Niger J Paediatr 2018; 45 (4):185 –191

ORIGINAL

Yarhere IE
Nte AR

A Ten-year review of all cause paediatric mortality in University of Port Harcourt Teaching Hospital, Nigeria (2006 – 2015)

DOI:http://dx.doi.org/10.4314/njp.v45i4.4

Accepted: 3rd December 2018

Yarhere IE (✉)
Nte AR
Department of Paediatrics,
University of Port Harcourt
Teaching Hospital
Email:
iroro.yarhere@uniport.edu.ng

Abstract*: Introduction:* Morbidity and mortality reviews provide platforms for quality controls and improvement in systems already put in place for health care delivery. A 10-year retrospective analysis of paediatric morbidities and mortalities was carried out in the Department of Paediatrics, University of Port Harcourt Teaching Hospital to establish their patterns and trends.
Methods: Data on children admitted into the Department from 1st January 2006 – 31st Dec 2015 were extracted from admission books and mortality review cards in CHEW, SCBU, Wards and DTU. were analysed. Information retrieved included name, age, sex, dates and times of admission and deaths, admitting diagnosis, and working diagnosis, and causes of deaths.
Results: There were 20,215 admissions and 1,592 (7.87%) mortalities with more neonatal (4.53%) deaths. Deaths due to Perinatal conditions, infections, malaria and surgical conditions were commonest causes of death. Neonatal mortality rate per neonatal admission was 16.5% and that of the post neonatal age group was 4.608%. Factors identified as contributory to mortalities were delays in recognition of conditions, delays in actions, and systems errors.
Conclusion: Mortality due to pneumonia has reduced more than that due to diarrhoea and malaria, but perinatal conditions are still the most frequent causes of mortality in the neonatal period.

Key words: Childhood deaths, neonatal deaths, malaria, acute respiratory infections, Nigeria

Introduction

Though there was reduction in the mortality indices in Nigeria from 1990 to 2013,[1] Nigeria did not achieve the child related Millennium development goals set out by the United Nations before the expiration period in 2015. [1] Childhood mortality is higher in Nigeria than in many other African, and European countries and though the under 5-mortality rate has improved compared to previous years the overall mortality seems unchanged or increasing.[2] Under-5 mortality rate reduced from 213.2/1000 in 1990 to 117.4/1000 in 2013 but this pales in comparison with countries like Kenya (98.7 to 70.7) and Germany (8.5 to 3.9). Many other sub Saharan African and Asian countries did not halve their childhood mortality rates but some achieved reduction in the mortality and morbidity indices.[3]

In the years preceding this review in our department, mortality rate was 7·67%[4] for all admissions, and this was higher than 4.4% in UBTH in 2012. Many reasons for the high mortality rate were given. Strategies were put in place to try to reduce this as best as possible like the triaging system in the emergency room. There is clear need for hospital administrations to put in place rigorous, systematic and effective processes to enable access to prompt quality care to prevent mortality or serious morbidity. Open collaborative and transparent reviews of morbidity and mortality in a hospital provide avenues for examination of processes and standards, when available, improvement in areas of practice and ultimately prevent deaths that are avoidable.[5,6] Many childhood killer diseases like diphtheria, tetanus, and pertussis have been largely reduced because of improved care and channeling of funds to those areas. To test the veracity of this claim, we decided to study a 10-year review of all cause mortality in the paediatric unit of the University of Port Harcourt Teaching Hospital. We also hoped to see a trend or change from the previous years, as there were improved facilities and skills in managing childhood diseases

Materials and Methods

The study was a retrospective data analyses of morbidity

and mortality at the Paediatric Department of the University of Port Harcourt Teaching Hospital. It is a training site for medical students, resident doctors and other allied health workers. The department operates a 100 bed space unit combining in and out patient services at the Children out patient (CHOP) clinic, Consultant paediatric clinic (CPC), Children medical wards (CHMW) I and II, Diarrhoea training unit (DTU), and Special care baby unit (SCBU). A two-way referral system also operates between the department and other dental, surgical and psychiatry disciplines. Some children referred to these other disciplines can be managed and discharged without further referral to the Paediatrics department.

