PEER REVIEW HISTORY

ARTICLE DETAILS

TITLE (PROVISIONAL)	Modeling the Household cost of Paediatric Malaria Treatment in a Rural County in Kenya; Do non-user fee payments matter? A partial cost of illness analysis
AUTHORS	Kodhiambo, Maurice Onditi; Oyugi, Julius Otieno; Amugune, Beatrice Kagai

VERSION 1 – REVIEW

REVIEWER	Deborah A McFarland Rollins School of Public Health - Emory University
REVIEW RETURNED	14-Aug-2019

GENERAL COMMENTS	General comments * The paper purports to be a 'comprehensive' model for the cost of treatment of pediatric malaria. It is not comprehensive. The costs are those of the patient - an important perspective - but a total cost model would include both health systems as well as patient costs. This distinction is conflated throughout the manuscript. * It is not clear to this reviewer whether the sample of patients includes both inpatient and outpatient services. Given that one of the parameters is the number of days if stay at the facility, one can assume the sample is of inpatients. * The authors use the term indirect costs incorrectly. Indirect costs, per the authors, include transport and food. These are not indirect costs. They are direct out of pocket expenditures. See specific comments below. * The model presented seems overly specified for the type of data in the model. Comments by page and line number *pg 1, line 26 - this is not a comprehensive model of cost of treatment for pediatric malaria in Homa Bay. It is a model of patient and care giver costs (household costs) and does not include treatment costs. The authors do say that the costing was done from a patient perspective. This should be in the objective. *pg 1, line 42, a verbal autopsy? This makes no sense. *pg 2, line 26, I simply do not understand why the term verbal autopsy is used. There is no patient outcome data presented in this paper. *pg 3, line 4, 'official scrapping' unclear. Presume this means that there are no official user fees for pediatric patients. *pg 3, 34-35, this is a convenience sample. What is the outcome that was measured? *pg 3, line 54, why children under 13? Rationale. *pg 4, line 12, for those unfamiliar with services available at each level it would be helpful to include that information in a footnote or box.

	*pg 4, line 21-22, indicate in table whether patients were exiting after an outpatient visit or an inpatient stay. *pg 6, line 3-7, costing done from patient perspective. This should be clear from the abstract. It is not. *pg 8, line 36, severity of illness as perceived by caregiver? *pg 11, line 19ff, are these results presented in a table? *pg 12, line 46ff, again the perspective should be stated in the introduction and methods. *pg 12, line 55ff, use of term indirect here is not correct *pg 14, line 9-10, you cannot say that the greatest contributor to total cost of care is the opportunity cost. You did not measure total costs as defined in reference 21.

REVIEWER	Rachel Stelmach RTI International, United States
REVIEW RETURNED	28-Oct-2019

GENERAL COMMENTS	Overall, this study asks a worthwhile question and sketches out a worthy approach to answering it, but I have some questions and concerns that I would need to see addressed before I could recommend this paper for publication. Major comments 1. The use of standard multiple linear regression to estimate cost drivers concerns me. As is usual for cost data, the data presented in this manuscript are right-skewed (i.e. most observations cluster in the lower observed range, but there are multiple high outliers). Multiple linear regression can be conducted on skewed outcome data as long as the residuals are normally distributed, but the authors don't indicate that they checked that. I suggest the authors use bootstrapping, specifically using the bias-corrected and accelerated method, to calculate their confidence intervals, as this would help to deal with the skewness of their cost data. 2. Looking at the survey given in the supplemental files, it does not appear that the survey actually used the ingredients approach to costing, which requires researchers to gather both the unit counts and unit costs of each component. Instead, they asked for the total cost by component category. The methods section should be revised to reflect this methodology. 3. Given the importance of the type of the facility to the result, I would like to understand better the differences between these types of facilities. The fact that the authors found neither a level one nor a level six (?) facility in the area suggests that this might be an external classification rather than one constructed by the authors. If that is the case, then I would like to see a reference to the organization that generated these levels. In any case, I suggest the authors add an explanation, perhaps in the form of a table, that describes what characteristics define these levels. 4. The sampling paragraph states that three level five facilities were included in the sample, but Table 1 states that only one was included. Furthermore, the supplemental files state (page 53, section 3.6.5) that "Five strata will be used including level one, level two, level three, level four and level six facilities. The County has two Level four facilities, no level five facilities and one level six facility. Both the two level four facilities and the level six facility will therefore be included in the sample." There's clearly an error in that sentence, as there should be no level six in a five-level identifier. I think this is where the rogue reference to "level six"

