ORIGINAL ARTICLE

Pattern of morbidity and mortality of newborns admitted into the sick and special care baby unit of Enugu State University Teaching Hospital, Enugu state

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Abstract

Background: Being the highest contributor to under-5 mortality, neonatal mortality and morbidity has great impact to the attainment of millennium development goals 4 (MDG 4). In Nigeria and other developing countries, this indicator strongly poses a major challenge in achieving this goal. **Objectives:** To determine the morbidity and mortality pattern of admitted babies in the special care baby unit (SCBU) of Enugu State University Teaching Hospital (ESUTH). **Materials and Methods:** This is a comparative and descriptive longitudinal study of causes of morbidity and mortality between babies born within (inborn) and outside our hospital facilities (outborn) based on information on place of birth, APGAR scores, age on admission, diagnosis on admission, duration of hospital stay, and outcome of newborns admitted into the sick and SCBU over a 1 year period. **Results:** A total of 261 neonates were admitted during the period under review. The common causes of admissions seen from the study were perinatal asphyxia (80, 30.7%), low birth weight (64, 24.5%), neonatal sepsis (44, 16.9%), and neonatal jaundice (16, 0.06%). A total of 37 (14.2%) deaths were recorded during the period. The leading causes of deaths were severe form of perinatal asphyxia (18, 52.9%), neonatal sepsis (10, 29.4%), and very low birth weight (two, 0.06%). Fifty-five percent of all the deaths occurred within 24 h of admission. Death due to asphyxia was more in babies born outside the hospital (outborn) than in babies born within the hospital (inborn). Equal number of outborn and inborn babies died from neonatal sepsis. The age at presentation to the sick baby unit was significantly lower in inborn (P = 0.004), while age at death was not different in both group of newborns (P = 0.876). **Conclusion:** The neonatal mortality rate and the causes of death in this study are similar to those documented by other studies in Nigeria and are largely preventable. Strengthening perinatal care, emergency obstetric services, and enhancement of neonatal resuscitation skills to traditional birth attendants (TBAs) and other community health workers are necessary to reduce the neonatal mortality in our setting and other rural settings across developing countries.

Key words: Enugu, morbidity, mortality, newborn

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Introduction

The first 28 days of life accounts for the most vulnerable period in life. This period accounts for 50-70% of infant mortality and 39% of under-5 deaths[1] and 40% of preventable child death in the USA.[2] In Nigeria; 241,000 newborns die from preventable and treatable causes every year giving a neonatal mortality rate of 40/1,000 live births.[3] This places the country at an unenviable position of highest neonatal mortality rate in Africa and the second highest in the world. The survival of the newborn is dependent on

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the care received.[4] Neonatal deaths in advanced countries are largely due to unpreventable causes like congenital abnormalities; while in developing countries, newborns die mainly from preventable causes like infections, birth asphyxia, and prematurity.[5] Regular neonatal auditing is very vital as disease pattern vary from place-to-place and with time, even in the same place.[6] This study assess the pattern of morbidity and mortality of newborns admitted into the special care baby unit (SCBU) of Enugu State University Teaching Hospital (ESUTH), Parklane, Enugu over a 1 year period from its re-opening in June 2012-May 2013.

Materials and Methods

This hospital-based comparative and descriptive longitudinal study was carried out in the sick and SCBU of the ESUTH, over a period of 1 year from June 2012-May 2013. The sick and SCBU of ESUTH admits sick babies born outside and within the hospital respectively in their first 28 days of life. Following admission of sick newborns the following information were collected from the mother or caregiver at the time of admission: The mother's age, sex of baby, birth weight, age at admission, gestational age at birth, APGAR score at 1 and 5 min after birth, diagnosis at presentation, duration of hospital stay, outcome, and cause of death for those that died. For patient delivered outside our hospital, information from the referral notes were used (which usually contains the time of birth, birth weight, APGAR score, etc.). For those delivered by traditional birth attendants (TBAs) and other untrained personnel, the APGAR score was estimated from the mothers based on information such as whether child cried immediately after birth, activity, color, and respiratory effort of the newborn after birth. The 5 min APGAR score was used to diagnose and grade the degree of perinatal asphyxia.

