On the association between skilled attendance at birth and newborn survival in sub-Saharan Africa

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Abstract:

Background: Recent studies have shown that newborns delivered with skilled attendance at birth (SAB) have higher neonatal mortality than those without in sub-Saharan Africa. Uncertainties in measurement of SAB, selection bias and poor quality of care were suggested as explanations. We reassessed the relationship by distinguishing the first day of life versus days 2-27.

Method: We analyzed data from 20 countries in sub-Saharan Africa for which DHS data were available on the period 2010-2014. We fitted a generalized linear mixed model on mortality outcome defined in three categories: died on day 1, day 2-17 and survived days 2-27. Analysis were adjusted for socio-demographic variables.

Results: newborn delivered with SAB have similar first day mortality risk as those without SAB. However, past the first day, there is higher survival chances associated with SAB.

Conclusion: Focus on improving quality of skilled delivery care is urgent to accelerate decline in neonatal mortality in sub-Saharan Africa.

EXTENDED ABSTRACT

Background:

Recent studies have demonstrated higher neonatal mortality among children of women who received skilled attendance at birth (SAB) compared to those who did not in sub-Saharan African countries. Even when mortality is restricted to the first week of life, higher risk of death is still observed among children who received SAB than those who did not. Common explanation to this counter-intuitive finding highlights low quality of maternal and newborn services, uncertainty in the measurement of SAB from reports from women and possible selection effects on those who accessed SAB. For the latter it is thought that women accessing delivery services in health facilities may do so because of their higher prior risk of adverse delivery outcome or potential complications arising during labor such that these women arrive late at the health facility when their conditions or those of their baby have worsen drastically.

We reassessed this relationship by distinguishing deaths on the first day of life from days 2-27. We hypothesize that if the selection effect is real, the negative association between SAB and mortality will be seen only during the first day of life, when newborns are particularly vulnerable. Passed this period a positive association should be observed. We also assessed association between the receipt of a series of seven antenatal and postnatal care interventions by women and their newborns and mortality on day 1 and days 2-27.

Method:

Recent demographic and health survey data, conducted between 2010 and 2014, with measure of mortality from full birth history and selected antenatal and postnatal interventions were available for 20 countries in sub-Saharan Africa. We based the analysis on children born in the past five years preceding each survey.

We defined the main outcome of study as mortality variable with three categories that distinguish 1) children who died within the first day of birth, 2) children who died between 2-27 days of life, and 3) children under-five who survived the neonatal period. We initially separated out deaths on days 2-7 but the results of the analysis were similar to those of age 8-27 days. We therefore grouped them together.

We used three main independent variables: 1) skilled attendance at birth, measured during each survey; 2) receipt of a series of seven antenatal intervention by the mothers during the pregnancy that led to the live birth. These interventions include urine sample, blood pressure, blood sample, iron supplementation, tetanus protection, counselled on pregnancy complications, tested for HIV and received results. We calculated a variable that distinguished newborns for whom women received all seven interventions versus the others (1=receipt all seven interventions, 0=other). 3) receipt of five postnatal interventions including newborn weighed at birth, early initiation of breastfeeding, no prelacteal feed during first three days of live, postnatal care for newborn, postnatal care for the mother. We also computed a variable on receipt of all five postnatal interventions (1=receipt all seven interventions, 0=other). Other independent variables that were included as controls were urban/rural, wealth quintile, marital status, number of children have, age at birth, education.

For the analysis, we pooled all country data and run generalized linear mixed model with multinomial distribution and random effect for country. Parameters for predictors (fixed effects) are reported as relative risk ratio. We used the third category of the outcome variables (children under-five who survived the neonatal period) as the base category.

Three models were fitted. First, a model of the mortality outcome variable with skilled attendance at birth controlling for secondary independent variables listed above. This model was fitted on the pooled data of all 20 countries. Then, we ran two additional models of the outcome variable: one on the receipt of all seven ANC and PNC interventions and the other running the same model but restricting the data to births delivered with

skilled. All two models also controlled for the secondary independent variables. These two models were fitted on pooled of 18 countries, excluding Burundi and Rwanda for which information on postnatal health check was not collected.

Summary of results:

Table 1, 2, 3 show the results of the three regression models. Table 1 shows that, adjusting for socio-demographic variables included in the analysis, there is not statistically significant first day survival difference between newborns delivered with skilled attendance at birth and those who did not. Although the odd ratio appears to indicate higher risk of death on first among newborn delivered with skilled attendance, the relationship was not statistically significant. However, passed the first day of life, newborns delivered with skilled attendance are 16% less likely to die within 2-27 days than those not delivered by a skilled health personnel.

