficult in communication by whom?

We rephrased the sentence: "This may be related to the high frequency of infections due to kindergarten attendance, and difficulties experienced by young children in communicate their symptoms may justify the mothers' anxiety for non urgent conditions such as fever (fever phobia)."

Conclusions: the author demonstrated that the rate of prescription in frequent uses is higher compared to controls. This is in contrast with other reports that the authors considered in their list of references (Neumann MI et al). Does this high rate of prescription comes from pediatric ED or from mixed ED? May the higher prescription and diagnostic test rate be induced by patients evaluated in general ED more than pediatric ED? This may constitute an area of intervention with educational programs for ED physicians who may not be used to evaluate children or even pediatrician who are not used to work in the ED.

Prescriptions evaluated in the case-control study were not related only to ED access, so it is likely that in part they were due to family pediatricians. For drug prescriptions we performed a "sensitivity analysis", by excluding prescriptions dispensed during the 7 days that followed an ED access (page 10, lines 9-14; page 11, lines 28-37; tables 3), and we found that more than half of drug prescriptions are not attributable to ED.

Apologize for being verbose - what I guess I am suggesting is to better explain the results. Provide a balanced discussion of results and try to explain differences or common points with previous research.

Reviewer: 3

#### <b>Comments to the Author</b>

This regional population-based administrative database study by Dr Riva and colleagues describes the yearly prevalence of paediatric emergency department (ED) visits in the Lombardy Region, in Italy, and the factors contributing to the different patterns of use (categorized based on number of visits, triage code and outcome). The study has a particular focus on predictors of nonurgent visits in general as well as frequent nonurgent visits.

In addition, a case-control substudy was carried out to assess the healthcare resource use by frequent nonurgent visits compared with matched randomly selected controls.

The study addresses the relevant healthcare service issue of inappropriate utilization of ED services, common to many high-income countries. This study provides the first regional population-based data in Italy, where there is no common national surveillance database system in place to monitor health services use. The study design is appropriate for the research questions and is methodologically well conducted and described.

I have a few minor comments and suggestions to improve the overall quality of the manuscript to be suitable for publication:

## Overall comments

- Study aims – I suggest including the assessment of healthcare resource use in frequent nonurgent users in the study aims, otherwise the methods and results section on the case-control substudy seems somewhat disconnected

We rephrased the para concerning the study aims: “Our study aimed to estimate the yearly prevalence of ED attendance in the Lombardy Region and to determine the factors contributing to the different patterns of use, and to assess if frequent non urgent use, a proxy of inappropriate ED use, is associated with a higher healthcare resource consumption”

- I suggest reducing the number of abbreviations to improve readability

If this is OK for the editors we are willing to reduce the number of abbreviations (it may imply a greater length of the paper).

- English is of good quality but would benefit from some additional editing

## Section specific comments

- Abstract – line 25, please specify that physician refers to primary care physician

Done

- Introduction – page 3, lines 12-16, please include a reference to support this statement; line 53 please provide relevant references at the end of the sentence

Done

- Methods – it would be useful to report the area and the total population of the Lombardy region for non Italian readers,

We reported the number of inhabitants living in Lombardy region.

page 4, lines 13-15; I suggest adding in the Methods, close to the sentence "All data were analyzed using an anonymous

subject code" a statement on data management regarding consent obtained from the responsible regional authority for data analysis and the respect of the Italian policy on privacy and health data management

We added the statement that “All data were managed according to the current Italian law on privacy”.

As reported at the end of the manuscript (funding statement), the study was part of a project supported by the Regional Health Ministry of Lombardy Region (the owner of the databases).

- Results – page 8, line 53 when referring to the most important determinants it would be clearer to refer to LHM of Residence rather than residence setting for consistency with Table 1, so that to improve clarity;

Done

page 9, line 18 it looks like the words “was higher” are missing;

Corrected

page 7, line 53 –typo → ‘a’ to be removed;

Done

page 9, lines 44-50 FNU accesses instead of FNU use?

