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

TITLE (PROVISIONAL)	Interventions for reducing unplanned paediatric admissions: an observational study in one hospital
AUTHORS	Husk, Kerryn; Berry, Vashti; Tozer, Richard; Skipwith, Gina; Radmore, Robert; Ball, Susan; Ukoumunne, Obioha; Logan, Stuart

VERSION 1 – REVIEW

REVIEWER	Mando Watson Institution and Country St Mary's Hospital Imperial Healthcare NHS Trust London UK Competing interests Clinical Lead for Connecting Care for Children, a programme developing new models of care for child health
REVIEW RETURNED	10-Dec-2017

GENERAL COMMENTS	This study explores an important aim - to reduce unplanned admission in the childhood population. As the authors say, many units have tried to introduce service change in this field, without a good evidence base. This study therefore of value The paper is beautifully writen, clear to read with a good level of detail on methodology both of the intervention and of the study the figures are clear and helpful The outcomes are interesting, with a suggested impact of A&G to reduce <1 day admissions but increase overall bed days. The latter is explained by the impact of a fluctuating number of very long stay/mental health cases. Once the SSPAU is introduced, both < 1 day admissions and overall bed days drops significantly. Points of clarification/amendment/challenge, in no particular order: We are told that paediatric admissions are rising year on year, nationally but the paper's local data is different, with a flat number of admissions. This contradiction makes the reader uncomfortable. we are told 'there are indications that interventions reducing time taken to senior clinician review are effective in better managing paediatric acute care' in the summary box but the body of the paper does not really demonstrate that The (blue) admissions figures in figure 2 is different from figure 1 & 3. It isn't immediately obvious that the explanation is that figure 2 represents part year figures, while the others are full year. A small amendment to the title of the figure would clarify that there are likely to be many confounding variables;

	the authors have taken good care to reduce the confounding effect of the advice and guidance line and the short stay unit being introduced in the same year, however there are no data on the potential confounders eg of changes to the GP landscape occurring at the same time eg staffing levels eg The reader might like to understand if the impact of a fluctuating number of very long stay/mental health cases might also have impacted on the drop in ward admissions seen after the introduction of the SSPAU it would be good to have more data post-intervention to show a sustained effect but this would be best done as a follow up study rather than delay the definition of an admission as presence in the hospital at midnight, provides potential skew, particularly for very short stay patients: patients may be admitted to hospital as much or more, but if discharged before midnight, it will appear as a reduction in admissions. How has this been addressed by the authors? the text refers to admissions but does not specify age range eg children < 16 y. This is particularly noticeable in the figures. A simple change to the figure title would clarify that this paper demonstrates a significant reduction is hospital bed days. the financial benefit of this is substantial. why hasn't that been mentioned in the discussion? the minimal impact of the A&G line is disappointing. other A&G services have shown and impact on out patient usage eg http://bjgp.org/content/63/612/348 It would be helpful to understand why the out patient element hasn't been addressed in this analysis of the benefit of the A&G service ultimately I am left worrying that this paper simply demonstrates a shift in workload from one setting to another. I am not convinced that the new service has moved care upstream in order to improve quality and reduce costs. if the authors really believe this has happened, then it would be good for the paper to be amended in a way that addresses this

REVIEWER	Mitch Blair Institution and Country Imperial College London Competing interests None
REVIEW RETURNED	18-Jan-2018

GENERAL COMMENTS	Title: Interventions for reducing unplanned paediatric admissions: a natural experiment in one trust. This is a paper which adds to our evidence base by the testing of two interventions designed to reduce unplanned hospital admission in a single site. It is an observational study with an analysis based over a time period showing significant changes in patterns of service utilisation by patients. Introduction: Suggest add to reference 6 the work of Sands et al who described reasons for presentation over a ten year period in the East Midlands. Sands R, Shanmugavadivel D, Stephenson T, Wood D. Medical problems presenting to paediatric emergency departments: 10 years on.

