Spousal Age Differences and Risk of Infant Mortality in Nigeria: A Multi-level Analysis

Chibuogwu Izugbara
Department of Sociology, University of Pretoria, South Africa
Human Economy Programme, University of Pretoria, South Africa

Background/objectives: Nigeria remains the largest contributor to neonatal mortality in Africa. Nigeria's neonatal mortality rate is 48/1000 live births. Existing research on the causes of neonatal mortality in Nigeria has placed great emphasis on factors such as diarrhea, malaria, measles and acute respiratory infections, whooping cough, tuberculosis, bronchopneumonia, dirty feeding bottles and utensils, inadequate disposal of household refuse, poor storage of drinking water and household wealth index[1-4]. However, insufficient attention has been given to parental age-related factors. Understanding the implications of parental age differences for child health can add to our knowledge of the correlates of neonatal mortality and furnish insights to support the design and delivery of interventions to address the problem. To examine the implications of spousal age-related factors for child health outcomes.

Methods: Data for this study were drawn from the 2008 Nigeria Demographic and Health Survey. Univariate and multivariate statistical analyses were used to assess the relationship between neonatal mortality and parental age-related contextual factors focusing on maternal and paternal ages, spousal age, sex of child, household wealth index and place of residence.

Results: The multivariate logistic regression analyses yielded significantly increased risk of neonatal mortality among neonates of parents with age differences of 15 years or more.

Conclusions: Neonates of couples with age differences of less than 15 years die less compared to neonate of spouses with age difference of 15 years and above.

Introduction

Of the 130 million babies born globally every year, about 4 million die in the first 4 weeks of life, during the neonatal period.[5] Neonatal mortality rate is defined as the number of infants dying before reaching 28 days of life, per 1,000 live births.[6] Most neonatal deaths (99%) occur in low and middle-income countries, with two thirds occurring in Africa and Southeast Asia.[7, 8]

Globally, Nigeria ranks second to India with the highest number of neonatal deaths.[9] Currently in Africa, Nigeria's neonatal mortality rate is the highest of the region at 48/1000 live births with 241,000 neonatal deaths annually.[10] Neonatal mortality rates have declined in most of the developing world, yet remain disturbingly high in Nigeria.[9]

Deaths in the first month of life primarily reflect factors associated with maternal health, both before and during pregnancy, and health problems of the newborn.[11] Deaths in this age range result chiefly from inadequate growth (prematurity, intrauterine growth retardation) and congenital anomalies.[11] As a result, neonatal mortality rates provide an indicator of the factors affecting pregnancy, delivery, the health of the neonate and the adequacy of services in the prenatal, intrapartum and neonatal periods.[12]

Research into the causes of high neonatal mortality in Nigeria has focused on factors such as preterm birth, infections, asphyxia and low birth weight.[1] Maternal complications in labor, breastfeeding practices, dirty feeding bottles and utensils, inadequate disposal of household refuse, poor storage of drinking water, household wealth index and maternal characteristics are also correlated with neonatal mortality.[2-4] However, few studies have examined the implications of spousal age-related factors for child health outcomes. The few available studies were conducted in developed countries. These studies show that spousal demographic factors, especially age, have huge implications for early child health outcomes. For instance, European studies published between 2002 and 2008 associated advanced paternal age with fetal death, which includes both miscarriage and stillbirth.[13,14] Additionally, a 2002 study in Jerusalem linked paternal age with pre-eclampsia, a complication of pregnancy associated with the development of high blood pressure and protein in the urine.[15, 16]

Significant associations have surfaced between advanced paternal age and childhood conditions such as cleft lip and palate, childhood cancers, congenital heart defects and childhood neuropsychiatric conditions such as autism, schizophrenia, epilepsy and bipolar disorder.[17-19] Paternal age has also been implicated in the etiology of Trisomy 21, Down Syndrome.[20] Other studies found advanced paternal age to be associated with an increased risk of single gene disorders.[21]