Diagnosis of neonatal illness and cause of death was done using clinical information and where necessary laboratory reports by a specialist pediatrician and confirmed by a second specialist. Where there is a disagreement in diagnosis, a third specialist was consulted to evaluate the neonate and make an independent assessment on diagnosis and/or cause of death where applicable. There was high agreement in clinical diagnosis (98%) and cause of death (100%) between the two initial assessors.

Results were presented using percentages, odds ratios, and 95% confidence intervals (CIs) where appropriate.

Results

Characteristics of surveyed newborns

A total of 261 newborns were admitted during the period under review. One hundred and thirty-six (52.1%) were males and 125 (47.9%) were females giving a male: female ratio of 1.1:1. One hundred and forty-two (54.4%) were born inside ESUTH (inborn), while 119 (45.6%) were born outside the ESUTH (outborn). The overall mean age on admission and death was 37.87 h (1.57 days) and 106.64 h (4.44 days), respectively. The time between birth and presentation to the sick baby unit ranged from 0 to 504 h for inborn and 3 to 720 h for the outborn babies. The mean age on admission for the inborn babies which was 14.97 h (<1 day) after birth was significantly lower than the age at presentation for outborn babies 75.08 h (3.13 days) after delivery ($t = -2.98$, degrees of freedom (df) $=124$, $P = 0.004$).

Pattern and causes of morbidity in newborn in ESUTH

As shown in Table 1 below perinatal asphyxia (APGAR score 0-6) accounted for 80 (30.7%) of newborn admissions during review period. Of this number, prolonged obstructed labor accounted for 38 (48.0%); severe preeclampsia, eight (10.0%); meconium aspiration, six, (7.5%); post-datism, five (6.3%); mal-presentation, four (5.0%); eclampsia, three (3.8%); precipitate labor, (two, 2.2%); oligohydramnious (two, (2.2%); retained second twin, (one, 1.3%); cord compression (one, 1.3%); and unidentified cause, nine (11.3%). Thirty four (42.5%) of the asphyxiated newborns were moderately asphyxiated (APGAR score 4–6) and 46 (57.5%) were severely asphyxiated (APGAR score 0–3). The inborn accounted for 37 (46.3%) of the asphyxiated newborns compared to 43 (53.7%) of asphyxiated outborn babies ($\chi^2 = 8.10$, $P = 0.004$).

Of the 44 neonates admitted due to neonatal sepsis 17 (38.6%) were culture proven, while in 27 (61.4%) the diagnosis of neonatal sepsis was presumed with a documented response to antibiotic therapy. Of this number, 16 (36.4%) where inborn and 28 (63.6%) where out born ($P = 0.027$). *Staphylococcus aureus* was the commonest organism cultured and accounted for nine (53%) out of the 17 culture proven sepsis. Others were, *Streptococcus pneumonia* (three, 18%), *Escherichia coli* (three, 18%), *Enterococcus faecalis* (one, 6%), and *Haemophilus influenza* (one, 6%).

Low birth weight (birth weight <2.5 kg) accounted for 64 (24.5%) of the admitted newborns during the period under review. Of this number, 48 (75.0%) were inborn and 16 (25%) were outborn. Forty-seven (73.4%) of them were premature, while the rest 17 (26.6%) were small for gestational age (SGA) babies. Of 47 premature newborns; premature rupture of membrane accounted for 13 (28.0%); multiple gestation with premature rupture of membrane, 13 (28.0%); severe preeclampsia, four (9%); placenta previa, four, (9%); abruption placenta, two (5%); severe preeclampsia with multiple gestation, two (5%); ecclampsia, two (5%); chorioamnionitis with premature rupture of membrane, one (3%); cervical incompetence, one (3%); and idiopathic, five (11%). Ten (21.3%) of the premature babies were very low birth weight (birth weight <1.5 kg), while the rest were equal to or greater than 1.5 kg.

Neonatal jaundice (NNJ) was the cause of morbidity in 16 (7%) of the admitted newborns. Glucose-6-phosphate dehydrogenase deficiency accounted for NNJ in four (25%); fetomaternal ABO blood group incompatibility, two (13%); neonatal sepsis, three (19%); neonatal malaria, three (19%); glucose-6-phospate dehydrogenase coexisting with sepsis, one (7%); while the cause of jaundice was idiopathic in the others, three (19%).

