PEER REVIEW HISTORY

BMJ Open publishes all reviews undertaken for accepted manuscripts. Reviewers are asked to complete a checklist review form (**http://bmjopen.bmj.com/site/about/resources/checklist.pdf**) and are provided with free text boxes to elaborate on their assessment. These free text comments are reproduced below.

This paper was submitted to a another journal from BMJ but declined for publication following peer review. The authors addressed the reviewers' comments and submitted the revised paper to BMJ Open. The paper was subsequently accepted for publication at BMJ Open.

ARTICLE DETAILS

TITLE (PROVISIONAL)	Evaluation of Emergency Care Education and Triage Implementation: an observational study at a hospital in rural Liberia
AUTHORS	Towns, Kathleen; Dolo, Isaac; Pickering, Ashley; Ludmer, Nicholas; Karanja, Viola; Marsh, Regan H; Horace, Minnie; Dweh, Denny; Dalieh, Tresa; Myers, Sharon; Bukhman, Alice; Gashi, Jason; Sonenthal, Paul; Ulysse, Patrick; Cook, Rebecca; Rouhani, Shada

VERSION 1 – REVIEW

REVIEWER	Varndell, Wayne Prince of Wales Hospital
REVIEW RETURNED	13-Oct-2022

GENERAL COMMENTS	Thank you for the opportunity to review this manuscript. I provide the following feedback: Abstract – to be revised based on wider feedback Introduction Page 5, line 52: Suggest the following revision '>Timely< emergency care >significantly improves patient morbidity and mortality< across the spectrum of…' Study Setting Page 7, line 26: Suggest 'trainings' be revised to 'education intervention' to better reflect the study design – a pre and post evaluation of an education intervention at triage. Sub-heading 'Emergency Care Trainings' – suggest this is revised to 'Education Intervention' as this more accurately reflects your study design and aim. I would open with a sentence that briefly lists what the education interventions were, e.g. 'A series of education interventions were undertaken, that included training nurses in the use and application of the Integrated Interagency Trial Tool (IIATT) and completion of the WHO Basic Emergency Care course. A follow-up training session was held for staff unable to attend the initial training session.' The word 'trainings' appears too often. Suggest 'education sessions' is used as it will assist in making you meaning clear, and improve flow of you sentences.

	Inclusion of the IIATT as an image would assist readers, especially to understand which version you are using. Data collection Page 6: Across the manuscript, suggest 'handwritten' be changed to 'paper records' Variables and Outcomes Page 7, line 42 onwards: Suggest pre-training be classified 'pre-intervention period', with post-training be renamed 'post-intervention period across the manuscript. This would align with the study design and aim. Quality of care is a multidimensional concept that WHO defines (https://www.who.int/health-topics/quality-of-care#tab=tab_1) as care that is: effective, safe, people-centred, timely, equitable, integrated and efficient. How does this study address these components, or a selection of them? Results For clarity, suggest that the results be presented in order of the patient's journey: triage, then emergency care. This might make it easier for readers to understand the two key areas of care that you were aiming to impact – assessment of clinical urgency and associated outcomes (triage), and the completeness of emergency care and associated outcomes (emergency care). Page 9, line 50: When you state that adults were more likely to have a full set of vital signs, the range of vital signs able to be taken for an infant are much less than those compared to an adult. In some age groups, obtaining a BP is not always achieved. Under Table 1, you state that BP in younger patient groups is not reliable. So when you say 'complete set of vital signs', what are you referring to for adult and paediatric patients? It is mentioned in the key of table 3 – move this into the main body of the manuscript. The large piece that is missing, is, following the education intervention, did it change the priorisation / access to emergency care, having been triaged using IIATT, or the degree of emergency care needed? The majority of the results presented and discussed appear to focus on whether or not vital signs were documented and their odds ratios. What was the triage level of patients post education intervention? What was the admission rate per triage level? Did you see a trend of those categorised as red or yellow being admitted versus green level and discharged? Did you see patients represent? Was there are trend in those that represented? Post intervention, how did patient flow/care change compared to pre-intervention stage? Testing of use and impact of the IIATT has been undertaken before. Suggest authors review the following: Validation of the Interagency Integrated Triage Tool in a resource-limited, urban emergency department in Papua New Guinea: a pilot study (https://www.thelancet.com/journals/lanwpc/article/PIIS2666-6065(21)00103-6/fulltext) Implementation of a novel three-tier triage tool in Papua New Guinea: A model for resource-limited emergency departments https://www.researchgate.net/publication/347772248_Implementation_of_a_novel_three-tier_triage_tool_in_Papua_New_Guinea_A_model_for_resource-limited_emergency_departments/fulltext/5fec2cd945851553a0051126/Implementation-of-a-novel-three-tier-triage-tool-in-Papua-New-Guinea-A-model-for-resource-limited-emergency-departments.pdf Very little reporting or discussion has focused on emergency care subsequent to triage, or the wider impact of quality of care – see earlier point relating to WHO definition of quality of care.

