



RESEARCH ARTICLE

REVISED **A hidden burden of neonatal illness? A cross-sectional study of all admissions aged less than one month across twelve Kenyan County hospitals [version 2; referees: 2 approved]**Georgina A.V. Murphy ^{1,2}, Vivian N. Nyakangi ¹, David Gathara¹, Morris Ogero¹, Mike English ^{1,2}, Clinical Information Network¹Health Services Research, Kenya Medical Research Institute/Wellcome Trust Research Programme, Nairobi, Kenya²Centre for Tropical Medicine and Global Health, Nuffield Department of Medicine, University of Oxford, Oxford, UK**v2** **First published:** 18 Dec 2017, 2:119 (doi: [10.12688/wellcomeopenres.13312.1](https://doi.org/10.12688/wellcomeopenres.13312.1))
Latest published: 30 Jan 2018, 2:119 (doi: [10.12688/wellcomeopenres.13312.2](https://doi.org/10.12688/wellcomeopenres.13312.2))**Abstract****Background:** Small and sick newborns need high quality specialised care within health facilities to address persistently high neonatal mortality in low-income settings, including Kenya.**Methods:** We examined neonatal admissions in 12 public-sector County (formerly District) hospitals in Kenya between November 2014 and November 2016. Using data abstracted from newborn unit (NBU) admission registers and paediatric ward (PW) medical records, we explore the magnitude and distribution of admissions. In addition, interviews with senior staff were conducted to understand admission policies for neonates in these facilities.**Results:** Of the total 80,666 paediatric admissions, 28,884 (35.8%) were aged ≤ 28 days old. 24,212 (83.8%) of neonates were admitted to organisationally distinct NBUs and 4,672 (16.2%) to general PWs, though the proportion admitted to NBUs varied substantially (range 59.9-99.0%) across hospitals, reflecting widely varying infrastructure and policies. Neonatal mortality was high in NBUs (12%) and PWs (11%), though varied widely across facilities, with documentation of outcomes poor for the NBUs.**Conclusion:** Improving quality of care on NBUs would affect almost a third of paediatric admissions in Kenya. However, comprehensive policies and strategies are needed to ensure sick neonates on general PWs also receive appropriate care.**Open Peer Review****Referee Status:**

Invited Referees

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30 Jan 2018**version 1**published
18 Dec 2017

report



report

- Kathy Burgoine** , Mbale Regional Referral Hospital, Uganda
Mbale Regional Referral Hospital, Uganda
- Fatima Gohar**, UNICEF, Kenya

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Author roles: **Murphy GAV:** Conceptualization, Formal Analysis, Methodology, Project Administration, Supervision, Visualization, Writing – Original Draft Preparation; **Nyakangi VN:** Formal Analysis, Methodology, Project Administration, Writing – Original Draft Preparation; **Gathara D:** Methodology, Supervision, Writing – Review & Editing; **Ogero M:** Data Curation, Formal Analysis, Methodology, Software, Writing – Review & Editing; **English M:** Conceptualization, Funding Acquisition, Methodology, Supervision, Writing – Review & Editing;

Competing interests: No competing interests were disclosed.

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REVISED Amendments from Version 1

Reviewers' minor comments (from Kathy Burgoine and Fatima Gohar) have been addressed:

- Results - admission policies text has been updated to reflect the information provided in [Table 1](#). Specifically, 7 (not 8 as in version 1) of 12 hospitals admit referred neonates to their newborn units (NBU).
- Discussion - the discussion has been expanded to clarify the lack of national policy on neonatal admissions in Kenya and to discuss the mortality results found on NBUs and paediatric wards.
- Throughout the manuscript, 'newborn' has been changed to 'neonate'.

See referee reports

Introduction

Access to basic but high quality inpatient neonatal services for small and sick newborns will be key if progress is to be made in reducing neonatal mortality in low- and middle-income countries (LMICs)^{1,2}. Care should ideally be in a newborn unit (NBU) with specialised equipment and staff providing interventions such as feeding and respiratory support and phototherapy^{2,3}. However, evidence from single-site studies in Kenya and other resource-limited settings suggests that neonates are often admitted to general paediatric wards (PWs) due, among other reasons, to limited space and resources within the NBU^{4,5}. Little is quantitatively known about this neonatal population, neither their magnitude nor characteristics, due to poor information systems⁶⁻⁸. This hidden population of neonatal patients may not benefit from specialised care or quality improvement efforts and may be missed in national statistics used to inform policy and planning.

