**Author’s response to reviews**

**Title:** Primary Healthcare worker knowledge related to prenatal and immediate newborn care: a cross sectional study in Masindi District, Uganda

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**Author’s response to reviews:** see over
Response to reviewers’ comments

We are grateful to the reviewers for the comments that they have offered. We have examined each of the comments and adapted suggested changes or provided further explanations in the next as requested. Here below, we provide responses for each of the comments in the order in which they were made starting with the first reviewer. The red font is meant for the first reviewer and the blue font is for the second reviewer. In case both reviewers made similar comments, you may find some repetitions in our responses.

Reviewer Number 1

Discretionary Revisions

Comment (1) - Depending on how the data were coded, it would be insightful to analyze provider knowledge according to “% correct out of the total number of knowledge items” or assess the prevalence of incorrect or missing knowledge for key items.

The data was coded as yes=1 if appropriate and no=0 if inappropriate. We could did not assess for % score for individual health workers

(2) Minor Essential Revisions

Comment a)-

MCQ should be spelled out to represent ‘multiple choice questions’ (page 7).

Response

This one has been corrected to read Multiple Choice Questions in page 8 line 7-8: and reads as:

Twenty five multiple choice questions were administered by the trained research assistants.

Comment b)-

The last sentence of the ‘Data Analysis’ section is a bit awkward and should be
re-word, excluding the terms ‘hence’, ‘tends’, and ‘as such’ (page 8). A sentence should also be included to describe how the exact cut-off for the significance level was derived.

Response

As suggested we have reworded the sentence and removed redundant words like ‘hence’ and ‘tends’ and included a sentence to explain how the p-value was derived. The sentence now reads in the text: (page 9 line:16-20)

The chi-square test was used to test for level of significance. The Bonferroni adjustment was applied to estimate levels of significance since multiple testing tends to increase the chances for finding significant variables [23, 24]. In this analysis 12 repeated tests were done therefore the standard 0.05 level of significance was divided by twelve. A p-value equal or less than 0.004 was considered to be significant.

Comment c)-
Some words should be capitalized such as “Lancet Series” and “Table 1” while others need not be capitalized such as “low birthweight” (page 7).

Response:

We have followed the suggestion made. The Lancet Series and all the tables have been capitalized (as Lancet Series and Table 1, 2, 3, 4), low birth weight is now abbreviated as LBW throughout the text for example (page 4 lines 11-13) now reads:

The global agenda for newborn health through the Lancet Series[6] quantified the problem of neonatal mortality, outlined cost-effective interventions and suggested health system constraints that should be overcome [7].

Comment d)-
Additional copy-editing is needed to include correct punctuation. The authors commonly links two sentences with a semi-colon “;” which (given the number of them) is distracting to the reader. The same is true for including several “however” in the middle of sentences.

Response:

All the unnecessary semi-colons have been removed from the text and replaced with appropriate punctuations. ‘However’ that were placed in the middle of sentences have also been removed (for example page 10 line 8-10)
However, less than 40% could mention correct timing for the first ANC visit, the optimal number of visits and basic interventions that are offered during prenatal consultations (table 3).

However their difference in knowledge was not statistically significant ($p=0.438$).

**Comment d)** – Sometimes LBW is used. Other times it is spelled out. This should be made to be consistent (page 9).

**Response:**

We used Low Birth Weight in the abstract and abbreviated to LBW from then on we consistently used LBW in the text (page 2 line 8-10)

Questions were related to four domains of knowledge: prenatal care, immediate newborn care, management of neonatal infections and identifying and stabilizing Low-Birth Weight (LBW) babies.

**Comment e)** – It would be helpful in the results section for ‘Factors associated with…’ to describe the trend or direction of findings – not just merely stating if it’s statistically significant or not. For example, in ‘cadre of health worker’, the reader could see the trend if the comparable point estimates are presented or the difference indicator (not just the p-value alone). In fact, this would benefit all of the ‘Results’ section since currently there is only mention of findings being statistically significant or not significant.

**Response:**

We have included trends for all the results in addition to the p-values that were included earlier. The results section on ‘factors associated with level of knowledge’ now reads as follows: (page 10 line 21-24; page 12, 13 line 1-2)

**Factors associated with level of knowledge**

**Level of training**

In our assessments (table 5), 50.7% (36/171) of nursing assistants, 51.4% (37/72) general nurses and 62.5% (25/40) midwives were considered to be more knowledgeable in prenatal care. There was no statistical difference in the level of prenatal knowledge among general nurses ($p=0.232$) and midwives ($p=0.935$) with reference to nursing assistants.
Considering the level of knowledge for newborn care, 38.0% (27/71) of nursing assistants, 45.8% (33/72) of general nurses and 62.5% (25/40) of midwives were judged to be more knowledgeable. The level of knowledge for newborn care among general nurses was not statistically different compared to nursing assistants ($p=0.345$). Although a higher proportion of midwives were more knowledgeable compared to nursing assistants ($p=0.014$), this difference was not statistically significant. Only 15.5% (11/71) of nursing assistants, 11.1% (8/72) of general nurses and 12.5% (5/40) of the midwives were considered to be more knowledgeable in managing infections of the newborn. There was no statistical difference in the level of knowledge among general nurses ($p=0.442$) and midwives ($p=0.667$) compared to nursing assistants.