REVIEWER	Lang, Eddy University of Calgary
REVIEW RETURNED	13-Nov-2022

GENERAL COMMENTS	Thank you for the opportunity to review this manuscript describing the impact of two educational interventions on the completeness of documentation and the effect on 6 potentially life-saving process outcomes tied to unstable and critically ill patients. This research represents an important contribution to the evidence base on emergency care and hospital operations in low-income countries. It provides useful guidance as to the optimal formulation and delivery of education designed to improve triage processes. The manuscript methods and results and clear and well-written. My only suggestion for improvement is to expand on the potential role of secular trends in contributing to the paper's findings.

VERSION 1 – AUTHOR RESPONSE

Reviewer: 1
Mrs. Wayne Varndell, Prince of Wales Hospital
Comments to the Author:
Thank you for the opportunity to review this manuscript. I provide the following feedback:

Comment:
Abstract – to be revised based on wider feedback.

Response: This was reviewed and changes were made based on wider feedback below.

Comment:

Introduction
Page 5, line 52: Suggest the following revision '>Timely< emergency care >significantly improves patient morbidity and mortality< across the spectrum of…'

Response: Thank you for this suggestion, this was reviewed and emended in the document. It now reads: "**Timely e**mergency care saves lives across.."

Comment:
Study Setting
Page 7, line 26: Suggest 'trainings' be revised to 'education intervention' to better reflect the study design – a pre and post evaluation of an education intervention at triage.

Response: Thank you, this was reviewed and emended in the document. Please see examples of changes starting on page 7.

Comment:
Sub-heading ‘Emergency Care Trainings’ – suggest this is revised to ‘Education Intervention’ as this more accurately reflects your study design and aim. I would open with a sentence that briefly lists what the education interventions were, e.g. ‘A series of education interventions were undertaken, that included training nurses in the use and application of the Integrated Interagency Trial Tool (IIATT) and completion of the WHO Basic Emergency Care course. A follow-up training session was held for staff unable to attend the initial training session.’

Response: Thank you for this suggestion, this was reviewed and emended in the document. This section now reads:

“Education Interventions

A series of education interventions were undertaken with ED staff, that included both nurses and physician assistants, to train them on the implementation of the Integrated Interagency Trial Tool (IIATT) and completion of the WHO Basic Emergency Care course. For the first **intervention**, a series of **education sessions** were conducted to improve emergency care at JJD in late April and early May 2019.”

Comment:
The word ‘trainings’ appears too often. Suggest ‘education sessions’ is used as it will assist in making you meaning clear, and improve flow of you sentences.

Response: Thank you for this suggestion, the paper was reviewed and replaced in most areas with education sessions to improve clarity.

Comment:
Inclusion of the IIATT as an image would assist readers, especially to understand which version you are using.

Response: We agree that the IIATT image would help assist readers, unfortunately this is not ours to publish but is now included in the reference to find the tool.

Comment:
Data collection
Page 6: Across the manuscript, suggest ‘handwritten’ be changed to ‘paper records’

Response: Thank you for this suggestion, we reviewed and emended in document. Please see changes noted both in the abstract, “Emergency Department **paper records”** and document, “…bound book with **paper records**, described above.”.

Comment:
Variables and Outcomes
Page 7, line 42 onwards: Suggest pre-training be classified 'pre-intervention period', with post-training be renamed 'post-intervention period across the manuscript. This would align with the study design and aim.