Furthermore, the literature shows that the rate of transmitted de novo single nucleotide mutations increases with paternal age.[22] For instance, achondroplasia, the most common form of dwarfism, is a disease in which the probability of having an affected offspring increases exponentially as a function of the father's age.[22] Additionally, the interaction between parental age difference and offspring count in humans has been examined.[23] In such studies, the offspring count for men reached a maximum when the female partner was approximately 6 years younger than the male.[21, 23] The implications of spousal age-related factors for child health outcomes remain an understudied issue in neonatal mortality in Nigeria. According to a 2012 UNICEF report, early childhood health determines the quality of health, well-being, learning and behavior across a person's life span. Early childhood is a period of great development, and with this development comes great vulnerability.[10]

Against this backdrop, this paper examines whether age differences between spouses is associated with neonatal mortality in Nigeria. The similarities or dissimilarities in mortality rates of neonates with regard to differences in their parents' ages are conceptualized and divided into taxonomically and analytically useful categories. Knowledge about these similarities and dissimilarities is linked to the general literature on infant and childhood mortality in Nigeria and the rest of the developing nations.

The implications of spousal age-related factors for child health outcomes remain an understudied issue in neonatal mortality in Nigeria.

Study Design

Population

The data used in this study are from the 2008 Nigeria Demographic and Health Survey (NDHS), the most comprehensive of all the demographic and health surveys conducted in the country. The study was conducted by the National Population Commission (NPC) from June to October 2008, with financial support from the United States Agency for International Development (USAID) and United Nations Fund for Population Activities (UNFPA). ICF Macro International provided technical assistance. Questionnaires were administered on a nationally representative sample of 36,800 households drawn from all 36 states and the Federal Capital Territory.[24] The 2008 NDHS elicited information on demographic and health indicators both at the national and state levels. Data for this study was collected from 33,385 women of reproductive age (15-49 years) who had had at least one live birth in the five years preceding the survey (2003-2008), with a total of 104,808 births. Of these births, 5,665 neonates died.

Statistical Analysis

The outcome variable for this study is neonatal mortality and was measured as the duration of survival since birth in days. The children's survival status and age at death in days (if the child had died), or the last 28 (0-27) days they were known to be alive (if child was still living at the time of the survey), were combined to generate the outcome variable. Neonates known to have died (i.e. non-censored observation) were regarded as the cases, whereas neonates who were still alive at the time of the survey were treated as right-censored. Right censoring occurs when a subject leaves the study before an event occurs, or the study ends before the event has occurred.[25] The key explanatory variable in this study is spousal age difference, which is categorized as (1) 1-14 year age difference and (2) 15 or more year age difference.

Bivariate associations were used to examine the association between the independent socioeconomic and demographic variables and the dependent variable, spousal age difference. In order to examine such an association, Pearson Chi-squared test assisted in identifying factors that are significantly associated with spousal age difference. The final stage of the analysis was multivariate analysis yielding the odds ratios. The binary logistic regression model was used in this study because the outcome variable is dichotomous or binary: neonatal mortality was coded as 0 (Dead) and 1 (Alive), respectively.

Descriptive statistics calculated in this study included maternal and paternal ages, child's sex, household wealth index and place of residency. For the purpose of this study, maternal age was divided into three age categories: 15-24 (reference group), 25-34 and 35-49 years, while paternal age was divided into four age categories: 15-24 (reference age group), 25-34, 35-44 and 45-64 years. Different age groups were used for males and females because the mean and median ages of menopause for Nigerian women are 49±3 and 49.0 years, respectively.[26] A new variable, spousal age, was generated by comparing the three maternal age groups with the four paternal age groups. The matching up of these age groups made it possible to study spousal age differences. Rates of neonatal mortality were calculated for each maternal and paternal age group. The adjusted odds ratio along with their 95% confidence intervals associated with maternal and paternal age groups, with reference to the 15–24 age groups, were derived through unconditional multivariate logistic regression analysis.

Odds ratio (OR) is defined in this study as the measure of association between an exposure and an outcome. It represents the odds that an outcome will occur given a particular exposure, compared to the odds of the outcome occurring in the absence of that exposure.[27] Paternal age is defined as the age of the father in completed years at the time of delivery.[28] Maternal age is defined as the age of the mother in completed years at the time of delivery.[28] Spousal age difference is defined in this study as the difference between the ages of spouses.