About 38.0% (27/71) of nursing assistants, 69.4% (50/72) of general nurses and 65.0% (26/40) of midwives were considered to be more knowledgeable in identifying and caring for LBW babies. Compared to nursing assistants, general nurses ($p=0.000$) were significantly more knowledgeable in identifying and stabilizing LBW babies but midwives were not significantly different ($p=0.007$).

**Level of care**

Nearly equal proportions of health workers 53.2% (59/111) and 54.2% (39/72) deployed at health centre levels III/II and the hospital/health centre level IV respectively were considered to be more knowledgeable in prenatal care. There was no statistical difference in the level of prenatal knowledge between health workers that were deployed in the hospital/health centre level IV ($p=0.893$) compared to those deployed at health centres of levels III/II.

About 44.1% (49/111) of health workers deployed at the health centre levels III/II and 50.0% (36/72) of those deployed at hospital/ HC IV were considered to be more knowledgeable in immediate newborn care. However their difference in knowledge was not statistically significant ($p=0.438$). Only 12.6% (14/111) of health workers based at health centre levels III/II and 13.9% (10/72) based at the
hospital/health centre of level IV were judged to be more knowledgeable in managing infections of the newborn. There was no statistical difference in knowledge levels for infection management between the two levels of care \((p=0.803)\). With regards to identifying and stabilizing LBW babies, 54.1% (60/111) of health workers deployed at health centre of levels III/II and 59.7% (43/72) deployed at the hospital/health centre level IV were considered more knowledgeable. There was no statistical difference in the level of knowledge between the two categories \((p=0.450)\).

**Years of service**

Regarding health worker knowledge about prenatal care, 49.4% (39/79) of health workers who had served for five years or less and 56.7% (59/104) of those who had served six years or longer were considered to be more knowledgeable. There was no difference in prenatal knowledge between health workers who had served six years or more compared with those who had served five years or less \((p=0.324)\).

In terms of immediate newborn care, 45.6% (36/79) and 47.1% (49/104) of health workers who had served five years or less and six years or more respectively were considered to be more knowledgeable. There was no statistical difference between health workers who had served six years or longer with reference to health workers who had served five years or less \((p=0.836)\).

Just 10.3% (8/79) and 4.8% (5/104) of health workers who had worked for five years or less and six years or longer respectively were judged to be more knowledgeable in managing infections of the newborn. The knowledge difference in managing infections of newborns was not statistically significant \((p=0.167)\) among those who served six years or more compared to those who had served five years or less. About 55.7% (44/79) of health workers who had served five years or less and 56.7% (59/104) who had served six years or more were judged to be more knowledgeable in identifying and stabilizing LBW babies. But the difference in knowledge was not statistically significant \((p=0.889)\).
**Comment**
- Page 10, ‘Level of care’ – the lead word of the paragraph ‘again’ should be removed.

We have removed the suggested word (again) from and reconstructed this paragraph. The paragraph reads as follows: Page 11 line 16-21)

**Level of care**

Nearly equal proportions of health workers 53.2% (59/111) and 54.2% (39/72) deployed at health centre levels III/II and the hospital/health centre level IV respectively were considered to be more knowledgeable in prenatal care. There was no statistical difference in the level of prenatal knowledge between health workers that were deployed in the hospital/health centre level IV ($p=0.893$) compared to those deployed at health centres of levels III/II.

**Comment**
Describe the authors’ rationale for comparing knowledge of providers by level of care and unit of assignment.

**Response:**
We have included in the text our rationale for comparing knowledge by levels of care, and considered it wise to remove comparison by unit of assignment. This is found on (page 7 lines 2-9 and page 9 line 1-3)

Outpatients’ departments for health facilities serve as the first point of contact for all patients. Health workers deployed at the outpatients department conduct a triage before referral for further management can be made to the relevant unit. The young child clinics where immunization and educational messages for safe motherhood, newborn care and breastfeeding are conducted are situated in the out-patients department. The Public Service Standing orders for Uganda suggests regular deployment of health workers across different units and deployment of highly qualified general nurses and midwives at higher levels of care (hospital and health centre level IV) [22].

As mentioned earlier general nursing and midwifery training are meant to develop polyvalent health workers and therefore prepared to address routine problems like maternal and newborn care. Based on these arguments we considered important comparing the different levels of care.
Comment –

There is a spelling error in the first sentence of the ‘Discussion’ Section.

Response:

This has been corrected and it reads as follows (page 13 line 4-5)

In this study we aimed to determine the level of health worker knowledge regarding recommended prenatal and newborn care.

Comment –

Please include a table of the item level responses (% correctly responding for each item).

Response:

We have introduce a new table in the results and named it Table 3 Correct responses on page 23-24