Other disease conditions caused hospital admission in 57 (21.8%) of all admitted newborns. This condition as shown in Table 2 includes meconium aspiration syndrome (one, 1.8%), hypoglycemia (three, 5.2%), Erb's palsy (four, 7.0%), imperforate anus (one, 1.8%), multiple congenital anomalies (two, 3.5%), aspiration syndrome (seven, 12.3%), postdates (five, 8.8%) macrosomia (eight, 14.0%), spinal-bifida (one, 1.8%), transient tachypnea of newborn (three, 5.2%), dehydration fever (two, 3.5%), congenital pneumonia (six, 10.5), neonatal meningitis (four, 7.0%), clavicle fracture (two, 3.5%), malaria (seven, 12.3%), and hemorrhagic disease of new born (one, 1.8%). These conditions were seen in 30 (52.6%) of inborn and 27 (47.4%) of outborn babies ($P = 0.808$) [Figure 1].

Out of the 261 neonates admitted, 37 died, giving a death rate of 14.2%. Nineteen (51.4%) out of these were males and 18 (48.6%) were female ($\chi^2 = 0.122$, $P = 0.727$). The causes of death are shown in the Table 3 below.

As seen above; of the 142 admitted inborn newborns, 15 (10.5%) died compared to 22 (18.5%) of the 119 outborn admissions. The proportion of death outcome was not significantly different in both newborn groups ($\chi^2 = 2.499$, $P = 0.1139$). The mean age at death was also not significantly different between inborn 4.26 days (102.13 h) and outborn 4.73 days (113.40) newborn categories ($t = -0.1578$, df = 23, $P = 0.867$).

Though the proportion of deaths due to asphyxia was not significantly different for both newborn categories ($P = 0.741$), the case fatality for perinatal asphyxia was higher for outborn babies (48.4%) compared to 40.0% for inborn. Conversely case fatality for neonatal sepsis was higher in inborn 31.3% than outborn babies (40%). All the 21 (100%) deaths from perinatal asphyxia were due to severe form of perinatal asphyxia. On an average, outborn had a higher case fatality rate than inborn neonates (18.5 vs. 10.5%). Cox regression analysis showed that on the average outborns were 1.46 times more likely to die compared to inborn newborns inborn (HR) =1.463, CI 0.633–3.382). This however did not attain statistical significance. Figure 2 show survival curve of neonates born within and outside the hospital.

Discussion

In this study, a total of 261 patients were seen over a 1 year period. More males (136, 52.1%) were seen in this study than females (125, 47.9%) in keeping with findings in other similar studies in Nigeria which reported more males than females.[7,9]

Table 1: Causes of admission in SCBU of ESUTH

Diseases	Number of newborns *n* (%)		Total	*P* value
	Inborn	Outborn		
Perinatal asphyxia				
Moderate (4-6)†	22 (67.4)	12 (32.6)	34	0.255
Severe (0-3)†	15 (32.6)	31 (67.4)	46	0.006
Neonatal sepsis	16 (36.4)	28 (63.6)	44	0.027
Low birth weight	48 (75.0)	16 (25.0)	64	0.003
Neonatal jaundice	10 (63)	6 (38)	16	0.509
Others	30 (52.6)	27 (47.4)	57	0.808
Total	141 (54.0)	120 (46.0)	261	0.288

†APGAR score criteria for asphyxia type based on the National Neonatal Perinatal Database (NNPD) 2000. SCBU=Special care baby unit; ESUTH=Enugu State University Teaching Hospital