	Emerg Med J [Internet]. 2012 May [cited 2016 Aug 1];29(5):379–82. Available from: http://www.ncbi.nlm.nih.gov/pubmed/21609944 Line 28 – suggest adding in reference Watson M and Blair M, Emergency departments and minor illness: some behavioural insights Arch Dis Child Jan 2018 doi:10.1136/archdischild-2017-314057 Page 5, Line 12 – Martin et al reference missing. Page 6 – suggest the specified data collection definition document is added to the paper as a supplementary file. Section on setting on this page needs to be further expanded to include some idea of throughput of ED attendances and number of beds and structure of unit in terms of total number of paediatric inpatient beds and approximate staffing levels. This would allow further comparability or adoption in other similar sized units. Page 7, Line 45 – suggest replacing sentence “we analysed routine hospital data across four outcomes for children under 18 years” with “we analysed routine hospital data for four service parameters for children under 18 years”. Page 8, Line 3 – the advice and guidance phoneline was evaluated on all parameters (remove outcomes) The SSPAU was evaluated for paediatric ward admissions (replace “on”). Page 11, Line 40 – indicating that this was significantly lowered post intervention. Page 17, Figure 1 – this graph would benefit from the addition of admissions as proportion of all attendances. This is approximately 20.3% in 2010 and 17.8% in 2014. This could be added to the graph just above the admissions bar charts or within them, depending on clarity. In summary, I think this is a very well written paper with a small number of changes recommended. Two aspects of clarification that would help, on page 6, line 48 – some of idea of the waiting time to be seen in rapid access clinical appointments and similarly for standard outpatients. Secondly, the authors mention that an A&G clinic code was logged, but it is not clear whether this attracted a particular change in tariff from commissioners. One of the key barriers in implementation of innovative models of care is confusion around the appropriate business model for payment of such innovations and it would be useful for the authors to note a few lines on the acceptability of this type of intervention in terms of future sustainability and to help other units who are trying to adopt other innovations.

VERSION 1 – AUTHOR RESPONSE

We thank the two reviewers and associate editor for their considered comments, we have addressed these individually and detail our changes below, we feel the manuscript is clearer and improved as a result.

Response to reviewers:

Figures shouldn't be embedded in the text file, but uploaded as separate Image files. Please convert and submit your figure into TIFF, JPEG or PNG file format. Choose the correct file designation whether as mono image or colour image. Please ensure that figures are a minimum of 300 dpi and a maximum of 600 dpi. All images should be mentioned in the text in numerical order and figure legends should be listed at the end of the manuscript.

We have removed these from the text document and now include as separate files.

Reviewer 1:

1. We are told that paediatric admissions are rising year on year, nationally but the paper's local data is different, with a flat number of admissions. This contradiction makes the reader uncomfortable.

Thank you for drawing our attention to this, is does feel disjointed and this is largely because it is so; therefore, we have been more explicit and stated that 'in the face of' national rises the local case study has had flat admissions. We have also highlighted the fact that the trust still wanted to implement interventions, which is important.

See:

Page 4, Paragraph 1: "Whilst rates vary by area (and indeed in the site included in this study admission rates are flat), such increases are unsustainable and therefore remain a research priority."

Page 6, Paragraph 1: "Admission rates at Torbay, in the face of a national increase, are relatively flat; despite this the clinical team are still implementing strategies to reduce unplanned acute admissions."

2. We are told 'there are indications that interventions reducing time taken to senior clinician review are effective in better managing paediatric acute care' in the summary box but the body of the paper does not really demonstrate that.

We had made an unfair conceptual leap in that statement, but the basis we think was useful to highlight and as such we have reworded this to now indicate that A&G and SSPAU, as examples of reducing time taken to senior clinician review, are effective.

See:
Page 3, "What this study adds": "There are indications that advice and guidance and SSPAU, as examples of interventions reducing time taken to senior clinician review, are effective in better managing paediatric acute care."

3. The (blue) admissions figures in figure 2 is different from figure 1 & 3. It isn't immediately obvious that the explanation is that figure 2 represents part year figures, while the others are full year. A small amendment to the title of the figure would clarify that.

We have amended both the title and legend of figure 2 to make this more explicit: this now reads: "Comparison of April-October (part-year) Periods"

4. There are likely to be many confounding variables; the authors have taken good care to reduce the confounding effect of the advice and guidance line and the short stay unit being introduced in the same year, however there are no data on the potential confounders eg of changes to the GP landscape occurring at the same time eg staffing levels.