In table 2, newborns who received all five postnatal care interventions show higher likelihood of survival either on day 1 (OR=0.2) or day 2-17 (OR=0.51) than those who did not receive all interventions. Interestingly, when ANC interventions are considered, newborns whose mothers received all interventions have slightly higher likelihood to die during the first day of live than the others. The relationship disappeared during days 2-27, where newborns whose mothers received all ANC intervention have a marginally higher survival chances. In table 3, these relationships are maintained.

Conclusion:

In sub-Saharan African countries, no first day survival difference is observed between newborn delivered with skilled health personnel compared to those who did not. However, skilled attendance at birth is beneficial passed day 1 with newborn showing significantly higher likelihood of survival. Finding confirmed possible selection of birth delivered with skilled attendance but point mostly to quality of delivery care.

Table 1: Generalized linear mixed model results for *mortality of newborn* of 20 countries over skilled attendance at birth and demographic variables. (mortality variable: 1 = "died within 1 day", 2 = "died within 2 to 27 days", reference level = "survived 0-27 days")

Independent variable	Mortality outcome variable	Category	Odds Ratio	Lower Confidence Limit for Odds Ratio	Upper Confidence Limit for Odds Ratio	P-value
Number of children ever born	1	1 vs. 5+	1.27	0.86	1.885	0.2284
	2	1 vs. 5+	0.99	0.683	1.447	0.9741
	1	2-4 vs. 5+	0.85	0.69	1.053	0.1383
	2	2-4 vs. 5+	0.75	0.609	0.923	0.0066
Age of mother at birth	1	15-19 vs. 20-29	0.95	0.781	1.154	0.6019
	2	15-19 vs. 20-29	1.19	0.909	1.559	0.2063
	1	30-39 vs. 20-29	1.26	1.069	1.491	0.0061
	2	30-39 vs. 20-29	1.13	0.94	1.362	0.1915
	1	>=40 vs. 20-29	1.88	1.437	2.449	<.0001
	2	>=40 vs. 20-29	1.7	1.308	2.201	<.0001
Current marital status of mother	1	other vs. Married	1.03	0.888	1.204	0.6689
	2	other vs. Married	1.17	0.958	1.438	0.1217
	1	single vs. Married	1.12	0.837	1.488	0.4561
	2	single vs. Married	1.56	1.241	1.969	0.0002
Education level of mother	1	Primary vs. No education	1.04	0.9	1.204	0.591
	2	Primary vs. No education	1.03	0.919	1.159	0.5942
	1	secondary+Higher vs. No education	0.94	0.728	1.221	0.6565
	2	secondary+Higher vs. No education	0.82	0.643	1.056	0.1255
Residence	1	Urban vs. Rural	0.99	0.823	1.186	0.8969
	2	Urban vs. Rural	1.13	0.92	1.385	0.2454
Wealth quintile	1	Poorer vs. Poorest	1	0.826	1.205	0.984
	2	Poorer vs. Poorest	1.03	0.878	1.214	0.6965
	1	Middle vs. Poorest	1.01	0.892	1.154	0.8246
	2	Middle vs. Poorest	1	0.814	1.219	0.9694
	1	Richer vs. Poorest	1.02	0.871	1.2	0.7854
	2	Richer vs. Poorest	0.92	0.741	1.14	0.4411
	1	Richest vs. Poorest	1.03	0.822	1.293	0.7916
	2	Richest vs. Poorest	0.9	0.622	1.304	0.5793
Skilled attendance at bith	1	Yes vs. No	1.16	0.93	1.437	0.1927
	2	Yes vs. No	0.84	0.712	0.988	0.0352

Table 2: Generalized linear mixed model results for *mortality of newborn* of 18 countries over receipt of selected ANC and PNC interventions and demographic variables. (mortality variable: 1 = "died within 1 day", 2 = "died within 2 to 27 days", reference level = "survived 0-27 days")