We set out to explore the burden of neonatal admissions and the distribution of these admissions between NBUs and PWs across 12 County (formerly District) hospitals in Kenya. We further explored what might influence where care is provided for neonates in these hospitals. Our aim is to provide preliminary data to inform thinking on how best to organise comprehensive neonatal services in Kenya and potentially other LMICs.

Box 1What is already known about this topic?

- Inpatient care in a specialised environment is important in efforts to reduce persistently high neonatal mortality in low-income settings.
- Single sites studies suggest that neonates can make up a high proportion of total paediatric admissions to hospitals in Kenya.
- Anecdotal evidence suggests neonates are sometimes admitted to general paediatric wards where they may receive less specialised care.

What does this add?

- Across 12 Kenyan County hospitals neonates admissions represented over a third of all paediatric admissions and 16.2% of neonates admissions were to paediatric wards.
- Little consistency was observed in admission policies across these large public sector hospitals, though most hospitals had a policy of admitting newborns from the community to the paediatric ward rather than the newborn unit. The physical infrastructure of a hospital may influence their admission policies.
- Clearer agreement on the best way to organise neonatal services is needed to ensure small and sick newborns receive care in the most appropriate setting with access to specialised services.

Methods

This study was conducted across 12 County (formerly District) hospitals in Kenya, which form part of the Clinical Information Network (CIN)^{9,10}. Data abstracted from medical records for all admissions to the PW between 1st November 2014 and 30th November 2016 were included in the study. Procedures for such data collection have been previously described^{9,10}. Additionally, information about admissions to the NBU was retrospectively abstracted from admission registers at each hospital for the same time period by the same data clerks during February-June 2017. All data entry followed strict standard operating procedures and employed purpose-designed standardised data capture tools created in [REDCap](#). Inbuilt range and validity checks and pre-designed cleaning scripts were run daily and weekly, respectively, on aggregate data with corrections made, where possible, by referring back to source documents.

Information on admission policies for neonatal patients was obtained through telephone discussions with the nurse in charge and paediatrician at each health facility in April 2017 ([Supplementary File 1](#)).

Data analysis was conducted in R statistical software version 3. Neonates were defined as patients aged ≤ 28 days old.

Ethical statement

Scientific and ethical approval for the study was obtained from the Kenya Medical Research Institute National Scientific and Ethical Review Boards (SERU protocol number 3459), and study hospitals provided assent for inclusion of their data in the study.

Results

A total of 80,944 children and neonates were admitted, 56,732 to the PW and 24,212 to the NBU, between 1st November 2014 and 30th November 2016 in the 12 County hospitals. After exclusion of the 278 PW admissions with no recorded age, 80,666 (99.7%) admissions were included in this analysis. [Figure 1](#) describes the distribution of these admissions for each hospital by patient group (neonate or older child) and ward (NBU or PW).

Neonatal admissions

The total number of neonatal admissions to the 12 County hospitals was 28,884, representing 35.8% of all paediatric admissions; 83.8% ($n=24,212$) were admitted to NBUs and 16.2% ($n=4,672$) to PWs. The number of neonates admitted to PWs as a proportion of total neonatal admissions ranged from 1.0% (H10:11/1,152) to 40.1% (H3:987/2,459). Neonates accounted for 8.3% (4,672/56,454) of admissions to PWs. This proportion ranged from 0.2% (H10:11/5606) to 20.4% (H2:750/3,685).

Among neonatal patients admitted to PWs, mortality was 11.1% (519/4,672); 4.9% (229/4,672) were referred and the remaining 84.0% (3,924/4,672) were discharged home. Outcome was reported for only 69.0% (16,699) of patients admitted to NBUs. Of those with a recorded outcome, mortality was 12.3% (2,052/16,699), 2.1% (347/16,699) were referred, and 85.6% (14,289/16,699) were discharged home.