Table 2: Other causes of admission in the SCBU of ESUTH

Cause of morbidities	*n* (%)		Total
	Inborn	Outborn	*N*
Meconium aspiration syndrome	0 (0.0)	1 (1.8)	1
Hypoglycemia	2 (66.7)	1 (33.3)	3
Erb's palsy	2 (50.0)	2 (50.0)	4
Imperforate anus	0 (0.0)	1 (100)	1
Aspiration syndrome	3 (42.9)	4 (57.1)	7
Multiple congenital abnormalities	1 (50.0)	1 (50.0)	2
Postdate	3 (60.0)	2 (40.0)	5
Macrosomia	8 (100)	0 (0.0)	8
Spinal bifida	0 (0.0)	1 (100)	1
Transient tachypnea of newborn	1 (33.3)	2 (67.7)	3
Dehydration fever	1 (50.0)	1 (50.0)	2
Congenital pneumonia	4 (66.7)	2 (33.3)	6
Neonatal meningitis	1 (25.0)	3 (75.0)	4
Clavicle fracture	0 (0.0)	2 (100)	2
Malaria	4 (57.1)	3 (42.9)	7
Hemorrhagic disease of newborn	0 (0.0)	1 (100)	1
Total	30 (52.6)	27 (47.4)	57 (100)

Pattern and causes of mortality in newborn in ESUTH. SCBU=Special care baby unit; ESUTH=Enugu State University Teaching Hospital

Table 3: Causes of neonatal deaths at the SCBU of ESUTH

Diseases	Death			χ^2 (*P* value)
	Inborn (*n*)	Outborn (*n*)	Total (*N*)	
Asphyxia	6	15	21	0.11 (0.741)
Neonatal sepsis	5	5	10	1.08 (0.298)
Very low birth weight	2	0	2	3.81 (0.051)
Others†	2	2	4	0.50 (0.481)
Total	15	22	37	2.50 (0.114)

†Other causes of mortality; inborn: Multiple congenital abnormalities and postdate with recurrent hypothermia; outborn: Meconium aspiration syndrome and neonatal meningitis. SCBU=Special care baby unit; ESUTH=Enugu State University Teaching Hospital

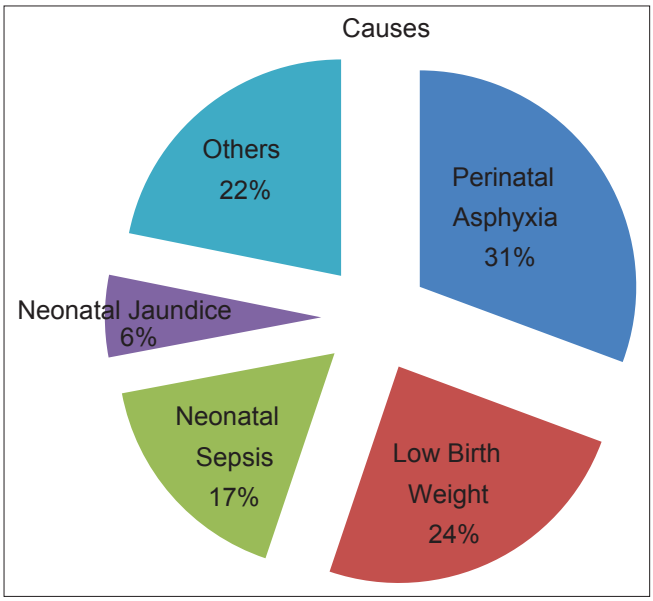

Figure 1: Causes of admission in special care baby unit (SCBU) of Enugu State University Teaching Hospital (ESUTH). †Others see Table 2 below