All admissions and deaths in the various units of the Department of Paediatrics were retrieved from the nurses' admission books and the mortality cards, from 1st of January 2006 and 31st of December 2015. Records of mortalities and morbidities reviewed at the weekly morbidity and mortality meeting were reviewed to aid identification and coding of the specific and remote causes of mortality. The data extracted from the nurses book and mortality cards included; age, sex, dates of birth, admissions and deaths, diagnosis at admission, and death, symptoms and signs, autopsy findings if done and management modalities including investigations, procedures and therapies.

Outcome variables

The main outcomes of interest were total admissions and deaths in neonatal and post neonatal age groups, age of death, case-specific mortality rates, and rates of death per year. Other outcome variables were duration of admission before death and number of admitted cases that discharged against medical advice.

Causes of deaths were coded using the International Statistical classification of diseases and related health problems 10 (ICD-10) and were classified according to system specific deaths, and because some cases were few in number, they were merged with other conditions, e.g., haemolytic uraemic syndrome was merged into acute renal failure and renal disorders as a whole. From the ICD classification, a more clinically useful cause of death was allocated to the mortality recorded in the card. Conditions with low mortality rates were classified as miscellaneous for better analyses of the data.

Contributory factors to mortalities were also reviewed using the D.E.C.S. framework, where D stood for Delays in presentation, delays in recognition of condition, diagnostic errors, and delays in decision making and actions, E; technical errors like faulty machine, lack of oxygen, incubator accidents, errors in omission and end of life conditions like cancers etc, C; complexities of disease burden, compliance with procedures and policy and communications or team work breakdown, S; lack of supervision of junior staff and system failures.

Statistical analysis

The data retrieved were entered into excel spreadsheets, and copied into SPSS v 20 for IBM and analysed using both soft wares. Simple rates and proportions were calculated and comparison done using Chi squared tests within various groups, and averages were compared using Student's "t" test. Where necessary, p values < 0.05 were considered significant.

Results

In the 10 years under review, there were 20, 215 admissions comprising 14, 669 post neonatal children and 5, 546 neonates ratio of 2·6:1, and an average yearly admission of 2,012·5/year. We had more male admissions than females, in a ratio of 1·3:1 (8,149 males and 6,520 females) in the post-neonatal age group. In the neonatal age group however, the ratio was 1·1:1, (2, 919 males and 2, 627 females)

The total mortality recorded was 1, 592 comprising 676 (42.4%) post neonatal deaths and 916 (57.5%) neonatal deaths giving a ratio of 1:1.3, and a yearly average of 159.2/ year. Average mortality per admission was therefore 7.87%, with post neonatal age group contributing 3.34% and the neonatal age group contributing 4.53%. The lowest mortality rate was recorded in 2007 and 2013, (7.3%) and the highest was in 2014 (9.3%).

Neonatal mortality rate per neonatal admission was 16.5% (916/5545) and that of the post neonatal age group was 4.608% (676/14,669). In the post neonatal age group, 22 % of deaths occurred within 24 hours of admission while in the neonatal age group it was 35%.

Table 1: Distribution of admissions and mortalities in the neonatal and post neonatal age groups for the 10 years under review according to sex.

Parameters	Total	Sex		
		Male	Female	
Admissions(total)	20,215			
Mortalities (total)	1,592			
Neonatal –admissions		2919	2627	
Mortalities		469 (51)	447 (49)	321 (35)
Within 24 hours		176	145	595 (65)
After 24 hour		293	302	
Post neonatal admissions		8149	6520	
Mortalities		349 (52)	349 (48)	
Within 24 hours		86	63	149 (22)
After 24 hour		263	264	527 (78)

Fig 1: Frequency distribution of annual admissions and deaths in the neonatal age group. Admissions were highest in 2015 year and lowest in 2014 for the neonatal age group but there were proportionate mortality rates per year irrespective of the number of admissions. The low admission in 2014 was due to a prolonged nationwide resident doctors' industrial action where the hospital services were reduced.