(a) We have now included data relating to staffing levels, at the start of the A&G phase there was an increase of 1 consultant (immediate and sustained change).

(b) The changes to the GP landscape are important and this is an issue we would very much like to explore in more detail, however we don't currently have these data. Therefore, we have sought to bring this to the reader's attention by including in this section a sentence noting that these are relevant issues but which lie outside of the scope of this project.

See:
(a) Page 6, Paragraph 3: "At the commencement of the A+G phase there was an increase from one to two consultants available for acute service provision. This increase was partly to enable more consultant input and partly to compensate for reduction in numbers of middle grade paediatric staff owing to rota gaps."

(b) Page 7, Paragraph 2: "During implementation of these intervention there were a number of changes to the GP landscape, which we are unable to account for due to a lack of robust data but remain important contextual factors."

5. The reader might like to understand if the impact of a fluctuating number of very long stay/mental health cases might also have impacted on the drop in ward admissions seen after the introduction of the SSPAU.

This is an issue we are seeking to explore in the later stages of this project as we feel that mental health admissions and their impact on the acute system are still poorly understood, but we don't currently have ICD data linked on these admission data so cannot assess comprehensively.

However, we do propose this as a reason underlying bed-day changes and so have extended this to include impact on ward admissions.

See:
Page 11, paragraph 5: "There was an increase in overall bed-days after the introduction of A&G, probably due to the fluctuating number of long-stay cases in the short time periods used, likely a direct impact of including child and adolescent mental health cases (something which is also likely to have had an impact on the decrease in ward admissions following the introduction of SSPAU)."

6. It would be good to have more data post-intervention to show a sustained effect but this would be best done as a follow up study rather than delay.

We completely agree, although given the difficulty in getting access and timely returns we agree this should be a follow up study. As above, we are drawing off ICD data together with admissions so we will analyse MH admissions in a subsequent study.

7. The definition of an admission as presence in the hospital at midnight, provides potential skew, particularly for very short stay patients: patients may be admitted to hospital as much or more, but if discharged before midnight, it will appear as a reduction in admissions. How has this been addressed by the authors?

The issue of overnight definition of admission is problematic, something we recognise in the paper (see Background), however we feel here it is most appropriate and does not introduce skew as it is consistent pre and post intervention, due to the fact that we use Ward admission (and not simple hospital admission) as the outcome.

ED and, after it opens, SSPAU, are reclassified as attendances, and SSPAU is not open overnight so individuals there at close will be discharged or admitted to the ward (thus being captured). A&G similarly.

We would argue we have addressed the problematic notion of admission then by (a) using overnight, and (b) citing our admission downstream on the Ward. To make this clearer we have stated that our definition of admission is Ward located and overnight and remains the same pre and post intervention, see:

Page 8, paragraph 3: “Importantly, these are paediatric ward overnight admissions not simply hospital admissions (i.e. SSPAU admissions are reclassified as attendances) and so are consistent pre and post intervention”

8. The text refers to admissions but does not specify age range eg children < 16 y. This is particularly noticeable in the figures. A simple change to the figure title would clarify that

We had stated in the abstract and setting that we include all those <18 years, but this is a good point about specifying on the figures and so we have amended the titles of Figures 1, 2, and 3 to include age range included.

9. This paper demonstrates a significant reduction is hospital bed days. the financial benefit of this is substantial. why hasn't that been mentioned in the discussion?

This links to comments made by Reviewer 2, and is certainly an important one. This paper deals primarily with effectiveness and quality, and while we wanted to address the financial implications comprehensively the funding landscape is so complex on this issue with block v fee for service models that we feel it is worthy of more robust evaluation to be useful and probably a paper in its own right. We do now include a discussion point on financial significance, however we note that this will be dependent on funding arrangements at individual sites.

See:
Page 11, paragraph 4: “there are likely to be linked financial benefits, however hospital-specific funding arrangements make robust assessments difficult; these interventions improve quality rather than simply reducing costs, with savings offset by the greater expense of providing additional consultant presence.”