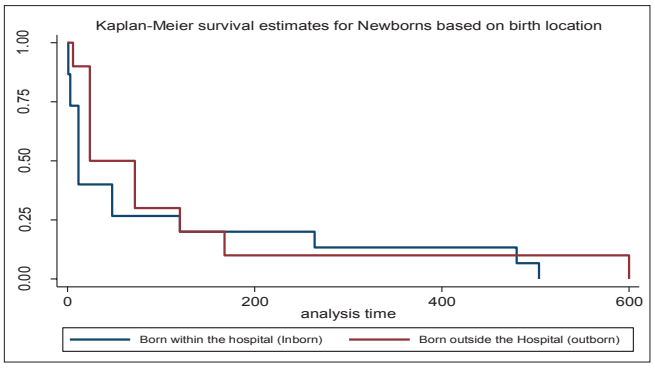

Figure 2: Survival curve of newborn babies dichotomized by place of birth

There was predominance of inborn patients (54.4%) compared to outborn (45.6%). This finding is in keeping with the finding in a similar study at University of Benin Teaching Hospital Benin City, Nigeria where 84.6% newborn admissions were inborn, while 15.4% were outborn babies.[10] This does not suggest that inborn babies usually get ill more often. The reason for this trend could be attributed to closer review of the inborn babies by specialist and experienced doctors who pick up early subtle signs of diseases in these newborns. Furthermore, it is more convenient and easier for sick babies delivered in our center to be referred to our SCBU than those born outside the center. Babies born outside our center have other options of accessing neonatal services from other nearby centers like University of Nigeria Teaching Hospital Enugu and other privately owned hospitals. The latter reason obviously and more importantly reduces the number of out born referrals to our center. However contrary to our finding, a study in Amino Kano Teaching Hospital (AKTH) in Northern Nigeria documented a predominance of outborn babies (50.9%) compared to inborn babies (49.1%)[7] admissions. This is easily justified as AKTH, being the only specialist hospital in the whole of Kano state in northern Nigeria, serves as the only major referral center for newborns requiring specialist neonatal services.

The four leading causes of admission seen in this study included; perinatal asphyxia, low birth weight, neonatal sepsis, and neonatal jaundice were consistent with the leading causes of admission documented in other studies in Nigeria.[7,8] However, unlike in our setting where neonatal tetanus was not a common cause of admission, studies in the south-south region of Nigeria[9,10] have recorded neonatal tetanus as a leading cause of newborn morbidity and mortality. This may be related to higher uptake of tetanus toxoids by mothers during pregnancy in this region compared to those in the southern part of Nigeria.

The study further showed that outborn babies presents to the hospital at a significantly later age than the inborn. This may be attributed to delays in diagnosis and decision making in seeking care for these newborns. Also is the delay in transportation which is not only due to difficulty in getting transportation to our remotely located facility, but also due to very poor and difficult roads network in Enugu state. In a similar study done in eastern Uganda[11] in 2010, the major contributing delays to newborn death were delay in problem recognition or in deciding to seek care (50%); delay to receive quality care at a health facility (30%); and transport delay (20%).[11]

Severe form of perinatal asphyxia accounts for all the deaths from perinatal asphyxia seen in this study. This is collaborated by similar findings in AKTH where most of the deaths from perinatal asphyxia were due to severe form.[7] Findings from this study also showed that asphyxiated inborn babies had a higher odd of surviving compared to outborn babies. Due to exorbitant hospital delivery charges, most of the out born deliveries just like in many settings in Africa are conducted by community health workers and TBAs who have little or no formal training in neonatal resuscitation. Hence, they offer little or no form of immediate resuscitation to the asphyxiated babies. In other cases recognition of the danger signs of asphyxiation comes hours after delivery. For those who recognize these sign and decide to refer, the major means of transportation especially for those coming from remote areas are motorbikes and the tricycles which not only delays presentation to the hospital, but also expose these sick neonates to even more adverse condition that could result in hypothermia. Hence, the out born asphyxiated

neonate arrives late to our center with at late stage of asphyxiation which increases their likelihood of dying. This is in contrast to the inborn babies delivered in the labor ward of our hospital which is in close proximity with the sick baby unit. More so the delivery of inborn with risk of asphyxiation is supervised by doctors and nurses who are skilled in newborn resuscitation; hence, resuscitation of the asphyxiated newborn starts in the labor ward with onward referral to the sick baby unit. These measures increase the odds of survival for inborn asphyxiated babies compared to the outborn babies.

Contrary to expectation, this study showed a higher likelihood of death for inborn neonates admitted for neonatal sepsis compared to the outborn babies. This may be due to difference in bacterial sources in both newborn categories. While the inborn are at higher risk of hospital acquired strains of infecting organism which are usually more difficult to treat due to drug resistance, the community acquired infections in outborn babies are usually less resistant, and responds better to antibiotics.