We replaced FNU use in “being FNU user”

There is some inconsistency between this statement and Table 2 and I suggest reporting here that adjustment for LHM of residence and average income per capita of the city of residence was performed;

There was a mistake in the footnotes of table 2. Average income of the city of residence was not included in the model, since it was not significant. The error was fixed.

page 9, line 55, what do the authors mean by selected? Randomly selected or met the FNU user definition?

We replaced “selected” with “identified”. The criteria were those reported in methods section, page 7, lines 20-31.

- Discussion – page 10, line 33, rather than cite the references reporting authors names it would be more helpful to refer to the Italian regions data come from. Please specify the regions where data are from

We replaced authors with settings: “Moreover, the percentages of non urgent visits and non urgent users were higher than those observed in five LHUs in Veneto Region and in one ED in Crotone area, in the South of Italy, but similar to those reported in a multicenter study involving ten Italian hospitals in 8 different Regions.”

in reference 34; line 38 – “for the first time” – it is unclear whether this is the first study to report such information on Italian data or whether for the first time such a high prevalence of nonurgent visit was reported;

The sentence was modified: “Our study evaluated for the first time in Italy the prevalence of frequent users; the observed rate (1 out of 20 ED attendees) is consistent with findings from other countries.”  
page 11, lines 3-4 any explanation why the findings of the study are in contrast with international studies?

This may be related to several factors: e.g. differences in health system organization and socio-cultural factors.

page 11, line 11 sentence “consistently with other studies we observed a higher rate of FNU use in the metropolitan area of Milan” – it reads as other studies looked at the metropolitan area of Milan, but I assume the authors refer to the metropolitan area in general so it would be useful to clarify this;

We rephrased the sentence “Consistently with other studies, we observed a higher rate of FNU use in a metropolitan area, represented by Milan in the case of Lombardy Region,...”

page 11, 39-52 could the authors report on the effectiveness of the different strategies listed and the reasons behind the choice of educational interventions for parents as a priority strategy based on their study results?

Regarding the evidence we added a comment “Different types of strategies have been proposed ... but the evidence of effectiveness of these strategies appears scant and generally of low quality.”

Concerning the second point, we rephrased the statement: “Our findings support the hypothesis that overuse of ED by the pediatric population may be due to a parental attitude toward a general overuse of healthcare resources. According to the results of our study, priority should therefore be given to educational interventions for parents aimed to increase the appropriateness of healthcare resource utilization”

- Conclusions – typo → an ED; conclusions are quite generic in their present form. I suggest reframing the paragraph to be more specific to the study overall objectives and to quantify the main findings (stating that the study showed an ED overuse is generic and does not emphasize the size of the findings)

We rephrased the conclusions: “Our study shows that there is an ED overuse in Lombardy: one out of four children and adolescents accessed ED during a one year period, and one out of 10 accesses were due to youths who were visited several times for non urgent reasons only. Frequent use of ED is partially associated with an inappropriate use of other healthcare resources. It is therefore necessary to adopt strategies to improve the appropriate use of health service resources in order to provide quality health solutions to real health needs.”

- Tables - Table 1 – LHU of residence “highest versus lowest” – does it stand for highest versus lowest number of citizens?

We clarified it in the footnote: “LHU with the highest value of prevalence of emergency department access versus LHU with the lowest value”

- Figures - Please define abbreviations or do not use abbreviations in figure legends

Done

• What this study adds – I suggest emphasizing more the novel findings of the study, putting them into context with respect to already available literature and Italian data  
“What the study adds” was changed in:

- For the first time an evaluation of ED accesses by children and adolescents in a large regional population was performed in Italy
- More than 1 out of 4 youths accessed ED; 3% of ED attendees were frequent non urgent users and accounted for 9% of visits.
- A greater use of healthcare resources (prescriptions for drugs, diagnostic tests, visits) was found in frequent non urgent users compared to controls