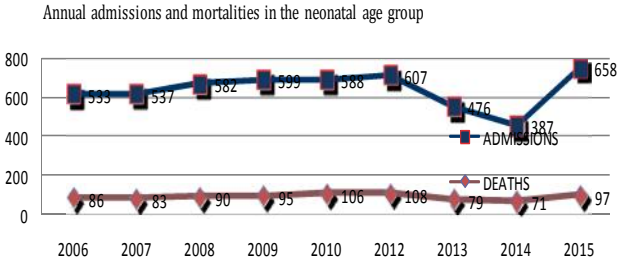
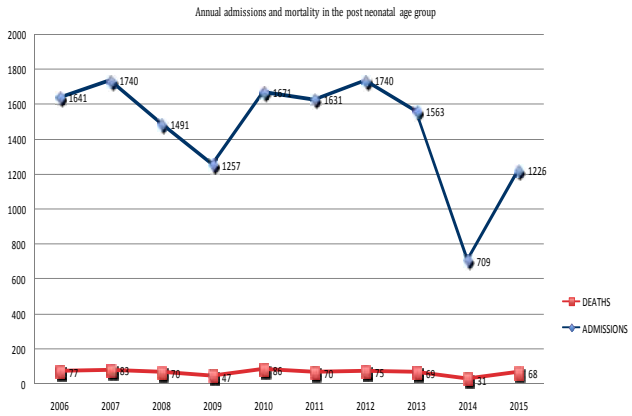


Fig 2: Frequency distribution of annual admissions and deaths in the post- neonatal age group. Admissions were highest in the 2007 and 2012 years, they were also lowest in 2014. Mortalities rates were proportionate yearly even in the years (2009 and 2014) with reduced admissions; ranges between 3·73% and 5·55%.



Age

The admission rate was highest among children less than 1 year of age, including the neonatal age groups, (10, 357 children i.e. 51·2%)
The age range of post neonatal mortality was 1 – 165 months, with a mean of 25·71 months and median of 15 months and 91% of these children of the post neonatal death was 60 months or less (under 5). Neonatal age range was 1 hour – 27 days with a mean of 3 days, median of 5 days, and 78% of these were under 2 days of age. Children between 6 and 14 years were only 68(10 %) of the population and most of them died of chronic systemic illnesses.

All cause mortality

Neonates with conditions necessitating surgical interventions had the highest mortality rate with 38·3% (153 out of 399), and prematurity and related complications had the second highest case specific mortality rates (31%) even though most neonates were admitted with neonatal sepsis, with mortality rate of 13·3%.
Conditions affecting the respiratory tract like pneumonia had the highest number of admissions (4880), however death was 100 giving a case fatality rate of 2% as against a case fatality rate of 4·58% in diarrhoeal diseases (129 / 4038) and malaria 3·19%.

Mortality due to common childhood illnesses (A)

In post neonatal period, infections (A) like diarrhoeal diseases; Shigella and HIV were the most frequent causes of deaths constituting 185 (27·4%) of deaths. Breaking this down further revealed diarrhoea contributing 107 (15·8%), AIDS, 38 (5·6%), Tuberculosis 28 (4·2%) and Shigella 12 (1.8%). There were 109 males (58·9%) and 76 females (41·1%) and the difference in proportion was significant, $\chi^2 = 5{\cdot}886$ and $p = 0{\cdot}015$. March and December were the months with the highest number of disease burden 21 each, and October had the least 10. The disease burden was also highest among under 5 children who contributed 91·9% of the total and children greater than 10 years were only 2·7%. Though there was a drop in the infection disease burden from the year 2010 through 2014, and a slight increase in 2015, the differences in proportion was not significant, $\chi^2 = 11{\cdot}703$ and $p = 0{\cdot}231$.
Case-specific mortality for infectious diseases is as follows; diarrhoeal diseases 107/2075 (5·16%), AIDS 38/683 (5·56%), Tuberculosis 28/347 (8·07%) and Shigella 12/152 (7·89%).

Table 2: Frequency of case specific mortality in the 10 ten-year review for neonatal and post neonatal age groups

Neonatal Disease conditions	Admissions	Deaths	Percentage
Prematurity	665	186	28
Neonatal sepsis	1405	224	16
Neonatal jaundice	941	91	10
Birth asphyxia	849	232	27
Infant of diabetic mothers	222	18	8
Acute surgical conditions	399	153	38.3
Post neonatal			
Diarrhoea	2075	95	4.6
Pneumonia	4880	100	2.05
Meningitis	1631	63	3.86
Malaria	4038	129	3.19
Sickle cell disease	1902	10	0.53
Oncologic diseases	203	35	17.24
Cardiac diseases	267	18	6.74
Neurologic diseases (except meningitis)	10	5	50
	683	92	13.4
HIV/AIDS	312	66	21.15
Renal diseases	849	49	5.77
Nutrition/ Endocrine	291	14	4.81
Acute surgical conditions			

Mortality due to Malarial diseases (B)

There were 101 malarial related deaths during the 10-year review with 37 males (36·6%) and 64 females (63·4%), the difference of which was significant, $\chi^2 = 7{\cdot}218$ and $p = 0{\cdot}007$. The mean age was 28·62 months, with a range of 2–97 months and a median of 18 months. Many of these cases presented in the February, March and April, and there was a gradual decrease in frequency of deaths as the years progressed with the highest in 2006 and the lowest between 2010 and 2015. Though these differences existed within months and years, they were not significant, $p = 0{\cdot}675$ and $0{\cdot}305$ respectively.