<table>
<thead>
<tr>
<th>Table 3: Proportions with correct response</th>
<th>Frequency n(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Timing of first ANC visit</td>
<td></td>
</tr>
<tr>
<td>Amenorrhea of two months</td>
<td>61(33.3)</td>
</tr>
<tr>
<td>2. Recommended number of ANC visits</td>
<td></td>
</tr>
<tr>
<td>At least four visits</td>
<td>155(84.7)</td>
</tr>
<tr>
<td>3. Routine interventions during ANC*</td>
<td></td>
</tr>
<tr>
<td>History</td>
<td>164(89.6)</td>
</tr>
<tr>
<td>Physical examination</td>
<td>168(91.8)</td>
</tr>
<tr>
<td>Laboratory investigations</td>
<td>154(84.2)</td>
</tr>
<tr>
<td>Health education</td>
<td>174(95.1)</td>
</tr>
<tr>
<td>Assessment for referral</td>
<td>110(60.1)</td>
</tr>
<tr>
<td>4. Frequency of health education</td>
<td></td>
</tr>
<tr>
<td>During every visit</td>
<td>179(97.8)</td>
</tr>
<tr>
<td>5. Important discussions with mothers*</td>
<td></td>
</tr>
<tr>
<td>Danger signs in pregnancy</td>
<td>174(95.1)</td>
</tr>
<tr>
<td>Birth preparation</td>
<td>169(92.4)</td>
</tr>
<tr>
<td>Care for the newborn</td>
<td>142(77.6)</td>
</tr>
<tr>
<td>Health facility delivery</td>
<td>172(94.0)</td>
</tr>
<tr>
<td>6. Mentioned danger signs in pregnancy*</td>
<td></td>
</tr>
<tr>
<td>Swelling of face and feet</td>
<td>172(94.0)</td>
</tr>
<tr>
<td>Excessive vomiting</td>
<td>166(90.7)</td>
</tr>
<tr>
<td>7. Routine measurements during ANC*</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>172(94.0)</td>
</tr>
<tr>
<td>BP</td>
<td>178(97.3)</td>
</tr>
<tr>
<td>Height of funds</td>
<td>162(88.5)</td>
</tr>
<tr>
<td>8. Initiation of BF</td>
<td></td>
</tr>
<tr>
<td>Within the first hour</td>
<td>158(86.4)</td>
</tr>
<tr>
<td>9. Advise in case no Breast milk</td>
<td></td>
</tr>
<tr>
<td>Continue with BF even when milk is not coming</td>
<td>151(82.5)</td>
</tr>
<tr>
<td>10. Duration for exclusive BF</td>
<td></td>
</tr>
<tr>
<td>4 months</td>
<td>142(77.6)</td>
</tr>
<tr>
<td>11. When to stop BF</td>
<td></td>
</tr>
<tr>
<td>24 months</td>
<td>117(64.0)</td>
</tr>
<tr>
<td>12. Newborn resuscitation*</td>
<td></td>
</tr>
<tr>
<td>Dry with cloth</td>
<td>111(60.7)</td>
</tr>
<tr>
<td>Use ambo-bag</td>
<td>136(74.3)</td>
</tr>
<tr>
<td>Suction of airway</td>
<td>160(87.4)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>------------------------------------</td>
</tr>
<tr>
<td>13.</td>
<td>Prevention of newborn bleeding</td>
</tr>
<tr>
<td></td>
<td>Give vitamin K$_1$</td>
</tr>
<tr>
<td>14.</td>
<td>Doze of vitamin K$_1$</td>
</tr>
<tr>
<td>15.</td>
<td>Treatment of eye infection</td>
</tr>
<tr>
<td></td>
<td>Apply silver nitrate</td>
</tr>
<tr>
<td>16.</td>
<td>Care for the cord after delivery*</td>
</tr>
<tr>
<td></td>
<td>Clean hands</td>
</tr>
<tr>
<td></td>
<td>Clean instrument</td>
</tr>
<tr>
<td>17.</td>
<td>Care of the cord in case of infection*</td>
</tr>
<tr>
<td></td>
<td>Wash with water and soap</td>
</tr>
<tr>
<td></td>
<td>Apply iodine</td>
</tr>
<tr>
<td></td>
<td>Apply antibiotic powder</td>
</tr>
<tr>
<td></td>
<td>Refer to hospital</td>
</tr>
<tr>
<td>18.</td>
<td>Stabilizing the temperature of LBW baby*</td>
</tr>
<tr>
<td></td>
<td>Put on clothes and cover head</td>
</tr>
<tr>
<td></td>
<td>Skin-to-skin</td>
</tr>
<tr>
<td>19.</td>
<td>Definition of a LBW</td>
</tr>
<tr>
<td></td>
<td>&lt;2500 gms</td>
</tr>
<tr>
<td>20.</td>
<td>Care for LBW baby*</td>
</tr>
<tr>
<td></td>
<td>BF early and frequently</td>
</tr>
<tr>
<td></td>
<td>Keep the child warm</td>
</tr>
<tr>
<td></td>
<td>Prevent infection from developing</td>
</tr>
<tr>
<td>21.</td>
<td>Importance of home visits*</td>
</tr>
<tr>
<td></td>
<td>To assess mother</td>
</tr>
<tr>
<td></td>
<td>To ask mother about baby</td>
</tr>
<tr>
<td></td>
<td>To assess baby for icterus</td>
</tr>
<tr>
<td>22.</td>
<td>The best timing for first postnatal visit</td>
</tr>
<tr>
<td></td>
<td>During first three days</td>
</tr>
<tr>
<td>23.</td>
<td>Who should conduct home visits*</td>
</tr>
<tr>
<td></td>
<td>VHT</td>
</tr>
<tr>
<td></td>
<td>Nurse</td>
</tr>
<tr>
<td></td>
<td>Midwife</td>
</tr>
</tbody>
</table>

*Totals may not necessarily add up to 183 because of multiple responses in some instances; **ANC**-Antenatal care; **BF**-Breastfeeding; **LBW**-Low Birth-weight; **MCQ**Multiple choice Question; **VHT** Village Health Team;

**Comment:**
The authors claim that the lack of differences in knowledge by cadre of health worker indicate that task delegation is possible (‘Discussion’ Section, page 12). However, I recommend this statement is revised given that knowledge was found to be low for all cadres. Thus, delegating to an equally less knowledgeable provider is not preferred.