Admission policies

Only nine of the 12 hospitals reported having a policy on admitting neonates to their PWs ([Table 1](#)). The three hospitals that

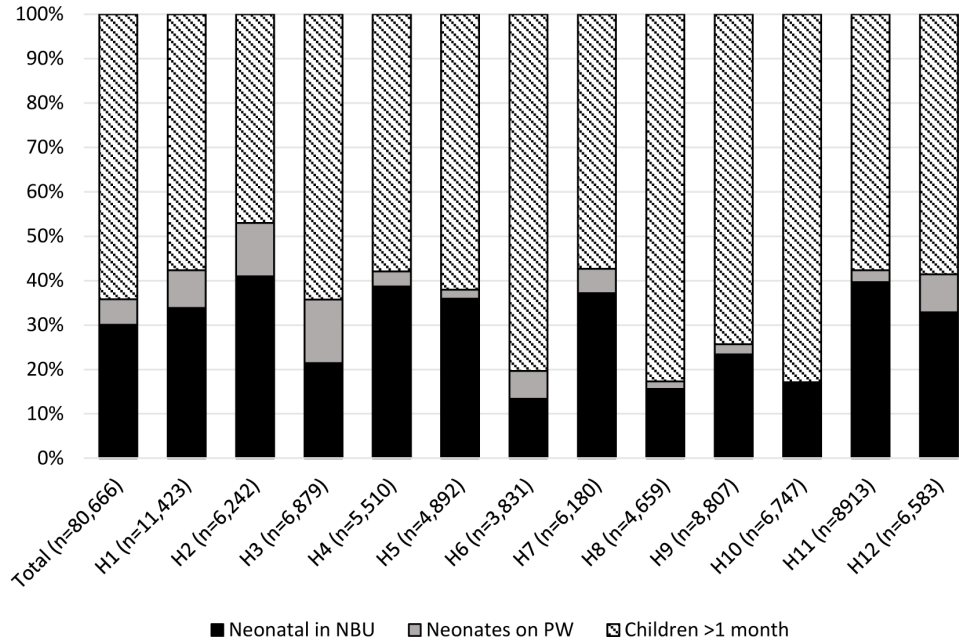


Figure 1. Neonatal and paediatric admissions to newborn units (NBU) and paediatric wards (PW) in County hospitals in Kenya, as a proportion of total paediatric admissions.

Table 1. Admission patterns of neonates across different hospitals.

	Physical size of NBU	Location of NBU	Neonates on PW	Inborn	Out-born/Readmissions	Out-born & preterm	Referred
H1	Large	Designated	Separate room	NBU	PW	PW/NBU†	NBU
H2	Large	Designated	All children <1 year in separate room	NBU	PW	NBU	PW/NBU§
H3	Small	In PW	Separate room	NBU	PW	REFER	NBU
H4	Large	Designated	Cubicle	NBU	PW/NBU*	PW/NBU*	PW/NBU*
H5	Medium	Designated with isolation room	Mixed with older children	NBU	NBU	NBU	NBU
H6	Small	In maternity	Mixed with older children	NBU	PW	NBU	NA
H7	Large	Designated	Mixed with older children	NBU	PW/NBU**	NBU	NBU
H8	Small	In maternity	Mixed with older children	NBU	PW	REFER	PW
H9	Large	Designated	Separate room	NBU	PW	PW	PW
H10	Medium	Designated	Mixed with older children	NBU	NBU	NBU	NBU
H11	Small	In maternity	Mixed with older children	NBU	NBU	NBU	NBU
H12	Large	Designated	Mixed with older children	NBU	PW	NBU	NBU

Inborn: Neonates born within the admitting hospital; Out-born: Neonates not born within the admitting hospital; Referred: Neonates referred from other hospitals; NBU: Routinely admitted to the newborn unit; PW: Routinely admitted to the paediatric ward; PW/NBU: Routinely admitted to either paediatric ward or newborn unit; REFER: Not admitted, instead referred to other hospitals; NA: Not applicable