Mortality due to respiratory diseases including pneumonia, bronchiolitis (J)

Seventy-seven children died from respiratory related diseases, with a case-specific mortality of 77/4880 (1·58%). Males constituted 65(84·4%) and females were 12 (15·6%) and the difference in proportion was significant $\chi^2 = 36{\cdot}481$ and $p < 0{\cdot}001$. There was a drop in mortalities with the progression in years with 2007 having the highest (14) and 2009 having the lowest (3). Monthly distribution of cases showed low mortalities in the dry months of the year (October through to February) and the rainy seasons of the years had higher

mortality rates. Again, children less than 60 months contributed a high proportion of mortalities (92·2%).

Mortalities due to Nervous system diseases including meningitis, demyelination diseases of the CNS (G)

There were 58 deaths from CNS related diseases constituting 8.6% of total post neonatal mortalities, with more males 49 (84·5%), and 9 females (15·5%), $\chi^2 = 27·59$ and $p < 0·001$. The age range of these children was 7 – 165 months and most of these were children less than 60 months 84%. The rainy season months had the highest number of patients, 38 (65·5%) and the difference in proportion was significant $\chi^2 = 5·586$ and $p = 0·018$ and 2014 saw the lowest number of CNS related mortalities. Case-specific mortality was high in CNS related diseases 58/1631 (4%).

Mortality due to neoplasia C

There were 57 (8·4%) of post neonatal mortalities with male preponderance 40 (70%) of neoplastic mortality and the difference was significant $\chi^2 = 9·28$ and $p = 0·002$. There were more blood related cancers than solid tumors, and the duration of illness between diagnosis and death ranged from 2 weeks – 3 years. Age range of children was 12 – 96 months and the mode was 12 months. There were 2 yearly peaks of mortality 2007 and 2012 and October was the month with the highest number of mortality. The case-specific mortality for neoplasia was the highest 57/203 (28%) in this report.

Mortality due to Sepsis

Sepsis was diagnosed in as many as 345 children over the period under review with a steady decline in the diagnosis from 2009 to 2015. The mortality rate for sepsis in post neonatal children was 7.5% with 51 cases. Of these cases, only 4 (7·8%) were over 5 years and the rest were under 5 years. The age range was 5 – 138 months with a mean of 28 months, median of 20 months. There were more females, 31 (60.8%) than males and the difference was not significant $\chi^2 = 2·373$ and $p = 0·123$. Many children, 308/345 (89·3%) diagnosed with sepsis had initial diarrhoeal diseases that terminated into septic process. There was seasonal variation in the proportion of mortalities due to sepsis as many more children were lost during the dry seasons of the year $\chi^2 = 4·412$ and $p = 0·036$.

Mortality due to renal diseases N

Renal diseases constituted 5·9% (40/676) of total mortality in the period under review. The year 2010 saw the highest number of deaths from renal conditions 7/40 (17·5%) with a steady decline afterwards. Age range of children who died from renal conditions was 2 – 130 months with a mean of 25·91 months and median of 17·50 months.

Contributory factors to mortality following weekly morbidity and mortality reviews

During the weekly morbidity and mortality review meetings in the 10-year under review, there were 1,368 cases discussed and contributory factors determined based on the reports by the managing team. Using the D.E.C.S. framework, the following were noted as contributory factors to the mortalities reviewed as shown in table 2.

Table 3: Contributory factors to mortality

	Contributory factors	Frequency	Percentage of total
D	Delays in recognition of condition	113	7·09
	Delays in response	40	2·51
	Diagnosis error	89	5·60
	Delays in decision making	20	1·26
E	Errors – technical	86	5·40
	Errors of omission	57	3·58
	End of life conditions	387	24·31
C	Complexity of disease burden (delays in presentation)	450	28·27
	Compliance with policy and procedure	28	1·76
	Communication or team work	35	2·20
S	Supervision of junior staff	37	2·32
	System failure or error	65	4·10

Kindly note that multiple combinations exist in this table, with delay in presentation to the hospital contributing the highest.