The mortality rate in this study was 14.2%, which is slightly higher than 13.3%; 19.3% seen in a study at Gwagwalada-Abuja.[8] Higher mortality rates were documented by similar studies in Benin city[10] and in the Niger delta region[9] (20.3%) each. Other studies documenting higher death rates include a study at University of Calabar Teaching Hospital (UCTH)[12] documenting a death rate of 19.3% and another study at AKTH, northern Nigeria[7] documenting a death rate of 16.9%. Limited facilities and manpower have been implicated in the higher mortality rates documented in the developing countries.[13]

Although the number of the inborn babies that died exceeds that of the outborn babies, the case fatality ratio for outborn babies (18.5%) was higher than that of the inborn (10.5%). Similarly, a study in Benin recorded a significant higher mortality risk in the outborn babies compared to in born babies.[10] The leading cause of death in this study is perinatal asphyxia 21 (56.8%) followed by neonatal sepsis 10 (27.0%). Perinatal asphyxia is also the leading cause of death (21.7%) at University of Abuja Teaching Hospital Gwagwalada, Abuja.[8] The second commonest cause of death in our study is neonatal sepsis. This however, was documented as the commonest cause of death by studies done in the Niger Delta[9] where it accounts for 25.7% of the deaths and another study at Calabar[12] where it accounts for 27.4%. In one other study, prematurity was implicated as the leading cause of death.[14]

Conclusion

The neonatal mortality in this study is high. The major causes are similar to those documented by other studies in Nigeria and are largely preventable. Strengthening perinatal care, emergency obstetric services, and enhancement of neonatal resuscitation skill are indispensable tools to enhance neonatal survival.

Limitations of the study

We were unable to carry out autopsy to determine the pathologic cause of death in our subjects due to lack of parental/caregiver's consent in some cases, cost implications in others, or combination of both. Hence, causes of death were clinically determined by two pediatricians independently. Where there is a disagreement, a third specialist was invited to make an independent assessment and cause of death. There was high agreement in cause of death between the initial assessors.

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References

1. Kingerberg C, Olomi R, Oreko M, Sam N, Langeland N. Neonatal morbidity and mortality in a Tanzanian tertiary health-care referral hospital. Ann Trop Paediatr 2003; 23:293-9.
2. US Today 2012. Available from: http://www.ustoday.com/new/world/story/2012-06-12/newbornmortalityrate/555346327 [Last accessed on 2013 Feb 09].
3. Federal Ministry of Health. Saving newborn lives in Nigeria: Neonatal health in the context of integrated maternal, neonatal and child health survey. 2nd ed. Abuja. Federal Ministry of Health, Save The Children, Jhpiego; 2011.
4. Yinger NV, Ransom EL. Why invest in newborn health? Policy perception on newborn health. Save the children Washington; 2003.
5. Jehan I, Harris H, Salat S, Zeb A, Moben N, Pasha O, *et al*. Neonatal mortality: Risk factors and causes: a prospective population based cohort study in Pakistan. Bull World Health Organization 2009; 87:130-8.
6. Abbassi KA. Neonatal disease profile in Larkana before and after establishment of the neonatal ward. J Park Med Assoc 1995; 45:235-6.
7. Mukhtar-Yola M, Iliyasu Z. A review of neonatal morbidity and mortality in Aminu Kano Teaching Hospital, Northern Nigeria. Trop Doctor 2007; 37:130-2.
8. Okechukwu AA, Achonwa A. Morbidity and mortality patterns of admissions into the Special Care Baby Unit of University of Abuja Teaching Hospital, Gwagwalada Nigeria. Niger J Clin Prat 2009; 12:389-94.
9. Ugwu GI. Pattern of morbidity and mortality in the newborn special care unit in a tertiary institution in the Niger delta region of Nigeria: A prospective study. Glob Adv Res J Med Sci 2012;1:133-8.
10. Omoigberale AI, Sadoh WE, Nwaneri DU. A 4 year review of neonatal outcome at the University of Benin Teaching Hospital. Benin City. Niger J Clin Pract 2010;13:321-5.
11. Waiswa P, Kallander K, Peterson S, Tomson G, Pariyo GW. Using the three delays model to understand why newborn babies die in eastern Uganda. Trop

Med Int Health 2010;15:964-72.

12. Nadar J, Akhtar S, Kishwar A, Naha N. Neonatal morbidity and mortality in the special care baby unit of Bangladesh Institute of Research And Rehabilitation. Ibrahim Med Coll J 2009; 1:69-76.
13. Boggs N. Statewide quality improvement initiative for neonatal infections. Pediatr 2011; 21:250-60.
14. Bhutta ZA. Priorities in newborn management and development of clinical neonatology in Pakistan. J Coll Physicians Surg Pak 1997; 7:231-4.

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