Response: Thank you for this suggestion. We have emended this within the document.

Comment:
Quality of care is a multidimensional concept that WHO defines (https://www.who.int/health-topics/quality-of-care#tab=tab_1) as care that is: effective, safe, people-centred, timely, equitable, integrated and efficient. How does this study address these components, or a selection of them?

Response: Thank you for this thoughtful question. We considered metrics within many of these domains, however due to limitations of documentation and study design, outcomes chosen focused on effectiveness. We have indicated this here: **"**From these lists, study outcomes were chosen based on local context, hospital and government priorities, and pre-existing documentation patterns that determined what baseline data was available. **Outcomes focused primarily on the effectiveness domain of quality of care."** It is important to note that although our outcomes focus on effectiveness, some of the interventions likely improved other areas like timely and equitable care. However, since we did not measure this, we have not included this in the manuscript

Comment:
Results
For clarity, suggest that the results be presented in order of the patient's journey: triage, then emergency care. This might make it easier for readers to understand the two key areas of care that you were aiming to impact – assessment of clinical urgency and associated outcomes (triage), and the completeness of emergency care and associated outcomes (emergency care).

Response: Thank you for this suggestion. Unfortunately, as noted above, due to limitations and study design we were not able to assess the validation of triage and assessment of clinical urgency and associated outcomes. Hopefully with the changes made above this will also help clarify the order the patient's journey and the layout of our results.

Comment:
Page 9, line 50: When you state that adults were more likely to have a full set of vital signs, the range of vital signs able to be taken for an infant are much less than those compared to an adult. In some age groups, obtaining a BP is not always achieved. Under Table 1, you state that BP in younger patient groups is not reliable. So when you say 'complete set of vital signs', what are you referring to for adult and paediatric patients? It is mentioned in the key of table 3 – move this into the main body of the manuscript.

Response: Thank you for this question. I have clarified this definition found under the variables and outcomes within the manuscript. It now reads:

"The primary study outcome was a complete set of recorded vital signs at any time during the patient's ED visit and was chosen given the importance of vital signs to triage and emergency care. [26,27] **A full set of vitals for patients age 5 and over includes heart rate, respiratory rate, oxygen saturation, blood pressure and temperature. A full set of vitals for patients under age 5 includes heart rate, respiratory rate, oxygen saturation and temperature. Blood pressure was not reliably recorded in this younger age group so was not included."**

Comment:
The large piece that is missing, is, following the education intervention, did it change the priorisation / access to emergency care, having been triaged using IIATT, or the degree of emergency care needed? The majority of the results presented and discussed appear to focus on whether or not vital signs were documented and their odds ratios. What was the triage level of patients post education intervention? What was the admission rate per triage level? Did you see a trend of those categorised as red or yellow being admitted versus green level and discharged? Did you see patients represent? Was there are trend in those that represented? Post intervention, how did patient flow/care change compared to pre-intervention stage? Testing of use and impact of the IIATT has been undertaken before. Suggest authors review the following:

Validation of the Interagency Integrated Triage Tool in a resource-limited, urban emergency department in Papua New Guinea: a pilot study (https://www.thelancet.com/journals/lanwpc/article/PIIS2666-6065(21)00103-6/fulltext)

Implementation of a novel three-tier triage tool in Papua New Guinea: A model for resource-limited emergency
departments https://www.researchgate.net/publication/347772248_Implementation_of_a_novel_three-tier_triage_tool_in_Papua_New_Guinea_A_model_for_resource-limited_emergency_departments/fulltext/5fec2cd945851553a0051126/Implementation-of-a-novel-three-tier-triage-tool-in-Papua-New-Guinea-A-model-for-resource-limited-emergency-departments.pdf

Very little reporting or discussion has focused on emergency care subsequent to triage, or the wider impact of quality of care – see earlier point relating to WHO definition of quality of care.

Response:

We agree these would be interesting and would be an important focus of future studies. The study was not designed to test the validity the Triage Tool as we did not follow patient outcomes beyond the emergency unit. We appreciate the prior validation studies and have added the first reference you gave to the second reference where it appeared in our methods section. Our aim was to look at process outcomes as markers of care quality to see if there were improvements in the care provided after the interventions.