Discussion

This study represents a review of mortalities in the paeditarics department showing the admission and mortality rate over a decade. The admission rate for the hospital was lower than that reported by Abhulimhen et al[7] in Benin and Kano,[8] Nigeria but higher than our previous report in Port Harcourt,[4] and that in Gusau, Northern Nigeria.[9] These rates are low compared to what is obtainable in developed countries with admission rates as high as 20,000 / year.[3,10,11,12] Though true, the paradox cannot be missed, where in countries with poor health care facilities and higher population like Nigeria, the recorded admission rates are lower than countries with better health care and lower population.

The outcome of this reduced admission rate like in our review is reflective in the mortality rates experienced in our hospital and other resource constrained settings. For instance, in countries with high admission rates, the mortality rates are low, whereas countries with low admission rates have higher mortality rates.[2,3,10] Increasing and strengthening the primary and secondary health care systems in Nigeria and other developing countries will not only increase admission rates but will also drive down mortality rates.

As at 2013, WHO estimated a global mortality rate of 13·2 / 1, 000 live births, but while many developed nations have rates as low as 0·6 / 1,000 live births like

Luxemburg, Nigeria has a rate of 128/ 1, 000 live births like in our study.[1,2,10] Though there is a reduction in these mortality figures over the years in each country surveyed, the rate of drop is not proportional in the resource-constrained countries compared to the developed countries. In our survey, there was no significant drop in mortality rates per admission over the 10-year period. This means there was little or no improvement in services rendered in these years and more needs to be done. Majority of deaths were due to certain conditions originating in the perinatal periods, as seen in other parts of Nigeria[8,13] and the developed countries.[10,11,12,14] This has been the norm for a long time and is similar to our previous report,[4] with preterm birth complications being the leading cause in this period. While efforts are being made to reduce preterm deliveries, more effort should be put into newer technologies to manage the preterm babies immediately they have been delivered. Every year during the Paediatric Association of Nigeria conference, Helping Babies Breath courses are organized for nurses and medical doctors to improve neonatal resuscitation skills. The effect of this is yet to be felt as the equipment needed are rarely maintained as revealed in the audit done by Oloyede et al in Akwa Ibom State.[15] Improving on this type of audit and encouraging it in all states will show the true nature of our neonatal care and buttress the reason for the slow or non-achievement of Millennium development targets in Nigeria.

Diarrhoeal diseases are still major causes of death from this report and many others in Nigeria and the world. The case fatality rate is still high at 5.16% out of 2,075 children treated in the years under review, which is higher than the previous results from the same center in 2005, but lower than that from Benin, and also lower than the global estimate for diarrhoeal deaths by Lui et al[10]. WHO also noted a non-significant drop in diarrhoeal deaths in Nigeria between 2000 (11%) and 2013 (10%) and the reasons for this very marginal gain is not far-fetched as only 38% of children under 5 years with diarrhoea receive Oral rehydration therapy. As for the long-term control of diarrhoeal diseases, while many mothers and caregivers use the universal prevention methods of hand washing before preparing meals and feeding babies, potable and clean water is still lacking in many parts of Nigeria and the developing world.[2] This lack of water nullified the effect of hand washing and universal prevention in diarrhoea control and prevention. Nigeria met the target of halting and began to reverse the spread of HIV/AIDS as reported by the W.H.O. in 2015 (2) but despite this, the percentage of deaths due to HIV/AIDS from 2000 to 2013 increased by one unit (2% to 3%). Comparing our previous report to this present one, we had a yearly death rate from HIV/AIDS of 3.8 as against 7 (4), which is an improvement and relates to the global efforts in eradicating this scourge.

Admissions from respiratory diseases and pneumonia in the post neonatal age group were the highest in this series and many others in Nigeria and the world. Mortality from pneumonia and respiratory diseases however was lower in this series than others with 1.58% case specific mortality. [4,7,10,13] Straightforward pneumonia without complications is amenable to antibiotic treatment so when these children present early, treatment and eventual cure is possible thus reducing the mortality in this study. However, with late presentations and change in the disease process, use of antibiotics and oxygen therapy may not stop the progression and complications of respiratory diseases but they can reduce mortality rates by 35 – 50%.[3] Ventilators and assisted mechanical ventilation in the emergency rooms of Nigerian hospitals will improve the outcome of children with severe respiratory compromise as this tides the child over until the pathologic process causing the damage is mitigated or removed.