**Response:**

We concur with this argument. This section on delegation has been revised and now reads as follows: (page 14 lines 1-8)

There were so few differences in the levels of knowledge between the different cadres of health workers ranging from relatively highly qualified general nurses and midwives to less qualified nursing assistants. This raises two fundamental concerns: first is the quality of training of the former category[25] and second, it adds to the debate of delegation of tasks to less qualified staffs [26]. On the one hand, our results demonstrate that delegation is possible [27] given no difference in the level of knowledge between the different categories of health workers. On the other hand, it raises doubts
because knowledge was found to be low for all cadres therefore making delegation to equally less knowledgeable cadres less desirable.

Comment: -
Page 12, the sentence “It is therefore likely that when this opportunity…..” is difficult to follow and understand. Please rephrase.

Response:
This phrase has been revised to read as follows: (page 14 lines: 15-18)
The first postnatal check-up is expected to occur within the first three days of birth since this is considered the most dangerous time for newborn babies [29]. In case of illness newborns are likely to present late to the health facility, usually in critical conditions therefore increasing the chances of dying from hitherto preventable causes.

Comment: -
Page 14, the paragraph on referrals should be completely revised/rephrased. This article measured provider knowledge. It did not measure provider competency and skill. Therefore, it’s premature to imply that the quality of care provided to women was inadequate – using terms such as “detrimental” or “completely compromised”. In fact, throughout the discussion – please take more care not to jump to conclusions about the specific care and counselling provided to women based on the ‘provider knowledge’. Sentences in the discussion section implying this should be re-worded to note that – it’s possible, holds implications, suggests that, etc.

Response:
The section on referral has been revised and the suggested phrases have been adapted to read as (page 15 lines: 21-24 & page 16 lines:1-3)
Health workers deployed to higher levels of care (hospital/health centre level IV) were considered to have similar level of knowledge to health workers deployed to lower levels (health centre level III/II).

This finding holds implications for the referral system in Masindi. The referral system is organized such that difficult medical conditions are referred for better management from lower levels of care to higher levels of care because referral implies a significant gradient in knowledge as well as competences and
The current situation raises further questions on how supervisory roles of the hospital/health centre level IV to health centre levels III/II can be organised and implemented.

**Comment**

Knowledge scores may be low because the questionnaire items were not validated, unclear, not well administered, too long, etc. This should be noted in the limitations section.

**Response:**

We acknowledge this concern regarding the questionnaire items. We have included the source of the questionnaire used in this study and where further modifications were derived from as shown in the section ‘data collection’ (page 7 lines: 21-27).

**Data collection**

Interviews were conducted from November to December of 2011. Five research assistants were trained on the objectives of the study, the study tools and study methodology for two days. The research tool was adapted from Leif et al. [20] who used it in Vietnam to assess health worker knowledge regarding newborn care. Further modification of the tool was done based on the literature [21] (for tools refer to additional file 1). Tools were pretested among health workers in the neighbouring district of Hoima.

**Comment**

Tables – include total sample size

**Response:**

All tables 1-5 have the sample size indicated. Where totals do not sum up to 183 this is indicated at the bottom of the tables as shown in pages 20-26.

**Comment**

The results section should speak to the odds ratios in Table 4. These odds ratios with 95% CIs should be presented in the text.

**Response:**

The results section has been revised and the odds ratios with their corresponding p-values have been included in the text (page 10 line 21-24 & pages 11, 12 & page 13 lines 1-2):

*Factors associated with level of knowledge*

*Level of training*
In our assessments (table 5), 50.7% (36/171) of nursing assistants, 51.4% (37/72) general nurses and 62.5% (25/40) midwives were considered to be more knowledgeable in prenatal care. There was no statistical difference in the level of prenatal knowledge among general nurses ($p=0.232$) and midwives ($p=0.935$) with reference to nursing assistants.

Considering the level of knowledge for newborn care, 38.0% (27/71) of nursing assistants, 45.8% (33/72) of general nurses and 62.5% (25/40) of midwives were judged to be more knowledgeable. The level of knowledge for newborn care among general nurses was not statistically different compared to nursing assistants ($p=0.345$). Although a higher proportion of midwives were more knowledgeable compared to nursing assistants ($p=0.014$), this difference was not statistically significant. Only 15.5% (11/71) of nursing assistants, 11.1% (8/72) of general nurses and 12.5% (5/40) of the midwives were considered to be more knowledgeable in managing infections of the newborn. There was no statistical difference in the level of knowledge among general nurses ($p=0.442$) and midwives ($p=0.667$) compared to nursing assistants.

About 38.0% (27/71) of nursing assistants, 69.4% (50/72) of general nurses and 65.0% (26/40) of midwives were considered to be more knowledgeable in identifying and caring for LBW babies. Compared to nursing assistants, general nurses ($p=0.000$) were significantly more knowledgeable in identifying and stabilizing LBW babies but midwives were not significantly different ($p=0.007$).