We designated the primary outcome to be obtaining a full set of vitals given the importance of having vital signs on recognizing patient acuity. If Vital signs are not being performed, then

you may be missing critical patients. Implementation of triage, done as part of intervention 1, was associated with an improvement in the number of patients with a full set of vital signs. Unfortunately, the study was not designed to examine the accuracy or effects of the triage system on time to evaluation, patient outcome or disposition.

All of the study's secondary outcomes focus on markers of care effectiveness. For example, if you are not checking a glucose in someone coming in with altered mental status you could be missing an easily reversible cause. We agree that future randomized control studies are needed to further quantify the impact of care and better evaluate other aspects of the WHO definition of care.

We reviewed the results and discussion to ensure adequate attention was devoted to the process outcomes on quality of care. We reduced the focus of vital signs in the results, found on both page 10 and 14.

Reviewer: 2
Dr. Eddy Lang, University of Calgary
Comments to the Author:
Thank you for the opportunity to review this manuscript describing the impact of two educational interventions on the completeness of documentation and the effect on 6 potentially life-saving process outcomes tied to unstable and critically ill patients. This research represents an important contribution to the evidence base on emergency care and hospital operations in low-income countries. It provides useful guidance as to the optimal formulation and delivery of education designed to improve triage processes. The manuscript methods and results and clear and well-written. My only suggestion for improvement is to expand on the potential role of secular trends in contributing to the paper's findings.

Response: Thank you for your comments. We apologize for our confusion, but we were unclear what the reviewer meant by the role of secular trends. If additional clarification could be provided, we would be happy to adjust.

Reviewer: 1
Competing interests of Reviewer: None.

Reviewer: 2
Competing interests of Reviewer: none

Editor(s)' Comments to Author (if any):

Comment:
-Please note that declarative titles are not part of the journal format. As such, please revise the title of your manuscript to include the research question, study design and setting. This is the preferred format of the journal. See published articles for examples.

Response: We have revised the tile to reflect journal formatting. **"Evaluation of Emergency Care Education and Triage Implementation: an observational study at a hospital in rural Liberia"**

Comment:
-Please revise the 'Strengths and limitations of this study' section of your manuscript (after the abstract). This section should contain up to five short bullet points, no longer than one sentence each, that relate specifically to the methods. The novelty, aims, results or expected impact of the study should not be summarised here.

Response: We have revised the "Strengths and Limitations" Section it now reads:

Strengths and Limitations of this study

- **This study contributes to limited research on educational interventions in LMICs -- where emergency care is in its infancy – by evaluating changes in care processes as a result of educational interventions.**
- **This study evaluated both pediatric and adult populations which fully represents the patient population presenting to the emergency department.**
- **This is an observational cross-sectional study, so causality cannot be established.**
- **This is a single center study and generalizability of results is unknown.**
- **The study design retrospectively reviewed documents and did not include direct observations which may not fully represent actual practice.**

Comment:
Throughout, please avoid causational language, to better reflect what can be concluded from the observational study design.

Response: We have carefully reviewed the paper to avoid causational language, please see changes below. If you have identified any further concerning causal statements please let us know.

"patients who were triaged were nearly 16 times as likely to have a full set of vitals than those who were not, even in the same time period, **suggesting** that small interventions **can be associated** with improved emergency care."

"These findings **suggest** that limited emergency care trainings **are associated** with improved quality of emergency care provided by front-line providers and nurses. **Future randomized studies should be considered to quantify the impact."**

"This study demonstrated an improvement in most process metrics after the implementation of triage and emergency care training in rural Liberia, supporting the **utility** of short-course interventions on facility-based care"

Comment:
-Along with your revised manuscript, please include a copy of the STROBE checklist indicating the page/line numbers of your manuscript where the relevant information can be found (https://strobe-statement.org/index.php?id=strobe-home).

Response: We have attached and updated STROBE checklist

VERSION 2 – REVIEW

REVIEWER	Varndell, Wayne Prince of Wales Hospital
REVIEW RETURNED	11-Jan-2023

GENERAL COMMENTS	Appropriate changes have been made in reference to earlier feedback, with rationale provided. I have no further comments.