The malaria case specific mortality rate in this series is 2.5%, and in a world trying to eradicate malaria, this is high considering the efforts put in to roll back malaria, but lower than the rate estimated in the World Health statistics between 2000 and 2013.[2] This rate is much lower than that reported by Abhulimen et al because it was an Emergency room report while ours was all malarial admissions in the wards and emergency room. The complications leading to malarial deaths included anaemic heart failure, cerebral malarial and hypoglycaemia but most patients had multiple combinations. The trend of reduced malarial mortality also stems from the fact that many parents start early malarial treatment as soon as the child gets a fever as recommended by many health bodies trying to reduce the malaria burden in Nigeria.

From our analyses, the age at which children die remain the same over the years with under-five mortality being the highest and fewer teenage deaths.[4,11,12,16] There were also fewer teenage admissions in the years under review as teenage issues like teenage pregnancies and their complications, road traffic accidents, substance abuse rarely present to the paediatric department. Hill et al [17,18] in their predictive model showed a relatively high mortality within the 5 – 14 year old children compared to previous years and under-fives, and based their theory on the achievements of programmes aimed at protecting younger children. In our institution, teenagers with chronic diseases like diabetes mellitus, chronic kidney disease, sickle cell anaemia and asthma transition to the adult clinics and continue their care.

Like in our previous study, 22 % of the observed mortality in the post neonatal age group happened during the first 24 hours of presentation and more than half of these were within the first the first 6 hours. The rate was even higher in the neonatal age group and majority of these mortalities presented either over the weekend or after normal working hours. The rates are higher than those seen in Tanzania where mortality within the first 24 hours for newborns was 20% of the total newborn deaths.[19] The rates may be lower in developed countries but Black questioned the reasons for this mortality rate at weekends and came up with several possibilities with no specific conclusions but several recommendations.[20] Improving emergency services and standard of care

available during the close of normal work hours will therefore reduce the mortality rates in most hospitals. Providing emergency care centers in various cities separate from the tertiary and improving the secondary health care centers in Nigeria removes some burden from the tertiary health care centers and also makes it possible for patients to access health care in close proximity. This will also make the patients present at the early part of the children's disease process. In recent times, provision of basic items and tools for managing simple disease processes have been lacking in many hospitals.

Understanding that the purpose of any morbidity or mortality review is to teach, ensure quality control, prevent recurrence of avoidable human and system errors, and make sure policies and procedures are followed, a process needs to be put in place to make sure these meetings hold regularly. During our discussions, we noted many avoidable mortalities especially those due to delays in recognition of patient's condition, errors in knowledge and diagnosis, non-compliance with management protocols, technical and system failures contributing to the mortalities recorded. These factors are not different from those obtained in a systematic review by Merali and other authors, where an audit showed that substandard practice by health workers contributed most to maternal mortality.[5,6,13,21,22] They concluded that the presence of health care professionals was not enough to prevent mortality, but adequate training and refresher courses will help ensure minimum standards are maintained. Patient delays in accessing health care has been discussed especially when they have to pay out-of-pocket for services and medications.

Conclusion

In conclusion, though there is a reduction in the case fatality rates with diarrhoea and pneumonia, they still remain the highest causes of mortality in post neonatal age groups. There were no emerging diseases in this study causing death though within this period of review, Ebola and Lassa fever epidemics happened in Nigeria. Improving and limiting the contributory factors associated with mortality in children will reduce mortality rates and the onus is on health institutions to reduce waiting time, improve facilities and equipment and maintain them.

Conflict of interest: None
Funding: None

Acknowledgement

We acknowledge the efforts of our residents and consultants who participated in the morbidity and mortality review meetings. We also acknowledge specifically Drs. Chidinma Chukwumerije, Chika Aiyedun, Gertrude Agbedeyi, Uche Obikwu for coordinating and retrieving mortality cards used to generate the statistics for this manuscript.