10. The minimal impact of the A&G line is disappointing. other A&G services have shown and impact on outpatient usage eg http://bjgp.org/content/63/612/348 It would be helpful to understand why the outpatient element hasn't been addressed in this analysis of the benefit of the A&G service.

Many thanks for the citation and this raises another key issue, the differences in intention for seemingly coherent ‘Advice and Guidance’ services. Some of these systems are intended to manage workload across all areas, however the system implemented in this site was solely for the management of emergency cases and discussion of such by GP and senior paediatrician. For that reason, and in discussion with our clinical co-investigators, we assessed on the outcomes listed and not on the more non-acute outpatient side. The intention in this instance was to avoid unnecessary admissions and so we assessed those.

11. Ultimately, I am left worrying that this paper simply demonstrates a shift in workload from one setting to another. I am not convinced that the new service has moved care upstream in order to improve quality and reduce costs. if the authors really believe this has happened, then it would be good for the paper to be amended in a way that addresses this.

We agree that this is an important point and feel that the significance of these system interventions demonstrates improved quality and safety of care for children who don't need to be in hospital, using the proxy of admission. We completely agree that cost benefits are important but are complex and not definitively demonstrated here.

We have reframed sentences in our introduction and discussion to be clearer about the links between system shift, quality of care and the benefit of these new services clinically.

See:
Introduction: Page 4, paragraph 1: "Admission to hospital is an undesirable outcome for children and their parents for many reasons, including disruption to family life, increased emotional distress and exposure to infections. There are also significant cost implications of a hospital admission."

Discussion: Page 11, paragraph 2: "increased partnership working between paediatrics and primary care, enabling more responsive and flexible care, with GPs valuing consultant contact and the ability to manage acute illness through discussion."

And: Page 11, paragraph 4: "there are likely to be linked financial benefits, however hospital-specific funding arrangements make robust assessments difficult; these interventions improve quality rather than simply reducing costs, with savings offset by the greater expense of providing additional consultant presence."

And: Page 12, paragraph 1: "These reductions in assessments in hospital care represent, we believe, not only an improvement for those individuals but greater consultant involvement in assessment and management has reduced investigations and interventions. It is possible that some parents whose children were not admitted experienced increased anxiety managing them at home, but we believe that consultant review before discharge and safety netting allays most fears."

Reviewer 2:

12. Suggest add to reference 6 the work of Sands et al who described reasons for presentation over a ten year period in the East Midlands. Sands R, Shanmugavadivel D, Stephenson T, Wood D. Medical problems presenting to paediatric emergency departments: 10 years on. Emerg Med J [Internet]. 2012 May [cited 2016 Aug 1];29(5):379–82. Available from: http://www.ncbi.nlm.nih.gov/pubmed/21609944

Many thanks for the citation, we have now added.

13. Line 28 – suggest adding in reference Watson M and Blair M, Emergency departments and minor illness: some behavioural insights Arch Dis Child Jan 2018 doi:10.1136/archdischild-2017-314057

Again, thanks for the useful citation, we have now added.

14. Page 5, Line 12 – Martin et al reference missing.

Apologies for the confusion, this was noted in our cover letter to the editors but not in the manuscript. This reference relates to a linked submission by the same team which we are seeking to cite (if successful).

15. Page 6 – suggest the specified data collection definition document is added to the paper as a supplementary file.

We have now added this as suggested, please see supplementary material.

16. Section on setting on this page needs to be further expanded to include some idea of throughput of ED attendances and number of beds and structure of unit in terms of total number of paediatric inpatient beds and approximate staffing levels. This would allow further comparability or adoption in other similar sized units.

We have expanded this section to better describe the relative size and staffing levels of the unit, which as indicated will be useful for assessing broader applicability.

See:
Page 6, paragraph 1: “Torbay Hospital is a foundation trust, medium-sized district general hospital, with paediatric services comprising a 19 bed/cot inpatient ward, including a two bed HDU and six bed adolescent unit. Staffing consists of 13 acute consultants, eight level one training grades plus six middle tier trainees.”