## VERSION 2 – REVIEW

<b>REVIEWER</b>	Reviewer name Niccolò Parri Institution and Country Department of Emergency Medicine and Trauma Center Meyer University Children's Hospital viale Gaetano Pieraccini, 24 Florence, 50139 Competing interests None
<b>REVIEW RETURNED</b>	16-Mar-2018

<b>GENERAL COMMENTS</b>	<p>Thank you for letting me review the manuscript. The manuscript looks more focused and clear. There are few typing errors in the manuscript (e.g. extra spaces) that I recommend to review before submitting the final version.</p> <p>Comments:</p> <ul style="list-style-type: none"> <li>- Please spell out all acronyms the first time you cite them in the text both in the abstract and manuscript. e.g. CI: (95% confidence interval [CI] xx-xx) and then (95% [CI] xx-xx).</li> <li>- Page 4 line 12-18: “and to assess if frequent non-urgent use, a proxy of inappropriate ED use” and</li> <li>-Page 5 lines 40-47 “Three utilization patterns were identified based on the criteria used in previous studies: Non-urgent access: defined by white or green triage codes and patient’s discharge as the outcome (including if the patient declined admission or left the ED before/during the medical examination) “</li> </ul> <p>The authors in their response to the reviewer cited Vedovetto et al. Health Serv Res. 2014; 49(4): 1290–1305. As one of the main source of this definition, the article of Vedovetto et al defined the concept of inappropriate ED visit rather than non-urgent ED visit. Non-urgent patients remain a poorly identified population, reflecting a complex issue. The term “non-urgent” indicates mainly the level of severity of the medical problem that results in an ED visit (such as vital signs, being hospitalized or not...). In contrast, the term “inappropriate” covers, in addition to the medical problem, the social and psychological contexts of patients, visiting hours (during business hours or not), and availability of health care around the ED.</p>
-------------------------	--



	<p>Categorization conducted retrospectively at the end of the consultation is necessarily biased in its approach but may provide information on the problem of non-urgent ED patients, which seems to be one of the scope of the authors. If the authors refer to the article of Vedovetto for their definition of inappropriate cases, line 12-18 in page 4 should be changed and the use of non-urgent and inappropriate should be reviewed in all the manuscript.</p> <p>-Page 11 line 43 The conclusion is that the author demonstrated that the rate of prescription in frequent uses is higher compared to controls. In their response to the reviewer the authors stated that prescriptions evaluated in the case-control study were not related only to ED access, so it is likely that in part they were due to family pediatricians as they excluded prescriptions dispensed during the 7 days that followed an ED access and found that more than half of drug prescriptions were not attributable to ED.</p> <p>How do they defined that prescriptions were not related to ED Visits? What "not related to ED access" mean? Did the prescription numbers included drugs that may constitute a chronic therapy of the patient? There are possibilities that the original ED prescription was prolonged more than 7 days for health/diagnosis related factors that could be not fully understandable by chart review and that may be related to the ED visit? Could the prescription performed later than 7 days be a consequence of the ED prescription (e.g. further test, consultation)? If the authors have data that may explain these differences I encourage to include these details.</p>
--	---

<b>REVIEWER</b>	Reviewer name Silvia Bressan Institution and Country University of Padova, Italy Competing interests None
<b>REVIEW RETURNED</b>	18-Mar-2018
<b>GENERAL COMMENTS</b>	The authors responded satisfactorily to the comments/points raised.

## VERSION 2 – AUTHOR RESPONSE

Reviewer: 1

There are few typing errors in the manuscript (e.g. extra spaces) that I recommend to review before submitting the final version.

Response: We checked the manuscript and we hope to have fixed all the typo errors

Comments:

- Please spell out all acronyms the first time you cite them in the text both in the abstract and manuscript.  
e.g. CI: (95% confidence interval [CI] xx-xx) and then (95% [CI] xx-xx).