**Level of care**

Nearly equal proportions of health workers 53.2% (59/111) and 54.2% (39/72) deployed at health centre levels III/II and the hospital/health centre level IV respectively were considered to be more knowledgeable in prenatal care. There was no statistical difference in the level of prenatal knowledge between health workers that were deployed in the hospital/health centre level IV ($p=0.893$) compared to those deployed at health centres of levels III/II.
About 44.1% (49/111) of health workers deployed at the health centre levels III/ II and 50.0% (36/72) of those deployed at hospital/ HC IV were considered to be more knowledgeable in immediate newborn care. However their difference in knowledge was not statistically significant ($p=0.438$). Only 12.6% (14/111) of health workers based at health centre levels III/II and 13.9% (10/72) based at the hospital/health centre of level IV were judged to be more knowledgeable in managing infections of the newborn. There was no statistical difference in knowledge levels for infection management between the two levels of care ($p=0.803$). With regards to identifying and stabilizing LBW babies, 54.1% (60/111) of health workers deployed at health centre of levels III/II and 59.7% (43/72) deployed at the hospital/health centre level IV were considered more knowledgeable. There was no statistical difference in the level of knowledge between the two categories ($p=0.450$).

**Years of service**

Regarding health worker knowledge about prenatal care, 49.4% (39/79) of health workers who had served for five years or less and 56.7% (59/104) of those who had served six years or longer were considered to be more knowledgeable. There was no difference in prenatal knowledge between health workers who had served six years or more compared with those who had served five years or less ($p=0.324$).

In terms of immediate newborn care, 45.6% (36/79) and 47.1% (49/104) of health workers who had served five years or less and six years or more respectively were considered to be more knowledgeable. There was no statistical difference between health workers who had served six years or longer with reference to health workers who had served five years or less ($p=0.836$).

Just 10.3% (8/79) and 4.8% (5/104) of health workers who had worked for five years or less and six years or longer respectively were judged to be more knowledgeable in managing infections of the newborn. The knowledge difference in managing infections of newborns was not statistically significant ($p=0.167$).
among those who served six years or more compared to those who had served five years or less. About 55.7% (44/79) of health workers who had served five years or less and 56.7% (59/104) who had served six years or more were judged to be more knowledgeable in identifying and stabilizing LBW babies. But the difference in knowledge was not statistically significant ($p=0.889$).

**Comment**

The title has typographical errors. Instead, it should read: “Primary healthcare worker knowledge related to prenatal and immediate newborn care: a cross-sectional study in Masindi District, Uganda.

**Response**

We have changed the title to punctuate it as suggested by the reviewer, it reads as follows: (page 1 line 1-2)

Primary Healthcare worker knowledge related to prenatal and immediate newborn care: a cross sectional study in Masindi District, Uganda
Reviewer 2

Major Compulsory Revisions

INTRODUCTION

Comment 1
Please expand upon the previous literature to further describe what has already been established about health workers and cite the relevant literature.

Response:

The introduction has been expanded to include studies from India and Uganda (page 4 lines 22-26 & page 5 lines 1-2)

In India for example, high level of knowledge among Community Health Workers was considered pivotal for improving coverage and adherence to recommended newborn care practices [11]. In eastern Uganda, neonatal mortality autopsies demonstrated low levels of knowledge among health workers regarding prenatal and newborn care as a major cause [12]. Similar reasons have been highlighted in other disease conditions [13]. In Viet Nam knowledge levels regarding neonatal care among primary health care workers was found to be low [14].

Comment 2
Have any other studies examined health worker knowledge? It seems like understanding health worker training is very closely (hopefully!) related to knowledge; it would be helpful to review literature on this as well.

Response:

We make reference to training in the section for introduction, but indicate that this was not the purpose of our study. The last sentence of the ‘introduction’ (page 5 lines 13-14)
In-service training for health workers is known to enhance competences and performance [18-19] but this was not assessed in our study.

METHODS

Comment 1
The last sentence of the “Study site” paragraph is not clear to me. Could you please rephrase and indicate what the numbers in parentheses mean?

Response:
In this section we have explained what the parenthesis means by describing the tier system for health in Uganda. The section on methods now reads: (page 6 Lines 1-6)

In Uganda, the health care system is organised into a four-tier system: hospital, health centres of levels IV, III and II. All levels of care are mandated to offer antenatal consultations and delivery services for pregnant women. Specifically, health centre of level II offers out-patients consultations. Health centre of level III offers outpatients, inpatients and laboratory services. Health centre of level IV and hospital offer caesarean operations and blood transfusion services in addition to outpatient and inpatient services. Hospitals serve as the main referral centre for the district health system. Masindi district has two referral hospitals-Masindi and Kiryandongo general hospitals, one health centre of level IV,10 health centres of levels III and 21 health centres of level II.

Comment 2
I suggest combining the description about the health care facilities with the “Study site” paragraph as this information would be helpful to understand the description of the facilities presented earlier in the Methods section.

Response
This suggestion has been taken. The description about the health care facilities have been moved under the study site: (page 5 lines 16-24, page 6 lines -6)

Methods
Study site

This study was conducted in Masindi district in Western Uganda. Masindi district is located 214 kilometres from the capital Kampala. It has a projected population of 603,000 inhabitants. The predominant cadres working at the health facilities are general nurses, nursing assistants and midwives. General Nurses, midwives and nursing assistants are posted and periodically transferred across all health facilities in the district. In this region about 97% of all pregnant women made at least one antenatal consultation, 42% made four or more antenatal consultations and 43% delivered at a health facility (paper under review).