Ages of parents were categorized in order to probe the interaction between different age groups of spouses on child health outcomes. Age gaps of spouses coded "1-14" and "15 and above" years were used to simplify the analysis and interpretation of results and because the author was interested in two possible outcomes (i.e., neonates surviving or dying). The range of 1-14 age difference was used because the mean age difference between spouses in Nigeria is 12.0 years if the wife marries before age 15, compared to 8.5 years if the wife marries at or after age 20.[24] Spousal age differences in Nigeria are even greater when the woman is a second or third wife. In polygynous marriages, the mean age difference between spouses is 15.3 years, compared to 8.8 years in monogamous marriages.[24]

Table 1: Bivariate analyses of neonatal mortality and maternal and paternal socio-demographic characteristics

Characteristics	Outcomes at end of neonatal period (n=104,808)		
	Deaths (%) (n=5,665)	Odds ratio	95% CI
Maternal age at birth of child *			
15-24	9.54	1	
25-34	30.81	0.84	.7632516 .9310423
35-49	59.65	0.95	.8675274 1.046113
Paternal Age at Birth of child*			
115-24	9.54	1	
25-34	30.81	0.84	7632515 .9310425
35-44	37.98	0.91	.8264131 1.00369
45-64	21.67	1.1	.9335352 1.150172
Child's Sex*			
Male	57.37	1	
Female	42.63	0.79	.7314063 .8150122
Parental Age Difference*			
1-14	13.99	1	
15-Abov	17.33	2.3	.0966805 .410784
Household wealth Index*			
Poor	30.16	1	
Moderate	47.87	0.90	9055806 1.025992
Rich	21.97	0.70	.6449142 .7492019
Region of Residence			
Urban	4.48	1	
Rural	5.72	1.3	.1907969 .3217599

Source: Calculated from the 2008 Nigeria Demographic and Health Survey

Table 2: Adjusted odds ratios from logistic regression of neonatal mortality and spousal demographic factors.

Characteristics	Neonatal Births (104,808)	
	Odds ratio	95% CI
Maternal age at birth***		
15-24	1	
25-34	0.84	.2701677 .0714504
35-49	0.95	.4285714 .8472978
Paternal Age at Birth***		
15-24	1	
25-34	0.75	2701677 .0714504
35-44	0.89	2012994 .0568129
45-64	0.96	0687766 .1399118
Child's Sex***		
Male	1	
Female	90	.8784612 .9367374
Spousal Age Difference***		
1-14	1	
15-Above	1.4	.5384616 .6190392

Source: Calculated from the 2008 Nigeria Demographic and Health Survey

Results

In the bivariate analysis of neonatal mortality and demographic variables at the individual level, neonates of women aged 35-49 or older were 95% more likely to die compared to those of women aged 15-24 (Table 1). With regard to paternal age, 37.98% of neonatal deaths were correlated with men who were between 35-44 years old (Table 1). Mortality among neonates was more prevalent among spouses with age differences of 15 years and above (Table 1). Male neonates had a higher rate of mortality at 57.37% compared to 42.63% among female neonates. The odds ratio for death among girls was 0.79 (95% CI .73140 - .81501) (Table 1). Spouses living in rural areas were 1.3 times more likely to experience neonatal mortality compared with their urban counterparts (OR, 1.3, CI: .19079-.32175). With regard to household wealth index, neonatal mortality was highest among parents of moderate households (Table 1).

Logistic regression analysis showed that sex of child, spousal age difference and maternal and paternal ages were significantly associated with neonatal mortality. Female children were less likely to die as neonates compared to male children (Table 2). Spouses with age difference above 15 years were more likely to experience neonatal mortality compared to those of the reference group category (OR. 1.4, 95% CI 0.539-0.619). Older mothers (35-45) were more likely to experience mortality among neonates compared to younger mothers (OR. 0.95, 95% CI 0.429- 0.847) (Table 2).