17. Page 7, Line 45 – suggest replacing sentence “we analysed routine hospital data across four outcomes for children under 18 years” with “we analysed routine hospital data for four service parameters for children under 18 years”.

Many thanks, we have made that correction.

18. Page 8, Line 3 – the advice and guidance phone line was evaluated on all parameters (remove outcomes). The SSPAU was evaluated for paediatric ward admissions (replace “on”).

Many thanks, we have amended both of these.

19. Page 11, Line 40 – indicating that this was significantly lowered post intervention.

Again, thanks, we have amended.

20. Page 17, Figure 1 – this graph would benefit from the addition of admissions as proportion of all attendances. This is approximately 20.3% in 2010 and 17.8% in 2014. This could be added to the graph just above the admissions bar charts or within them, depending on clarity.

We agree this is beneficial information to add, and have done so – please see Figure 1.

21. Page 6, line 48 – some of idea of the waiting time to be seen in rapid access clinical appointments and similarly for standard outpatients.

We have amended this sentence to now give a clearer description of the option available:

See:
Page 6, paragraph 4: “From November 2014, calls could result in: referrals to the newly established Short Stay Paediatric Assessment Unit (SSPAU) to be seen that day (Monday to Friday) or, where it was felt that immediate assessment was not required: advice and guidance to GPs and parents enabling them to manage at home, sometimes with further review; booked review on SSPAU early the next day; or booked into urgent (1-2 week) slots in consultant or registrar clinics.”

22. The authors mention that an A&G clinic code was logged, but it is not clear whether this attracted a particular change in tariff from commissioners. One of the key barriers in implementation of innovative models of care is confusion around the appropriate business model for payment of such

innovations and it would be useful for the authors to note a few lines on the acceptability of this type of intervention in terms of future sustainability and to help other units who are trying to adopt other innovations.

We completely agree that this is a central issue, and indeed links to comments made by the previous reviewer. However, we do feel that our work here is around effectiveness and quality, with the funding landscape of such complexity even in small regions that to say anything of use it would be necessary to collect much more data and is probably a paper in its own right. We do now note in the discussion that, whilst important, financial benefits will be dependent on funding arrangements at individual sites.

See:
Page 11, paragraph 4: “there are likely to be linked financial benefits, however hospital-specific funding arrangements make robust assessments difficult; these interventions improve quality rather than simply reducing costs, with savings offset by the greater expense of providing additional consultant presence.”

Associate Editorial comments:
23. Amend your title, replace "a natural experiment in one trust" with "an observational study in one hospital"

We have now made that amendment.

24. In the text and abstract refer to a "hospital" rather than a "trust" as many international readers may not know that a trust is a hospital.

We have amended.

25. Table 1 add the dates for the periods for the data

We have added these.

26. Amend heading What this study hopes to add to What this study adds (Sorry this is our fault in Instructions to authors)

We have amended.

VERSION 2 – REVIEW

REVIEWER	mando Watson Institution and Country St Mary's Hospital Imperial College Healthcare NHS Trust London, UK
REVIEW RETURNED	26-Feb-2018

GENERAL COMMENTS	As with the previous version, this study explores an important aim - to reduce unplanned admission in the childhood population. As the authors say, many units have tried to introduce service change in this field, without a good evidence base. This study therefore of value The paper is beautifully writen, clear to read with an excellent level of detail on methodology both of the intervention and of the study. The figures are clear and helpful The outcomes are interesting, with a suggested impact of A&G to

	reduce <1 day admissions but increase overall bed days. The latter is explained by the impact of a fluctuating number of very long stay/mental health cases. Once the SSPAU is introduced, both < 1 day admissions and overall bed days drops significantly. The revised manuscript successfully addresses many of the points that I raised in my previous comments. The discussion emphasises the improved quality offered by consultant-delivered care. While this is important, the study set out to look at activity and was not really designed to measure quality. As with my previous comment, it would be helpful to understand why the out patient element has not been addressed in this analysis of the benefit of the A&G service

REVIEWER	Mitch Blair Institution and Country Imperial College London Competing interests Supervising MD on intervention in ED
REVIEW RETURNED	05-Mar-2018

GENERAL COMMENTS	All issues well addressed