	comes from in the text? The authors need to re-check this whole section for accuracy. 5. How were the interviewers trained to ask people to value their opportunity costs for bringing the child to treatment? The prompt in the interview guide, "Value of lost productive hours during care seeking (Kshs)", doesn't give a clear enough indicator of how that was done. This is particularly important given that I assume at least some of the caregivers do not work outside of the home or work in the informal sector and, as such, are unlikely to receive a regular wage. The authors particularly need to explain this in better detail given the weight they give these findings in their discussion section. 6. The actual reported costs to the patients need to appear in the results section, ideally before the modelling exercises. No new findings should appear for the first time in the discussion section. In addition, the authors should give actual numbers to describe the direct and indirect costs. 7. The supplemental files include survey guides and methodologies for multiple studies. I suggest limiting these files to only those that are directly relevant to this manuscript. 8. The discussion asserts that indirect costs serve as a barrier to care, but the study includes no questions about patients' ability to afford this treatment. The authors also do not provide any context about the income level of either participants specifically or county residents as a whole, beyond the fact that it has "poverty levels above the national average". Without this context, it is hard to assess the extent to which these costs represent a burden to the participants' families. 9. The writing is generally understandable, but the manuscript needs a thorough copyedit. For example, the authors should choose "Homa Bay county", "Homa Bay County", or "Homa-Bay county" as their means of referring to the county. The number of digits after the decimal points also needs to be standardized throughout the manuscript. Minor comments Page 2 1. Lines 49-51: The authors assert that "cost modelling for malaria treatment has previously focused on adult patients", but then cite a study that focused on costs for children. There may be few studies focused on costs related to malaria treatment for children, but they clearly do exist. 2. Line 53: "it was largely assumed" by whom? Is there a citation for this? Page 3 1. Lines 26-27: What is the prevalence of malaria in the county? How does it compare with the rest of Kenya? What is the seasonality of malaria in this region, and how does it align with the study period? Page 4 1. Lines 21-23: The protocol states that every other patient, not every patient, was to be approached. Is this a typo, or were the methods changed? If the latter, why? 2. Lines 54-56: Which languages? 3. Lines 5-27: What were the dates of data collection? Page 5 1. Lines 6-11: Please state explicitly what year and currency costs were collected in and reported in. (E.g. 2019 USD) 2. Lines 6-11: According to the survey instrument, costs were gathered in Kenyan shillings. What was the exchange rate used to

	convert costs to USD, and what was the source of that exchange rate? 3. Lines 28-30: What version of R and Excel did the authors use? Page 6 1. Lines 5-7: “The outcomes, total cost was measured by verbal autopsy from the participants” is unclear to me. Is “The outcomes” a remnant from a previous revision? 2. Lines 9-11: The Patient and Public Involvement Statement doesn’t give much information about what this “preliminary reconnaissance” involved, nor about what changes were made in response to it. This statement should either be expanded or dropped. 3. Lines 23-25: The authors need to at least mention the other components of “the whole study”, as there is no reference to the other studies in the protocol within the manuscript itself. At first glance, I read this wording as suggesting that this manuscript presented only preliminary findings. Page 9 1. I suggest including the baseline comparison level for each of the parameters so that Tables 3 and 4 can stand alone, without the reader needing to reference Table 2. Page 11 1. Some of these confidence intervals are given in shillings rather than USD, but the point estimates are all in USD. Please choose one currency. 2. Lines 32-33: “This is a significant model fit” is a misuse of the word “significant,” as there is no hypothesis testing associated with this R2 value itself. Please rephrase to “This model therefore explains much of the variation in costs,” or something similar. Page 12 1. Lines 21-22: These coefficients appear to be in shillings, but the text refers to the USD values. Please choose one currency. Page 13 1. This wall of text needs to be broken up into paragraphs.

VERSION 1 – AUTHOR RESPONSE

Reviewer 1

General comments

1. The term comprehensive has been removed and replaced with partial cost of illness analysis in the title. (Page 1 line 2)

2. Only in patients were sampled. This has now been specified in the revised manuscript (page 1 line 14)

3. The term indirect costs has been replaced by the term non user fee payments, both in the title and throughout the document (e.g. page 1 line 2)

Specific Comments

Comment number 1 On pg 1, line 26: The term 'comprehensive' has been removed and replaced with the phrase 'partial cost analysis' or 'household costs' (Page 1 lines 2, 13 and 15)

Comment number 2 On pg 1, line 42 and comment number 3 on pg 2, line 26: The term verbal autopsy has been replaced with the term exit interview (Page 2 line 6)

Comment number 4 On pg 3, line 4: The statement has been rephrased to show that the government waived user fees for paediatric malaria although some facilities are still reported to be charging them (Page 2 line 28)

Comment number 5 On pg 3, lines 34-35: The term convenient has been replaced by strategic to remove the ambiguity even though it was not intended to imply a convenient sample (Page 3 line 19)

Comment number 6 On pg 3, line 54: Children of ages below 13 years were chosen because they tend to depend wholly on parental or guardian decisions as they are not yet financially or socially independent and this is now explained in the revised manuscript (Page 4 lines 3-5)