In Uganda, the health care system is organised into a four-tier system: hospital, health centres of levels IV, III and II. All levels of care are mandated to offer antenatal consultations and delivery services for pregnant women. Specifically, health centre of level II offers out-patients consultations. Health centre of level III offers outpatients, inpatients and laboratory services. Health centre of level IV and hospital offer caesarean operations and blood transfusion services in addition to outpatient and inpatient services. Hospitals serve as the main referral centre for the district health system. Masindi district has two referral hospitals-Masindi and Kiryandongo general hospitals, one health centre of level IV, 10 health centres of levels III and 21 health centres of level II.

Comment 3

Why is it relevant to examine prenatal knowledge among health workers assigned to outpatient or children’s departments? Please explain.

Response

We have offered an explanation why we examined prenatal knowledge among health workers assigned to out-patients or children’s department. First, the training curriculum for nurses and midwives is designed to produce polyvalent health workers capable of handling common medical conditions including maternal and newborn health. Secondly,
deployment of health workers is routinely done to allow them to practice in all sections of the health care system. Third, out-patients departments are an entry point for all patients where a triage is done before a referral can be made to the relevant department. Forth, the young child clinic where immunization, health education is conducted is also located at the outpatients department. In the text this has been explained on: (page 6 lines 24-27 and page 7 lines 1-9)

The training curriculum of nursing cadres in the Ugandan health system is meant to produce polyvalent health workers capable of handling general nursing as well as maternal, child and newborn health. General Nurses, midwives and nursing assistants are routinely deployed in the different levels of care like health centres level II, III, IV or hospital and within these centres they can be assigned in different service points like maternity, children’s ward, and out-patients department and so on. Outpatients’ departments for health facilities serve as the first point of contact for all patients. Health workers deployed at the outpatients department conduct a triage before referral for further management can be made to the relevant unit. The young child clinics where immunization and educational messages for safe motherhood, newborn care and breastfeeding are conducted are situated in the out-patients department. The Public Service Standing orders for Uganda suggests regular deployment of health workers across different units and deployment of highly qualified general nurses and midwives at higher levels of care (hospital and health centre level IV) [20].

**Comment 4**
From where were the knowledge questions obtained? Have they been used previously in other literature or field work? Please describe further how these were answered and measured.

**Response:**
We have mentioned the source of our questionnaire and how it was developed. We have further described how respondents answered the questions in the section for data collection which reads as follows: (page 7 lines 21-27, page 8 lines 1-11)

**Data collection**

Interviews were conducted from November to December of 2011. Five research assistants were trained on the objectives of the study, the study tools and study methodology for two days. The research tool was adapted from Leif et.al [14] who used it in Vietnam to assess health worker knowledge regarding newborn care. Further modification of the tool was done based on the literature [22] (for tools refer to additional file 1). Tools were pretested among health workers in the neighbouring district of Hoima. Research assistants visited one health centre at a time. At the health centre, health workers who had been selected were present on the day of the interview approached individually and requested to participate in the study by filling in the questionnaires. Research assistants waited for each respondent to complete the questionnaire before engaging with the next respondent. Questionnaires were immediately retrieved by research assistants after they were completed. More than one visit was made to the health centre in case the respondent was found to be absent. Telephone appointments were made for those who were out of their duty station, were on annual leave but resident within the district during the interview period. Twenty five multiple choice questions were administered by the trained research assistants. Interview questions were designed to assess knowledge on four broad areas of prenatal and newborn care: prenatal care, immediate newborn care, managing infections of the newborn and identifying and stabilizing LBW babies.

**Comment 5**

Was “years of service” specific to his/her role as a nurse, midwife or nursing assistant?

**Response:**
Yes, the years of service were specific for their years of service as a nurse, midwife or nursing assistant. We have now clarified this in the text (page 9 line 1-7) in the section for ‘independent variables’ and it reads:

Independent variables

As mentioned earlier general nursing and midwifery training are meant to develop polyvalent health workers and therefore prepared to address routine problems like maternal and newborn care. Based on these arguments we considered important comparing the different levels of care. Four independent variables were recorded. Level of training of the health worker, either nurse, midwife or nursing assistant (cadre of health worker). If health worker was currently deployed to – hospital or health centre of levels IV, III or II (level of care), number of years he/she has served after pre-service training (years in service) or years of service since first deployment.

Comment 6
The operationalization of the variables should be moved to earlier in the Methods section where the authors describe their measurement.

Response:

This has been done. We have moved it under the section for dependent variables.

(Page6 lines 12-25)

Dependent variables

Appropriate responses were coded as yes=1 while inappropriate responses were coded as no=0. Four composite variables were constructed from correctly mentioned primary responses to measure levels of knowledge in four domains of prenatal and immediate postnatal care. Prenatal care (timing and frequency of ANC, routine ANC activities, routine observations during ANC, frequency of health education and important messages offered, danger signs in pregnancy), immediate newborn care (initiation and frequency of breastfeeding, duration and cessation of breastfeeding, care for the cord
during delivery, newborn resuscitation, postnatal assessment and timing); managing infections
(newborn bleeding and vitamin K administration, managing eye infection, managing infected cord); care
for LBW babies (identify and stabilize a LBW baby, care for LBW baby). Health workers were judged to
be ‘more knowledgeable’ if, for each of the themes, they mentioned correctly any three of the prenatal
care practices, any three of the five components of immediate newborn care, any two of the three
options for managing infections and at least one of the two options for identifying and stabilizing LBW
babies.