Discussion

The findings of the study showed a clear effect of maternal and paternal ages on the risk of neonatal mortality. This finding suggests that older women may be at increased risk of neonatal mortality due to common diseases associated with older age, such as diabetes, hypertension and complications of pregnancy, such as abruption. This finding supports the research findings of Astolfi et al., who found that the risk of infant mortality was high in older women (35 years and above).[29]

Neonates born in rural areas were also more likely to die than their urban counterparts (OR, 1.3, CI: 0.19079-0.31275). This supports Izugbara's argument that cities and towns tend to have lower mortality rates than rural areas, possibly because people residing in rural areas are less educated than their urban counterparts, and the distribution of amenities favors the urban areas.[2] Increasing access to drinkable water in rural areas and facilitating access to health-care services to members of rural communities could reduce risks of neonatal mortality. An increased availability and access to drinkable water within the community could prevent children from contracting avoidable infections and water-borne diseases, such as diarrhea and other forms of infections. This study points to the importance of good infrastructure for child survival. This result has established an elevated risk of neonatal mortality for communities in poor socio-economic contexts. The findings also establish one of the reasons rural areas tend to have poorer child health outcomes than their urban counterparts.

Wealth index covariate is another important determinant of infant and child mortality that is established in this study. Spouses of the moderate wealth quintile reported the highest rate of neonatal mortality (Table 2). This corroborates previous findings by Omariba and Boyle, which established that socio-economic factors such as education, occupation and wealth index are more important in infancy than childhood.[30] Yaya et al.'s study of maternal and neonatal mortality in rural Ethiopia also found similar evidence.[31] This study found that the greatest risk for both neonatal mortality and stillbirth was found in the richest households, not the poorest. On the other hand, Uthman found a higher incidence of malnutrition, and thus of morbidity and mortality, among children of a low wealth quintile than among children of the wealthiest quintile.[32] This result was due to many factors, including lack of economic access to antibiotics and other drugs from

private vendors among poorer families. Wealthy families often have better access to these resources, in addition to better nutrition and improved housing. The finding of families of moderate wealth in Nigeria reporting the highest rate of neonatal mortality needs further investigation. It is important to understand how the true wealth status can be determined in Nigeria, since it is possible that the asset variables selected to indicate wealth status may not have correctly reflected the actual wealth status of all households.

Additionally, the data shows that the child's sex is an important predictor of neonatal mortality. Male neonates had higher rates of mortality compared with female neonates (Male, 57.37%, Female, 42.63%, Table 2). This finding also supports research findings of Wells.[33] The survival advantage of girls over boys may be attributed to a higher vulnerability to infectious disease among boys.[34] Another possible reason for the low rate of neonatal deaths among girls may be a result of the development of better early fetal lung maturity in the first week of life, resulting in a lower incidence of respiratory diseases in female neonates compared with male neonates.[35] Globally, it is estimated that approximately 23% of newborn deaths are attributed to respiratory problems.[36] Finally, there was a significant increase in the risk of neonatal mortality if the couple's age difference was above 15 years (Table 2).

Conclusion

Results from the logistic regression model showed that spousal age gaps, sex of child, maternal and paternal ages were statistically associated with neonatal mortality in Nigeria. The findings of this study have expanded on earlier research that implicated malnutrition, infection, dehydration and diarrhea in neonates in Nigeria. As the rate of neonatal mortality remains high in Nigeria, this may not be resolved until spousal age-related measures and household-focused interventions are implemented. Spouses with age gaps of 15 years and above should be encouraged to seek medical attention whenever the need arises in their neonates.

Discouraging marriages of spouses with age gaps of 15 years and above through effective family planning programs also needs to be considered among neonatal survival interventions because neonatal survival is related to the parents' ages through both genetics and behaviour. Parents pass on genetic material that either serves to improve or worsen their infant's survival. Finally, the finding of this study may be unique to Nigeria and may not necessarily be generalizable to other countries or populations. There is need for further studies, especially in newer datasets and across other countries, to confirm the findings of this research.

Study Limitation

Generally, mortality studies are faced with data limitations. The study draws on a cross-sectional secondary dataset. As a result, there is a tendency for child deaths to be underreported. Mothers may be reluctant to talk about their dead children either because it brings back sad memories or because their culture discourages mention of the dead.[2] However, recall errors arising from dates of birth and death given by women interviewed in the survey were minimized by restricting the analyses to births within the 5-year period preceding the survey. Finally, the proportion of missing data was relatively small, such that it may not have influenced findings of this study.