References

1. Ogenyi O, Toure D. Millennium Development Goals Endpoint Report 2015 Nigeria. UNDP. 2016
2. Watkins K QM, Dooley T. The state of the world's children 2016. UNICEF Publications. 2016
3. Way C. The Millennium development goals Report 2015. United Nations 2016
4. Nte AR, Yarhere I, Fiebai P. Pediatric Mortality: a review of causes among admissions at the University of Port Harcourt teaching Hospital (January 2003 - December 2005). *Niger J Paed. 2006;33:90 - 8.*
5. Merali HS, Lipsitz S, Hevelone N, Gawande A A, Laashoher A, Agrawal P, Spector J. Audit -identified avoidable factors in maternal and perinatal deaths in low resource settings: a systematic review. *BMC Pregnancy Childbirth. 2014;14:280.*
6. Gichobi D WP, Mutai J, Kamweya A. Factors associated with disease outcome in children at Kenyatta National Hospital (KNH). *J Public Health Epidemiology. 2010;2:262 - 266.*
7. Abhulimhen_Iyoha BI OAA. Morbidity and mortality of childhood illnesses at the emergency paediatric unit of the University of Benin Teaching Hospital, Benin City. *Niger J Paed. 2012;39:71 - 4.*
8. Mukhtar-Yola M Iliyasu Z. A review of neonatal morbidity and mortality in Aminu Kano Teaching Hospital, northern Nigeria. *Trop Doct. 2007;37:130 - 132.*
9. Bilkisu GI, Aminu MS, Onazi OS, Edem B, Aghadueki S, Muyideen AB. Pattern of medical childhood morbidity and mortality in a new specialist hospital in Gusau, Nigeria. *Annals Niger Med. 2014;8:15 - 17.*
10. Liu L, Oza S, Hogan D, Chu Y, Perin J, Zhu J, Lawn JE, et al. Global, regional, and national causes of under-5 mortality in 2000 - 15: an updated systematic analysis with implications for the Sustainable development goals. *Lancet 2016*
11. Viner RS, Hargreaves DS, Coffey C, Patton GC, Wolfe I. Deaths in young people aged 0 –24 years in the UK compared with the EU15+ countries, 1970–2008: analysis of the WHO Mortality Database. *Lancet. 2014;384:880 - 892.*
12. Yu Y, Qin G, Cnattingius S, Gissler M, Olsen J, Zhao N, Li J. Mortality in Children Aged 0-9 Years: A Nationwide Cohort Study from Three Nordic Countries. *PLoS. 2016;11:1 -17.*

13. Forae GD, Uchendu OJ, Igbe AP. An audit of paediatric mortality patterns in a Nigerian Teaching Hospital. *Niger Med J. 2014;55:130 -1303.*
14. English M, Ngama M, Musumba C, Wamola B, Bwika J, Mohammed S, Ahmed A et al . Causes and outcome of young infant admissions to a Kenyan district hospital. *Arch Dis Child. 2003;88:438-443.*
15. Oloyede I P, Udo P A. An audit of some health facilities and equipment for neonatal resuscitation in South South Nigeria. *Niger J Paed. 2016;43:197 - 200.*
16. Rajaratnam JK, Marcus JR, Flaxman AD, Wang H, Levin-Rector A, Dwyer L et al. Neonatal, postneonatal, childhood, and under-5 mortality for 187 countries, 1970–2010: a systematic analysis of progress towards Millennium Development Goal 4. *Lancet. 2010;375:1988 - 2008.*
17. Hill K, Amouzuo A. Trends in Child mortality, 1960 - 2000 In: Disease and Mortality in Sub-Saharan Africa Jamison DT, Feachem RG, Makgoba MW, Bos ER, Baingana FK, Hofman KJ, Rogo KO (eds) . The World Bank Washington DC. 2006
18. Hill K, You D, Inoue M, Oestergaard MZ. Child mortality estimation: Accelerated progress in reducing global child mortality 1990 - 2010. *PLOS Med. 2012;9:1 - 11.*
19. Ersdal HL, Mduma E, Svensen E, Perlman J. Birth asphyxia: A major cause of early neonatal mortality in a Tanzanian rural hospital. *Pediatr 2012: 129; e1238 - e1243*
20. Black N. Is mortality higher at weekends? If so, why? *Lancet. 2016;388:108 - 10.*
21. Najaf-Zadeh A, Dubos F, Pruvost I, Bons-Letouzey C, Amalberti R, Martinot A. Epidemiology and aetiology of paediatric malpractice claims in France. *Arch Dis Child. 2011;96:127 - 30.*
22. Russell A, Havranek E, Webster J, Hellawell G. Consultant -delivered care - what is it worth? *Bulletin Royal College of Surgeons:2015: 97; e22 - e25*