RESULTS

Comment 1

Was level of knowledge associated with years of service?

Response:

No, level of knowledge was not associated with years of service. This has been
presented in the results sections Table 5 page 26:

<p>| Table 5: Associations with health worker knowledge regarding maternal and newborn care |
|---------------------------------------------|------------------|------------------|------------------|------------------|</p>
<table>
<thead>
<tr>
<th>Independent variable</th>
<th>Level of knowledge</th>
<th>n(%)</th>
<th>OR(95% CI)</th>
<th>p-value</th>
<th>aOR(95% CI)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prenatal care (N=183)</td>
<td>More knowledge</td>
<td>36(50.7)</td>
<td>35(49.3)</td>
<td>0</td>
<td>0.935</td>
<td>0.232</td>
</tr>
<tr>
<td></td>
<td>Less knowledge</td>
<td>37(51.4)</td>
<td>35(48.6)</td>
<td>1.02[0.53-1.98]</td>
<td>0.935</td>
<td>1.38[0.71-2.69]</td>
</tr>
<tr>
<td></td>
<td>Nurse Assistant</td>
<td>27(38.0)</td>
<td>44(62.0)</td>
<td>0</td>
<td>0.345</td>
<td>1.38[0.71-2.69]</td>
</tr>
<tr>
<td></td>
<td>Nurse</td>
<td>33(45.8)</td>
<td>39(54.2)</td>
<td>1.38[0.71-2.69]</td>
<td>0.345</td>
<td>1.38[0.71-2.69]</td>
</tr>
<tr>
<td></td>
<td>Midwife</td>
<td>25(62.5)</td>
<td>15(37.5)</td>
<td>1.62[0.73-3.58]</td>
<td>0.232</td>
<td>1.62[0.73-3.58]</td>
</tr>
<tr>
<td></td>
<td>HC level III or II</td>
<td>59(53.2)</td>
<td>52(46.8)</td>
<td>0</td>
<td>0.893</td>
<td>0.893</td>
</tr>
<tr>
<td></td>
<td>Hospital or HC IV</td>
<td>39(54.2)</td>
<td>33(45.8)</td>
<td>1.04[0.57-1.89]</td>
<td>0.893</td>
<td>1.04[0.57-1.89]</td>
</tr>
<tr>
<td></td>
<td>Years of service</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1-5</td>
<td>39(49.4)</td>
<td>40(50.6)</td>
<td>0</td>
<td>0.324</td>
<td>0.324</td>
</tr>
<tr>
<td></td>
<td>6-32</td>
<td>59(56.7)</td>
<td>45(43.3)</td>
<td>1.34[0.75-2.43]</td>
<td>0.324</td>
<td>1.34[0.75-2.43]</td>
</tr>
<tr>
<td></td>
<td>Immediate newborn care (N=183)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>More knowledge</td>
<td>36(50.7)</td>
<td>35(49.3)</td>
<td>0</td>
<td>0.935</td>
<td>0.935</td>
</tr>
<tr>
<td></td>
<td>Less knowledge</td>
<td>37(51.4)</td>
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<td></td>
<td>Nurse</td>
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<td>1.38[0.71-2.69]</td>
<td>0.345</td>
<td>1.38[0.71-2.69]</td>
</tr>
</tbody>
</table>
This study compared knowledge levels between midwives, general nurses and nursing assistants that have different pre-service training backgrounds to start with. However, during practice all health
workers are expected to offer standard care to prenatal and immediate newborn babies. We did not assess for other health system factors like supervision and in-service training that could have also influenced the level of knowledge among health workers[35].

**Comment 3**
Did the authors construct multivariate models? It is mentioned in the analysis section, but I do not see the results of which mentioned in the Results.

**Response**
No, we did not construct multivariate models. It was in our original plan to do so but the idea was dropped after the emergence of the results. This phrase has now been removed from the text.

**DISCUSSION**

**Comment 1**
I recommend that the authors consider removing some of the repeating of results throughout the Discussion. For example, the first three sentences of the bottom paragraph on P. 12 are simply retelling results.

**Response:**
We have taken out the repeated results and the first paragraph now reads as follows

(page 13 lines 3-12)

Discussion
In this study we aimed to determine the level of health worker knowledge regarding recommended prenatal and newborn care. Our primary target of health workers were general nurses, midwives and nursing assistants.

**Low level of knowledge**

The most striking findings were the general low level of knowledge among health workers regarding prenatal and newborn care whereby fewer than 60% of health workers were considered to be more
knowledgeable in prenatal care, immediate newborn care or identifying and stabilizing LBW babies. Knowledge regarding infection management in newborn babies was considered least with only 7.1% of health workers judged to be more knowledgeable.

**Comment 2**
The differences between the knowledge of health workers deployed in maternity, antenatal and family planning clinics and those deployed in other areas in the clinic does not seem compelling. It is not clear why health workers assigned to the children’s ward, for example, would have the same level of knowledge in prenatal care and the immediate postnatal period. Could the authors explain their hypotheses here and discuss the implications better? Otherwise, they may want to consider removing this comparison.

**Response**
Based on this advice we have removed the comparison with health workers deployed in the children’s department and instead introduced comparison with years of service that have been presented in the results (Table 5 page 26)

**Comment:**

Please describe recommendations based on your findings.