References

1. Adeboye, M.A., Ojuawo, A., Ernest, S.K., Fadeyi, A., & Salisu, O.T. (2010). Mortality pattern within twenty-four hours of emergency paediatric admission in a resource-poor nation health facility. West African Journal of Medicine, 29(4), 249-252.
2. Izugbara, C. (2014). Whose child is dying? Household characteristics and under-5 mortality in Nigeria: research. South African Journal of Child Health, 8(1), 16-22.
3. Ogunjuyigbe, P.O. (2004). Under-five mortality in Nigeria: Perception and attitudes of the Yorubas towards the existence of "Abiku". Demographic Research, 11(2), 43-56.
4. Osonwa, O.K., Iyam, M.A., & Osonwa, R.H. (2012). Under-Five Mortality in Nigeria: Perception and Attitudes of the IKWERRES in Rivers State towards the Existence of "OGBA–NJE". Journal of Sociological Research, 3(2), 587-598.
5. Warren, J.B., Lambert, W.E., Fu, R., Anderson J.M, & Edelman, A.B. (2012). Global neonatal and perinatal mortality: a review and case study for the Loreto Province of Peru. Research and Reports in Neonatology. 2012(2), 103-113.
6. Fanaroff, A.A., Stoll, B.J., Wright, L.L., Carlo, W.A., Ehrenkranz, R.A., Stark, A.R., Bauer, C.R., Donovan, E.F., Korones, S.B., Laptook, A.R., Lemons, J.A., Oh, W., Papile, L.A., Shankaran, S., Stevenson, D.K., Tyson, J.E., & Poole, W.K. (2007). Trends in neonatal morbidity and mortality for very low birthweight infants. American Journal of Obstetrics and Gynecology, 196(2): 147. e1-8.
7. Neonatal mortality. (2015, February 1). Retrieved April 26, 2015, from http://data.unicef.org/child-mortality/neonatal
8. Kutty, V.R., Shah, P., Modi, D., Shah, S., Ramanathan, M., & Archana, A.R. (2012). Reducing neonatal mortality in Jhagadia Block, Gujarat: we need to go beyond promoting hospital deliveries. Journal of Tropical Pediatrics, 59(1), 49-53. doi:10.1093/tropej/fms043.
9. Ezeh, O.K., Agho, K.E., Dibley, M.J., Hall, J., & Page, A.N. (2014). Determinants of neonatal mortality in Nigeria: evidence from the 2008 demographic and health survey. BMC Public Health, 14, 521. doi:10.1186/1471-2458-14-521.
10. UNICEF (2012). Levels & Trends in Child Mortality, Estimates Developed by the UN Inter-agency Group for Child Mortality Estimation. Retrieved from http://www.childmortality.org/files_v19/download/Levels%20and%20Trends%20in%20Child%20Mortality%20Report%202012.pdf
11. Santos, I.S., Matijasevich, A., Silveira, M.F., Sclowitz, I.K., Barros, A.J., Victora, C.G., & Barros, F.C. (2008). Associated factors and consequences of late preterm births: results from the 2004 Pelotas birth cohort. Paediatric and perinatal epidemiology, 22(4), 350-359. doi: 10.1111/j.1365-3016.2008.00934.x.
12. Gould, J.B., Qin, C., & Chavez, G. (2005). Time of birth and the risk of neonatal death. Obstetrics & Gynecology, 106(2), 352-358.
13. Slama, R., Bouyer, J., Windham, G., Fenster, L., Werwatz, A., & Swan, S.H. (2005). Influence of paternal age on the risk of spontaneous abortion. American Journal of Epidemiology, 161(9), 816-823. doi: 10.1093/aje/kwi097.
14. Bray, I., Gunnell, D., & Smith, G.D. (2006). Advanced paternal age: How old is too old? Journal of Epidemiology and Community Health, 60(10): 851-853. doi: 10.1136/jech.2005.045179
15. Funai, E.F., Paltiel, O.B., Malaspina, D., Friedlander, Y., Deutsch, L., & Harlap, S. (2005). Risk factors for pre-eclampsia in nulliparous and parous women: the Jerusalem Perinatal Study. Paediatric and Perinatal Epidemiology. 19(1), 59-68.