* All neonates who were more than 10 days old on the day of admission were admitted to PW unless they had jaundice; ** All neonates from the community who were more than 24 hours old at admission were admitted to PW apart from preterm neonates; † Ward admission depended on the admitting clinician; § Referred neonates who were diagnosed with sepsis were admitted to the PW and those without sepsis were admitted to NBU

reported only admitting neonates to their NBUs, reported having a cubicle in the NBU for isolation of sick neonates from the community ('outborn' —either born at home or discharged home after birth). All other facilities reported admitting outborn newborns to the PW or in two cases (H4&H7) admitting this group to either the PW or NBU depending on their age and illness. Neonates born preterm (<36 weeks of gestational age) who required admission from the community were admitted to NBUs in most hospitals (Table 1). Neonates who were referred from other hospitals were admitted to NBUs in 7/12 hospitals and to the PW in 2/12 hospitals. Admission of referred neonates depended on their age and condition in a further two hospitals. For example, in one hospital (H2) referred neonates who were diagnosed with sepsis were admitted to the PW and those without sepsis were admitted to NBU.

Organisation of care

A relationship between the physical layout and infrastructure of the NBU and PW and the distribution of newborns between the two wards was observed. Hospitals (n=4) with a medium-large designated NBU (Table 1) admitted fewer (12.5%) neonates to the PW compared with hospitals (n=8) where the NBU was small and part of the maternity ward or PW (22.0%). However, there was little consistency of reported admission policy based on physical layout of the PW and NBU (Table 1).

Discussion

Our study describes, for the first time, neonatal admissions to both NBUs and PWs across a network of public hospitals that would typically be the first referral level for women with complicated pregnancies or for sick or preterm neonates in Kenya. On average, 35.8% of all paediatric admissions were aged ≤ 28 days and 16.2% of these neonates were admitted to PWs. Previous reports suggest that neonates are making up an increasing proportion of paediatric admissions in Kenya, yet important quality gaps exist for this patient group^{11,12}.

The practice of admitting neonatal patients to PWs is anecdotally described in healthcare settings internationally. However, the contribution of this patient group to overall neonatal and paediatric admissions is not well described in the literature. Where research has been conducted within resource-limited healthcare environments, concerns have been raised about the quality of care that neonates receive in this non-specialised paediatric setting where care may focus on the needs of older patient groups^{4,5}. As part of efforts to address the persistently high mortality among neonates in low-income countries, it will be important to ensure that small and sick newborns are receiving care in the most appropriate setting with access to specialised staff and equipment^{1,3}.

We observed inconsistencies in admission practices across hospitals related, at least in part, to the existing physical capacity and organisation of neonatal services. System-wide efforts to improve neonatal care could benefit from developing standardised policies, linking this to infrastructure and staff planning. Despite a recent effort to gain consensus among stakeholders on major neonatal conditions for admission to Kenyan hospitals¹³, there is currently an absence of written policy in many facilities

on when and where to admit, refer, or discharge neonates. It was observed that hospitals tended to admit outborn patients to PWs rather than NBUs. This is likely linked to infection prevention and control efforts. However, no formal policy on such an approach can be found for Kenya and some outborn newborns, specifically preterm newborns, are nonetheless often admitted to NBUs.

Our study finds that hospitals with larger designated NBUs were less likely to admit neonates to the PW. One option to ensure neonates access specialised care, while also limiting infection, is to expand the capacity of NBUs to appropriately accommodate older and outborn neonates. However, NBUs in public sector hospitals in Kenya currently struggle with overcrowding and high patient to nurse ratios¹². Hence, such a policy would require strategic investment in space, including isolation rooms, and specific staff for different patient groups in many settings. Additional space and staff may also be required to accommodate kangaroo mother care services, which are now recommended for all newborns <2000g in Kenya. If consolidating neonatal care within NBU is not the preferred option then similar investments will be needed to make PWs more appropriate for neonatal care.