Comment number 7 On pg 4, line 12: We have introduced Table 1 to to clarify on the classification of health facilities into levels (Page 4 line 20-29)

Comment number 8 On pg 4, line 21-22: Only in-patients were sampled. This has been clarified in the revised manuscript (Page 4 line 16)

Comment number 9 On pg 6, line 3-7: The costing from a patient perspective has been stated in the abstract and emphasized throughout the manuscript (Page 1 line 14)

Comment number 10 On pg 8, line 36: Yes, as perceived by the caregiver and this is now specified in the revised manuscript (Page 8 line 4)

Comment number 11 On pg 11 line 19ff: Yes these are now presented in a table (Page 8 lines 20-28)

Comment number 12 On pg12 line 46ff: The patient perspective has been stated both in the introduction and methods section (Page 2 second last line and Page 3 line 23)

Comment number 13 On pg 12, line 55ff: The term indirect costs has been replaced with non-user fee payments (Page 3 line 26)

Comment number 14 On pg 1,4 line 9-10: The statement has been rephrased to state that one of the major contributors to total household costs is the opportunity cost (Page 11 line 26)

Reviewer Number 2
Funding Statement
The funding statement has been taken to the right section (Page line)

Supplementary file citation
The supplementary file has been removed

Major Comments
1. The data was now checked for skewness and found to be skewed. Bootstrapping was therefore done as suggested (page 10 line 2)
2. The section has been revised and the term ingredients approach dropped

3. We have introduced table 1 that explains the classification of the health facilities by the ministry of health, Kenya (Page 4 lines 20-28)

4. At the time of developing the proposal (supplementary files, it was not clear which health facility levels are there in the county). On data collection we realized the county did not have any level I and Level VI facilities. There was a confusion in the statement. This has been rectified in the revised

manuscript (page 4 lines 11-15)

5. The data collectors were trained to ask the respondents their estimate of opportunity cost. This information was however triangulated by asking the respondents to state their occupation from which an estimate of lost earnings was estimated based on local remunerations and estimates of economic value of time. This explanation is provided in Page 5 lines 21 to 24.

6. We have added table 4 to capture the summary of actual cost and cost categories as obtained from the respondents (Page 8 lines 20-28)

7. The supplementary file has been removed as suggested by the editors

8. A statement on the socioeconomic context of Homa-Bay County has been included. The residents have high infant mortality, belong mainly to the lowest wealth quintile hence a poor GINI coefficient score according to KDHS 2014 (Page 3 lines 6-10)

9. The document has been fully edited in this revision

Minor comments
Page 2
1. Line 49-51. The statement has been rephrased to state that few cost modeling studies for malaria treatment from a patient perspective have been specifically focused on children in resource scarce settings as is the case in this study (page 2 line 18)

2. Line 53. The statement has been rephrased to 'it is expected that such a shift would improve financial access to treatment to the most needy of patients' (Page 2 line 23)

Page 3.
Lines 26-27. The prevalence of malaria in Homa-Bay County as of 2016 was 58,820 per 100000 persons, which is more than double the national prevalence of 20,252 per 100,000 persons (Ministry of Health, 2016) (Page 3 line 10)

Page 4
1. Lines 21-23: This was a typing error which was corrected to 'every other' (Page 4 line 11)
2. Lines 54-56: The languages were English, Swahili or Luo (Page 5 Line 13)
3. Lines 5-27. The Data was collected from August 2016 to November 2016 (Page 5 line 17)

Page 5
Lines 6-11: Data was collected in KShs but reported in 2016 USD (Page 5 line 22)
Lines 28-30: R-Studio and Excel (2016) were used for data analysis (Page 6 lines 3 and 5)

Page 6
Lines 5-7. The word outcome was deleted as it was not necessary
Lines 9-11: The statement was removed
Lines 23-25. This statement meant at the end of the whole cycle of the study including this publication. The phrase was however removed to make the section clear

Page 9
Baseline comparator levels have been included in the tables

Page 11
The USD has been used as the currency throughout the document

Lines 32-33: The statement has been rephrased as suggested

Page 12
Lines 21-22: The USD has been used as the currency throughout the document

Page 13
The text has been broken down into paragraphs as suggested

VERSION 2 – REVIEW

REVIEWER	Deborah A McFarland Rollins School of Public Health Emory University USA
REVIEW RETURNED	06-Jan-2020

GENERAL COMMENTS	Accept with revisions as submitted by authors.

REVIEWER	Rachel Stelmach RTI International United States
REVIEW RETURNED	17-Jan-2020

GENERAL COMMENTS	Well done on the revisions! My major concerns from the first submitted version have all been addressed. I do repeat my recommendation that the paper receive a thorough copy edit before publication, as quite a lot of typos and grammatical errors remain. After the copy edit, I am pleased to recommend this version of the manuscript for publication.