Effect	outcome	Category	Odds Ratio	Lower Confidence Limit for Odds Ratio	Upper Confidence Limit for Odds Ratio	P-value
num_children_born	1	1 vs. 5+	1.41	0.928	2.128	0.108
	2	1 vs. 5+	1.14	0.778	1.664	0.5048
	1	2-4 vs. 5+	0.93	0.726	1.201	0.5922
	2	2-4 vs. 5+	0.81	0.646	1.019	0.0717
age_cat	1	15-19 vs. 20-29	0.82	0.668	1.018	0.0728
	2	15-19 vs. 20-29	1.02	0.771	1.35	0.8861
	1	30-39 vs. 20-29	1.26	1.047	1.522	0.0148
	2	30-39 vs. 20-29	1.16	0.941	1.434	0.1639
	1	>=40 vs. 20-29	1.73	1.342	2.228	<.0001
	2	>=40 vs. 20-29	1.56	1.164	2.085	0.0028
current_marital_stat	1	other vs. Married	1.01	0.85	1.203	0.8999
	2	other vs. Married	1.09	0.905	1.31	0.3656
	1	single vs. Married	1.02	0.76	1.37	0.8916
	2	single vs. Married	1.45	1.148	1.841	0.0019
education_cat	1	Primary vs. No education	1.31	1.141	1.511	0.0001
	2	Primary vs. No education	1.2	1.029	1.411	0.0208
	1	secondary+Higher vs. No education	1.32	0.981	1.768	0.0668
	2	secondary+Higher vs. No education	1.03	0.799	1.34	0.797
residence	1	Urban vs. Rural	1.14	0.928	1.409	0.2093
	2	Urban vs. Rural	1.25	1.025	1.536	0.0281
wealth	1	Poorer vs. Poorest	1.19	0.973	1.447	0.0903
	2	Poorer vs. Poorest	1.14	0.965	1.336	0.1251
	1	Middle vs. Poorest	1.33	1.122	1.574	0.001
	2	Middle vs. Poorest	1.11	0.898	1.371	0.3375
	1	Richer vs. Poorest	1.47	1.198	1.802	0.0002
	2	Richer vs. Poorest	1.07	0.844	1.362	0.5693
	1	Richest vs. Poorest	1.61	1.218	2.135	0.0008
	2	Richest vs. Poorest	1.04	0.763	1.406	0.8199
Receipt of all seven ANC interventions	1	Yes vs no	1.08	1.054	1.109	<.0001
	2	Yes vs no	0.97	0.932	1.003	0.0724
Receipt of all five PNC interventions	1	Yes vs no	0.2	0.174	0.239	<.0001
	2	Yes vs no	0.51	0.457	0.577	<.0001

Table 3: Generalized linear mixed model results for *mortality of newborn* of 18 countries over number of ANC, PNC interventions *conditional on skilled delivery* and demographic variables. (mortality variable: 1 = "died within 1 day", 2 = "died within 2 to 27 days", reference level = "survived 0-27 days")

Effect	myoutcome1	Category	Odds Ratio	Lower Confidence Limit for Odds Ratio	Upper Confidence Limit for Odds Ratio	P-value
num_children_born	1	1 vs. 5+	1.59	1.052	2.402	0.0277
	2	1 vs. 5+	1.19	0.81	1.744	0.3771
	1	2-4 vs. 5+	0.93	0.731	1.181	0.5473
	2	2-4 vs. 5+	0.81	0.644	1.011	0.0627
age_cat	1	15-19 vs. 20-29	0.85	0.691	1.033	0.1001
	2	15-19 vs. 20-29	1.04	0.786	1.364	0.8027
	1	30-39 vs. 20-29	1.28	1.06	1.543	0.0102
	2	30-39 vs. 20-29	1.16	0.939	1.436	0.1669
	1	>=40 vs. 20-29	1.81	1.367	2.387	<.0001
	2	>=40 vs. 20-29	1.59	1.182	2.144	0.0022
current_marital_stat	1	other vs. Married	1.02	0.882	1.189	0.751
	2	other vs. Married	1.09	0.898	1.324	0.3832
	1	single vs. Married	1.07	0.806	1.422	0.6371
	2	single vs. Married	1.48	1.169	1.879	0.0012
education_cat	1	Primary vs. No education	1.26	1.097	1.457	0.0012
	2	Primary vs. No education	1.15	0.996	1.325	0.0562
	1	secondary+Higher vs. No education	1.24	0.937	1.64	0.1317
	2	secondary+Higher vs. No education	0.98	0.784	1.229	0.8708
residence	1	Urban vs. Rural	1.17	0.945	1.453	0.1495
	2	Urban vs. Rural	1.27	1.029	1.573	0.0263
wealth	1	Poorer vs. Poorest	1.15	0.949	1.383	0.1578
	2	Poorer vs. Poorest	1.11	0.943	1.307	0.2089
	1	Middle vs. Poorest	1.29	1.116	1.494	0.0006
	2	Middle vs. Poorest	1.09	0.892	1.327	0.4032
	1	Richer vs. Poorest	1.48	1.214	1.805	0.0001
	2	Richer vs. Poorest	1.08	0.858	1.347	0.5284
	1	Richest vs. Poorest	1.8	1.381	2.345	<.0001
	2	Richest vs. Poorest	1.09	0.777	1.516	0.6323
Receipt of all seven ANC interventions	1	Yes vs no	1.04	1.017	1.065	0.0006
	2	Yes vs no	0.96	0.933	0.985	0.0025
Receipt of all five PNC interventions	1	Yes vs no	0.4	0.339	0.484	<.0001
	2	Yes vs no	0.68	0.617	0.746	<.0001