We report similar neonatal mortality for NBUs and PWs (12.3% and 11.1%, respectively) in this study. These rates should, however, be interpreted with caution given the large degree of missing data from NBUs. It is possible that a considerable amount of neonatal mortality is missing due to failure to record outcomes in NBU admission registers for almost a third of patients. Previous studies of neonatal admissions to PWs in sub-Saharan Africa have found mortality rates as high as 20.3% and 31.5%^{4,5}. It is expected that neonates receiving less specialised care on PWs may have worse outcomes than those admitted to specialised NBUs. Our study has shown, however, that a simple comparison of mortality on PWs and NBUs is not a fair one given the difference in admission policies for neonates to these two wards. In particular, neonates admitted to NBUs tend to be considerably younger and more likely to be preterm births; hence, increasing their risk of mortality by comparison to their older term-born counterparts in PWs.

A limitation of our study is that information on admission policies was not collected during the same timeframe as admissions data. However, we do not expect that policies would have changed since the data collection period. Outcome data were missing for 31% of NBU admissions. Our estimates of mortality must, therefore, be interpreted cautiously. This may also signal wider problems with NBU admission data; missing data on admissions would result in us underestimating the total burden of neonatal admissions.

Conclusion

Neonatal patients, a vulnerable patient group, represent 36% of all paediatric admissions. A substantial proportion are admitted to PWs, where there may be challenges of delivering quality care. Reducing neonatal morbidity and mortality is likely to benefit from a comprehensive long-term strategy spanning the organisation and resourcing of appropriate services that goes beyond local quality improvement efforts.

Data availability

The source data are owned by the Kenyan Ministry of Health, County Governments and as the data might be used to de-identify hospitals the study authors are not permitted to share the source data directly. Users who wish to reuse the source data are able to make a request initially through the KEMRI-Wellcome Trust Research Programme data governance committee. This committee will supply contact information for the KEMRI Scientific and Ethical Review unit, County Governments and individual hospitals as appropriate. The KEMRI-Wellcome Trust Research Programme data governance committee can be contacted on: dgc@kemri-wellcome.org

Author contributions

GM designed the study and wrote the manuscript, with support from ME. VN analysed the data with support from MO and supervision from GM and DG. VN collected data on admission policies. All authors reviewed and provided input into the final version of the manuscript.

Competing interests

No competing interests were disclosed.

Grant information

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The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

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Supplementary material

Supplementary File 1: Calling script.

[Click here to access the data.](#)

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Open Peer Review

Current Referee Status:  

Version 1

Referee Report 12 January 2018

doi:[10.21956/wellcomeopenres.14445.r29113](https://doi.org/10.21956/wellcomeopenres.14445.r29113)



Fatima Gohar

Eastern and Southern Africa Regional Office (ESARO), UNICEF, Nairobi, Kenya

This paper is clearly written, well-articulated and technically sound. As a reviewer, I found a mismatch between table 1 and narrative part (pg.5) “neonates who were referred from other hospitals without sepsis were admitted to NBU”, while table 1 shows that neonates who were referred from other hospitals were admitted to NBUs in 7/12 hospitals except of H2 and H 4. I would request to recheck this part.

Is the work clearly and accurately presented and does it cite the current literature?

Yes

Is the study design appropriate and is the work technically sound?

Yes

Are sufficient details of methods and analysis provided to allow replication by others?

Yes

If applicable, is the statistical analysis and its interpretation appropriate?

Partly

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

Yes

Competing Interests: No competing interests were disclosed.

Referee Expertise: Maternal and Newborn

I have read this submission. I believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Author Response 18 Jan 2018

Georgina Murphy, University of Oxford, UK

Dear Fatima Gohar,

Many thanks for your very helpful review. We very much appreciate your time and expertise.

Thank you for picking up on the error in numbers of hospitals admitting referred newborns to the NBU. Table 1 is correct and the text has been updated accordingly in version 2 to indicate 7/12 hospitals admitting referred newborns to the NBU. We have further clarified this by including the new text underlined below:

Neonates who were referred from other hospitals were admitted to NBUs in 7/12 hospitals and to the PW in 2/12 hospitals. Admission of referred neonates depended on their age and condition in a further two hospitals. For example, in one hospital (H2), referred neonates who were diagnosed with sepsis were admitted to the PW and those without sepsis were admitted to NBU.

Kind regards,

Georgina Murphy

Competing Interests: No competing interests were disclosed.