16. Eiland, E., Nzerue, C. , & Faulkner, M. (2012) Preeclampsia 2012. Journal of Pregnancy, 2012(2012). doi:10.1155/2012/586578.
17. Sartorius, G.A., & Nieschlag, E. (2009). Paternal age and reproduction. Human Reproduction Update, 16(1), 65-79. doi:10.1093/humupd/dmp027.
18. Reichenberg, A., Gross, R., Weiser, M., Bresnahan, M., Silverman, J., Harlap, S., Rabinowitz, J., Schulman, C., Malaspina, D., Lubin, G., Knobler, H., Davidson, M., & Susser, E. (2006). Advancing Paternal Age and Autism. Archives of General Psychiatry. 63(9), 1026-1032. doi:10.1001/archpsyc.63.9.1026.
19. Cannon, M., Contrasting effects of maternal and paternal age on offspring intelligence. PLoS medicine, 2009. 6(3): p. e1000042.
20. Jyothy, A., et al., Parental age and the origin of extra chromosome 21 in Down syndrome. Journal of human genetics, 2001. 46(6): p. 347-350.
21. Malaspina, D., et al., Advancing paternal age and the risk of schizophrenia. Archives of general psychiatry, 2001. 58(4): p. 361-367.
22. Buizer-Voskamp, J.E., et al., Increased paternal age and the influence on burden of genomic copy number variation in the general population. Human genetics, 2013. 132(4): p. 443-450.
23. Fieder, M. and S. Huber, Parental age difference and offspring count in humans. Biology letters, 2007. 3(6): p. 689-691.
24. Commission, N.P., ICF Macro. Nigeria demographic and health survey, 2008. 2011.
25. Hosmer, D.W., S. May, and S. Lemeshow, Applied survival analysis. 2008.
26. Ozumba, B., et al., Age, symptoms and perception of menopause among Nigerian women. J Obstet Gynecol Ind, 2004. 54(6): p. 575-8.
27. Vittinghoff, E., et al., Predictor selection, in Regression Methods in Biostatistics. 2012, Springer. p. 395-429.
28. Izugbara, C., Socio-demographic risk factors for unintended pregnancy among unmarried adolescent Nigerian girls. South African Family Practice, 2015(ahead-of-print): p. 1-5.
29. Astolfi, P. and L. Zonta, Risks of preterm delivery and association with maternal age, birth order, and fetal gender. Human Reproduction, 1999. 14(11): p. 2891-2894.
30. Omariba, D. and M.H. Boyle, Family structure and child mortality in Sub-Saharan Africa: cross-national effects of polygyny. Journal of Marriage and Family, 2007. 69(2): p. 528-543.
31. Yaya, Y., et al., Maternal and neonatal mortality in south-west Ethiopia: estimates and socio-economic inequality. PloS one, 2014. 9(4): p. e96294.
32. Uthman, O.A., A multilevel analysis of the effect of household wealth inequality on under-five child under-nutrition: Evidence from the 2003 Nigeria Demographic and Health Survey. The Internet Journal of Nutrition and Wellness, 2008. 6(2).
33. Wells, J.C., Natural selection and sex differences in morbidity and mortality in early life. Journal of theoretical Biology, 2000. 202(1): p. 65-76.
34. Alonso, V., V. Fuster, and F. Luna, Causes of neonatal mortality in Spain (1975–98): influence of sex, rural–urban residence and age at death. Journal of Biosocial Science, 2006. 38(04): p. 537-551.
35. Khoury, M.J., et al., Factors affecting the sex differential in neonatal mortality: the role of respiratory distress syndrome. American journal of obstetrics and gynecology, 1985. 151(6): p. 777-782.
36. Organization, W.H., Global health risks: mortality and burden of disease attributable to selected major risks. 2009: World Health Organization.