Response: Done

- Page 4 line 12-18: "and to assess if frequent non-urgent use, a proxy of inappropriate ED use" and

-Page 5 lines 40-47 "Three utilization patterns were identified based on the criteria used in previous studies: Non-urgent access: defined by white or green triage codes and patient's discharge as the outcome (including if the patient declined admission or left the ED before/during the medical examination) "

The authors in their response to the reviewer cited Vedovetto et al. Health Serv Res. 2014; 49(4): 1290–1305.

As one of the main source of this definition, the article of Vedovetto et al defined the concept of inappropriate ED visit rather than non-urgent ED visit. Non-urgent patients remain a poorly identified population, reflecting a complex issue. The term “non-urgent” indicates mainly the level of severity of the medical problem that results in an ED visit (such as vital signs, being hospitalized or not...). In contrast, the term “inappropriate” covers, in addition to the medical problem, the social and psychological contexts of patients, visiting hours (during business hours or not), and availability of health care around the ED. Categorization conducted retrospectively at the end of the consultation is necessarily biased in its approach but may provide information on the problem of non-urgent ED patients, which seems to be one of the scope of the authors. If the authors refer to the article of Vedovetto for their definition of inappropriate cases, line 12-18 in page 4 should be changed and the use of non-urgent and inappropriate should be reviewed in all the manuscript.

Response: We agree that the definition of “non urgent visit” is a complex issue, and it is likely that the criteria we used (white/green triage code and patients discharged to home) has limitations. We also think that our criteria can adequately identify visits with a low/very low degree of urgency, but in some instances a single non urgent ED access may be appropriate (e.g. injuries).

As stated in the manuscript, in our opinion frequent non urgent use can be a proxy of inappropriate utilization since it concerns several accesses all with very low/low level of urgency.

We therefore think that the definition currently used in our paper can be considered quite accurate.

-Page 11 line 43 The conclusion is that the author demonstrated that the rate of prescription in frequent uses is higher compared to controls. In their response to the reviewer the authors stated that prescriptions evaluated in the case-control study were not related only to ED access, so it is likely that in part they were due to family pediatricians as they excluded prescriptions dispensed during the 7 days that followed an ED access and found that more than half of drug prescriptions were not attributable to ED.

How do they defined that prescriptions were not related to ED Visits? What “not related to ED access” mean? Did the prescription numbers included drugs that may constitute a chronic therapy of the patient? There are possibilities that the original ED prescription was prolonged more than 7 days for health/diagnosis related factors that could be not fully understandable by chart review and that may be related to the ED visit? Could the prescription performed later than 7 days be a consequence of the ED prescription (e.g. further test, consultation)? If the authors have data that may explain these differences I encourage to include these details.

Response: We performed our “sensitivity” analysis only on drug prescriptions (not on visit or diagnostic test prescriptions). In administrative databases it is not possible to identify the prescriber in an accurate manner and information on prescriptions performed in ED was not always recorded. We therefore considered a drug prescription not related to a ED visit if the date of prescription occurred more than 7 days after ED visit (we added a clarification as a footnote of table 3).

We are confident that a drug prescribed more than 7 days after an emergency department access is unlikely to be directly associated to the ED attendance (maybe some antibiotic prescriptions are a “refill” of a treatment course started in ED, but it is quite an uncommon event). We checked drug prescriptions and most of them, for both cases and controls, were antibiotics and nebulised anti-asthmatics (nebulised beclomethasone, flunisolide, salbutamol), i.e. therapies for acute respiratory tract infections (in Italy nebulised steroids are commonly prescribed as symptomatic treatment of upper respiratory tract infections). We therefore consider unlikely that the greater healthcare resource utilization observed in cases can be explained by a higher percentage of chronic patients among frequent non urgent users.

### VERSION 3 – REVIEW

<b>REVIEWER</b>	Reviewer name Niccolò Parri Institution and Country Department of Emergency Medicine and Trauma Center Meyer University Children's Hospital viale Gaetano Pieraccini, 24 Florence, 50139 Italy Competing interests None
<b>REVIEW RETURNED</b>	14-Apr-2018
<b>GENERAL COMMENTS</b>	The authors answered sufficiently to all the questions raised.