Referee Report 09 January 2018

doi:10.21956/wellcomeopenres.14445.r29110



Kathy Burgoine  1,2

¹ Neonatal Unit, Department of Paediatrics and Child Health, Mbale Regional Referral Hospital, Mbale, Uganda

² Mbale Clinical Research Institute, Mbale Regional Referral Hospital, Mbale, Uganda

Thank you for the opportunity to review this interesting and original paper from Kenya. It addresses the very real need to improve neonatal care in health facilities in Kenya and in similar low-resource settings (LRSs) if neonatal mortality is to be reduced. This paper highlights clearly that there need to improve availability and accessibility to specialist neonatal care in many hospitals in LRSs and that unfortunately many neonates are still cared for in non-specialist PWs. It also emphasises the need for consistency and guidance in admission policies of neonates in LRSs. This is a well written and highly relevant paper, which requires only minor revisions highlighted below.

Please ensure consistency of terminology throughout, ideally using neonate/neonatal in preference to newborn. Again please ensure consistency when using NBU and PW in plural form. Preterm is normally defined as <37 weeks completed gestation not <36 weeks.

It is interesting that the outcomes of 100% of neonatal patients are known for PW admissions and only for 69% of those admitted to NBUs. Given that these data came from the same county hospitals I wonder why the data collection was so much more complete in the PWs. I would like to see the possible reasons for this discussed in more detail. It is surprising that the mortality for the neonatal admissions to PWs was similar to the NBUs, one would expect that without specialist equipment and neonatal nursing that the mortality for those admitted to the PWs would be higher. This unexpected outcome should be highlighted and discussed. It is possible that the unknown outcomes for the NBUs hid a large proportion of the

neonatal mortality. Anecdotally that is what we experience in Uganda. This should also be discussed within the manuscript.

How was the size of the NBU defined? It would be interesting to know this and if possible to know the bed capacity, the actual bed occupancy and the physical size of the NBUs. If possible it would be useful to provide the broad criteria for admission of neonates to these county hospitals whether it was to the NBU/PW. That is did they have a weight or gestational cut-off for admissions, did they admit all neonates with jaundice or only requiring phototherapy, all cases of sepsis or only severe etc? This information would allow readers to better compare to their situation to this paper.

It would be good to see some discussion on the evidence for admitting outborn neonates to the PWs and not to the NBU.

Is the work clearly and accurately presented and does it cite the current literature?

Yes

Is the study design appropriate and is the work technically sound?

Yes

Are sufficient details of methods and analysis provided to allow replication by others?

Yes

If applicable, is the statistical analysis and its interpretation appropriate?

Yes

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

Yes

Competing Interests: No competing interests were disclosed.

I have read this submission. I believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Author Response 18 Jan 2018

Georgina Murphy, University of Oxford, UK

Dear Kathy Burgoine,

Thank you very much for your helpful and insightful feedback on our paper. We very much appreciate your time and expertise. We have provided individual responses to each of your comments (your comments are in bold) below and have made changes to the paper for version 2 (underlined text).

Please ensure consistency of terminology throughout, ideally using neonate/neonatal in

preference to newborn. Again please ensure consistency when using NBU and PW in plural form. Preterm is normally defined as <37 weeks completed gestation not <36 weeks.

Thank you, we have amended these throughout.

It is interesting that the outcomes of 100% of neonatal patients are known for PW admissions and only for 69% of those admitted to NBUs. Given that these data came from the same county hospitals I wonder why the data collection was so much more complete in the PWs. I would like to see the possible reasons for this discussed in more detail.

The sources of data for the PW and the NBU were different, which led to differences in quality of the data we were able to obtain. The PW data were extracted from the medical records in hospitals that are part of the Clinical Information Network, a network that aims to improve documentation. By contrast, the NBU data were extracted from the admission register, for which no intervention to improve documentation has been made. In addition, we have found in previous work, that data recorded in admission registers for newborns tends to be considerably more sparse than that found in medical records/clinical notes. We have mentioned this in the limitations and also included the following text in the discussion:

We report similar neonatal mortality for NBUs and PWs (12.3% and 11.1%, respectively) in this study. These rates should, however, be interpreted with caution given the large degree of missing data from NBUs. It is possible that a considerable amount of neonatal mortality is missing due to failure to record outcomes in NBU admission registers for almost a third of patients.