**Response:**
Our major findings were the low level of knowledge among primary health care workers for all aspects of maternal and newborn care. Secondly, the lowest proportion of health worker knowledge was shown in infection management for the newborn baby. Third, that level of knowledge was not associated with pre-service training, level of deployment and years of service. Our recommendations are focused on improving the levels of knowledge for health workers regarding prenatal and newborn care, more especially infection management. We make a comment on the implementation of the referral
system (considered to be important in maternal and newborn health) which is largely based on the fact that referral is usually made from less qualified lower level health centres to more qualified staffs in a higher level of care like hospital or health centre level IV. We also comment on supervision which should be done by those who are highly trained higher levels of care (and expected to be more knowledgeable) to less trained lower level facilities (expected to have less knowledgeable health workers). Our conclusion reads as follows; (page 16 lines 26, page 17 lines 1-13)

Conclusion

Primary health care workers who make contact with pregnant women and newborn babies in Masindi district have very low level of knowledge regarding prenatal and immediate newborn care. Low level of knowledge especially regarding infection management and caring for LBW babies should be considered an important concern for the health system in Masindi, since this category of newborns are also the most at risk. Other health system problems notwithstanding, low level of health worker knowledge regarding prenatal and immediate newborn care presents a major bottle-neck to neonatal mortality reduction in Masindi. This may be a similar problem across Uganda and other sub Saharan countries.

We suggest the district health system in Masindi district, through in-service training, should update health workers on recommended prenatal and newborn care practices to be offered to prenatal women. Particular attention should be paid to infection management. Lack of differences in prenatal and newborn care knowledge by level of care has implications for the implementation of the referral system, which is an important input for maternal and neonatal survival.

Comment 4
Is it appropriate to say “health workers who are in regular contact with pregnant women and newborn babies...” when some of these workers asassigned to other clinic areas? More clarification here would be helpful.
Response:
We have rephrased this in the conclusion within the text to read: (page 17 lines 1-2)
Primary health care workers who make contact with pregnant women and newborn babies in Masindi
district have very low level of knowledge regarding prenatal and immediate newborn care.

Minor Compulsory Revisions

INTRODUCTION

Comment 1
Be more specific and clear about your references to the “millennium target”, MDG, “lancet series,” and “Global Newborn Action.”

Response:
We have expanded the text about the Lancet Series and the Global agenda to explain some of the
details spelt out in these documents. The text now reads (page 4 Lines 11-18)

The global agenda for newborn health through the Lancet Series[6] quantified the problem of neonatal mortality, outlined cost-effective interventions and suggested health system constraints that should be overcome [7]. The series concludes that success is possible without highly developed technology [7].

More recently the Global Newborn Action [8] advocates for acceleration and scale up of high-impact interventions to address major causes of newborn mortality [6]. Both the Lancet Series and the Global Newborn Action underscore the importance of key interventions and quality care for women and their babies and specifically calls for interventions days before, during and after birth.

Comment 2
Instead of “preventive educational messages and accurate treatment”, a better word choice may simply be “education and treatment”

Response:
We have followed the advice offered by the reviewer and altered the phrase to read as follows (Page 4 lines 7-9)

Access to appropriate educational messages and treatment offered by health workers during the prenatal and immediate postnatal period is crucial in reducing morbidity and mortality rates among newborn babies [5].

Comment 3
Please insert a comma after “…with a health worker” and “…at the health facility [10]” in the first sentence of the third paragraph.

Response:

This comma has been inserted. Also the original referencing has changed. The text reads (page 5 lines 3-5)

In Uganda, nearly all pregnant women make at least one antenatal care consultation with a health worker, only 52% of deliveries take place at the health facility [15], and neonatal mortality remains relatively high at 29 per 1000 live births.

Comment: 4.
Please begin a new paragraph at “This study specifically aims…” and use “to assess” instead of “at assessing”.

Response:

A new paragraph has been introduced (page 5 lines 10-15)

This study specifically aims to assess the level of knowledge related to prenatal and newborn care among primary health care workers that make contact with pregnant women, immediate postnatal women and newborn babies in Masindi district, Uganda. The study further explored whether differences in knowledge were related to cadre of health worker, level of care or years of service after training. In-
service training for health workers is known to enhance competences and performance [18-19] but this was not assessed in our study.

METHODS

Comment

Please spell out MCQ.

Response:

We have spelt MCQ in full instead of the abbreviated form (page 7 Line 7-8)

Twenty five multiple choice questions were administered by the trained research assistants.

Comment 2

It seems like “or ‘less knowledgeable’” needs to be removed from the middle sentence of the data analysis section beginning with “Within each of the themes…”

Response:

This sentence has been rephrased to read as (page 9 Lines 11-14)

Correct responses were categorised into four themes using the egen command in stata: prenatal care, and newborn care, managing infection in the newborn and identifying and stabilizing LBW babies from where health workers were dichotomized as more knowledgeable or less knowledgeable.

RESULTS

Comment 1

The authors use the term “knowledgeable” in the Results section – as being knowledgeable or not, but in the Methods section, they suggest it’s “more knowledgeable” This inconsistency should be resolved.

Response:
This inconsistency has been resolved. We actually meant “more knowledgeable” and we have introduced the phrase in the results section and maintained it throughout the text. (Page 10 Line 10-11)

Overall, 98/183 (53.6%) were judged to be more knowledgeable about prenatal care (table 4).