It is surprising that the mortality for the neonatal admissions to PWs was similar to the NBUs, one would expect that without specialist equipment and neonatal nursing that the mortality for those admitted to the PWs would be higher. This unexpected outcome should be highlighted and discussed. It is possible that the unknown outcomes for the NBUs hid a large proportion of the neonatal mortality. Anecdotally that is what we experience in Uganda. This should also be discussed within the manuscript.

Indeed, given the large amount of missing data on mortality in the NBU, these data should be interpreted with caution. As you have rightly pointed out, it is likely that the missing data are hiding a large proportion of mortality. However, there are a few factors that may contribute to differences or similarities in mortality. It is true that the less specialised environment of the PW would lead us to expect poorer specialised care and hence higher mortality. On the other hand, however, the newborns admitted to the NBU tend to be younger than those admitted to the PW and most hospitals admitted preterm newborns to the NBU, even if 'outborn'. Given that neonatal mortality decreases with age and conditions due to preterm birth are major contributors to neonatal death in this setting, we may expect mortality in the NBU to be higher than in the PW. These two conflicting effects may work to cancel one another out, leading to recorded similar neonatal mortality on the two wards. It is certainly an interesting point worth highlighting, so we have included the following in the discussion section:

It is expected that neonates receiving less specialised care on PWs may have worse outcomes than those admitted to specialised NBUs. Our study has shown, however, that a simple comparison of mortality on PWs and NBUs is not a fair one given the difference in admission policies for neonates to these two wards. In particular, neonates admitted to NBUs tend to be

considerably younger and more likely to be preterm births; hence, increasing their risk of mortality by comparison to their older term-born counterparts in PWs.

How was the size of the NBU defined? It would be interesting to know this and if possible to know the bed capacity, the actual bed occupancy and the physical size of the NBUs.

The size of NBUs was defined in terms of the physical space rather than admission or bed numbers. These sizes are estimated based on experience of visiting the NBUs. Unfortunately, we do not have data on bed capacity, occupancy or measured physical size. However, if you are interested, in a recent study (Nairobi Newborn Study) we did obtain detailed information on bed capacity and occupancy for all NBUs in Nairobi City County. The work is under peer review at PLOS One. I am happy to share details. Furthermore, information on the facilities in Kenya is available from the Master Facility List (<http://kmhfl.health.go.ke>), however, the number of cots recorded appear to be out of date and are not disaggregated by ward.

If possible it would useful to provide the broad criteria for admission of neonates to these county hospitals whether it was to the NBU/PW. That is did they have a weight or gestational cut-off for admissions, did they admit all neonates with jaundice or only requiring phototherapy, all cases of sepsis or only severe etc? This information would allow readers to better compare to their situation to this paper.

We agree that such information would be very helpful. However, such detailed policies currently don't exist for hospitals in Kenya. Admission decisions tend, instead, to be up to individual clinicians and general hospital norms. An exception is the new national policy on admitting all <2000 g newborns for kangaroo mother care, as mentioned in the discussion section (though to-date there has been little active implementation of this policy). In recognition of this limitation and as part of the above mentioned study (Nairobi Newborn Study), we held stakeholder meetings to capture agreement on what newborns should and are routinely being admitted to hospitals in Kenya. The outcome of this work is published here: <http://gh.bmj.com/content/2/4/e000472>. We have included a brief explanation of this in the discussion:

Despite a recent effort to gain consensus among stakeholders on major neonatal conditions for admission to Kenyan hospitals,¹³ there is currently an absence of written policy in many facilities on when and where to admit, refer, or discharge neonates.

It would be good to see some discussion on the evidence for admitting outborn neonates to the PWs and not to the NBU.

Unfortunately, we have been unable to find any literature on this very important issue, apart from two papers (Simiyu et al and Okposio et al) that report the mortality and morbidity of newborns admitted to general PWs. We welcome any suggestions from others who may be familiar with other work on this topic. We have further highlighted the findings of these two studies in the discussion:

Previous studies of neonatal admissions to PWs in sub-Saharan Africa have found mortality rates as high as 20.3% and 31.5%.^{4,5}

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