

Trends and Factors Associated with Changes in Preterm Birth at Referral Hospital in Northern Tanzania. A Birth Registry-Based Study

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Abstract

Background: Preterm birth is a public health concern. It is a leading cause of neonatal mortality and the second leading cause of under-five mortality globally. Despite the current efforts in addressing causes and risk of preterm birth, the burden remains unacceptably high, especially in developing countries. Furthermore, while the risk factors for preterm birth are widely known, it is unclear how these factors change over time and how they influence changes in proportions of preterm birth.

Methods: This was a secondary data analysis using maternally linked data from the Kilimanjaro Christian Medical Center Medical birth registry from 2000 to 2018 and included all recorded deliveries. Data were cleaned and analyzed using STATA software version 15. The trends of preterm birth proportions were computed using Joinpoint regression model. The multivariable Poisson decomposition model was used to determine factors associated with changes in proportions of preterm birth.

Results: The proportions of preterm birth increased significantly from 11.5% in 2000 to 21.2% in 2018, with the annual percentage change of 5%. Change in proportions of antenatal care visits significantly contributed to 82%, 24% and 53% of changes in proportions of preterm birth respectively in all three phases while other factors such as multiple pregnancies, preeclampsia, use of alcohol during pregnancy and young maternal age (≤ 19 years) each contributed to less than 10% of the change in proportions of preterm birth.

Conclusion: The trend in the proportions of preterm birth has gradually increased in Northern Tanzania. Factors that contributed to the change in proportions of preterm birth are changing with time. ANC visits reported to be the main contributors for changes in PTB proportions across the study period. Therefore coordinated efforts are needed to promote early initiation, adequacy of ANC visits among women for early identification and management of high-risk pregnancies.

Keywords: Changes in Preterm Birth, Proportions, Trends, Birth-Registry, Tanzania

Background

Preterm birth (PTB) is the birth before completion of 37 weeks of gestation age or fewer than 259 days since the first day of a woman's last menstrual period [1]. Globally, approximately 15 million (10%) babies are born preterm in every year, the majority (81%) occurring in South Asia and Sub-Saharan Africa [2,3] The PTB rates vary between low- and high-income countries, ranging between 4-5% in Europe and 15-18% in Africa and South Asia [4]. In 2014, sub-Saharan Africa accounted for 28.2% of all PTB worldwide [5].

The trends in proportions of PTB are increasing in almost all countries with reliable data [3]. Despite the lack of reliable data for trends in proportions of PTB in SSA, 9 out of 11 countries with the highest (>15%) PTB rate are from the region [1]. In Tanzania, the proportions of PTB vary in different studies conducted within the five years. The studies reported that the proportions of PTB varies from 11.4% in 2010, 16.6% in 2014 and 11.0% in 2015 [5-7].

Globally, approximately one million babies die due to PTB related complications each year. This makes PTB be the leading cause of death among neonates and the second leading cause of death among under-five children [3]. Previous studies have shown that more than three-quarters of perinatal mortality are due to PTB complication [1, 7-9]. Furthermore, the risk of neonatal death due to complications of PTB differ by race, the risk is at least 12 times higher for an African baby compared to a European baby [10].

In Tanzania, more than 9500 children die due to PTB complications every year [11]. Furthermore, the survivors of preterm birth suffer from long-term life consequences, including neurodevelopmental functioning such as hearing, visual and learning disorders social [12]. Moreover, it poses an economic burden to the families and health system due to long hospital stay and neonatal intensive care admissions [12].

In various regions with reliable information, the changes in proportions of PTB have been associated with maternal demographic characteristics such as extreme maternal age (<20 years and ≥ 35 years), four and above antenatal care (ANC) visits, pregnancy history including previous PTB and conditions related to pregnancy and delivery, including preeclampsia, eclampsia, hypertension, infections such urinary tract infection, anxiety and abruption of the placenta [1, 9, 13]. Moreover, other factors such as parity of ≥ 4 , twin gestation, antepartum hemorrhage and prolonged PROM were also associated with PTB birth [10].

The Tanzania Ministry of Health implements several interventions like provision of reproductive health education, promoting family planning, nutrition, improving quality and uptake of ANC services [14]. These interventions are important for early identification and management of high-risk pregnancies. Despite that, PTB remains to be a critical challenge in obstetric practices, and the proportions are still unacceptably high [15]. A Possible explanation of rising trends of PTB may be due to change in risk factors for PTB, but this has not been explored. The interventions to reduce the proportions of PTB should target the risk factors influencing changes in the distribution of PTB in different settings.

Methods

Study design and setting

The study was a secondary analysis of a maternally linked data from the Kilimanjaro Christian Medical Center (KCMC) Medical birth registry, for all deliveries recorded from 2000 to 2018. The study was conducted at KCMC referral hospital in Moshi, Kilimanjaro region. KCMC is a referral, consultant and teaching hospital located in Moshi urban district, Kilimanjaro region in Northern Tanzania. It serves over 7 million people from Kilimanjaro and other nearby regions of Tanzania. The hospital also receives referred cases from the nearby regions including Arusha, Tanga and Manyara. Pregnant women with complications are referred for observation and delivery, while women in the local community (catchment area of KCMC hospital) come to deliver on their own willing. The hospital has an average of 4,000 deliveries per year.

Data collection

Data in the Medical Birth Registry are prospectively collected using a specially designed questionnaire and later entered in a computerized database. The questionnaire consists of several sections that collects basic information concerning mother, father of the child, home conditions, mother health before and during present pregnancy, information concerning deliveries and history of previous pregnancies including abortion, ectopic and molar pregnancies in chronological order. Participation and information given by the mother are given by informed consent. The form is mainly based on direct questions, but supplementary information is gathered from medical records and standard protocols. Patients file and ANC cards are also utilized for extraction and verification of interview data. Every woman delivered at KCMC is assigned with a unique identification number that is constant in her all deliveries at KCMC. This identification number is used to link mother with her respective siblings and makes it possible to create a reproductive history of deliveries for every woman.

Study participants & sample size

Between the year 2000 and 2018, KCMC Medical Birth registry recorded a total of 62,920 deliveries. We excluded 109 women who delivered before the year 2000, 62 missing unique identification number (which is required to link mother-child records), 67 missing dates of birth, 2,066 missing date of last menstrual period and six mothers with more than six births. Data were therefore, analyzed for 60,610 deliveries (**Figure 1**).

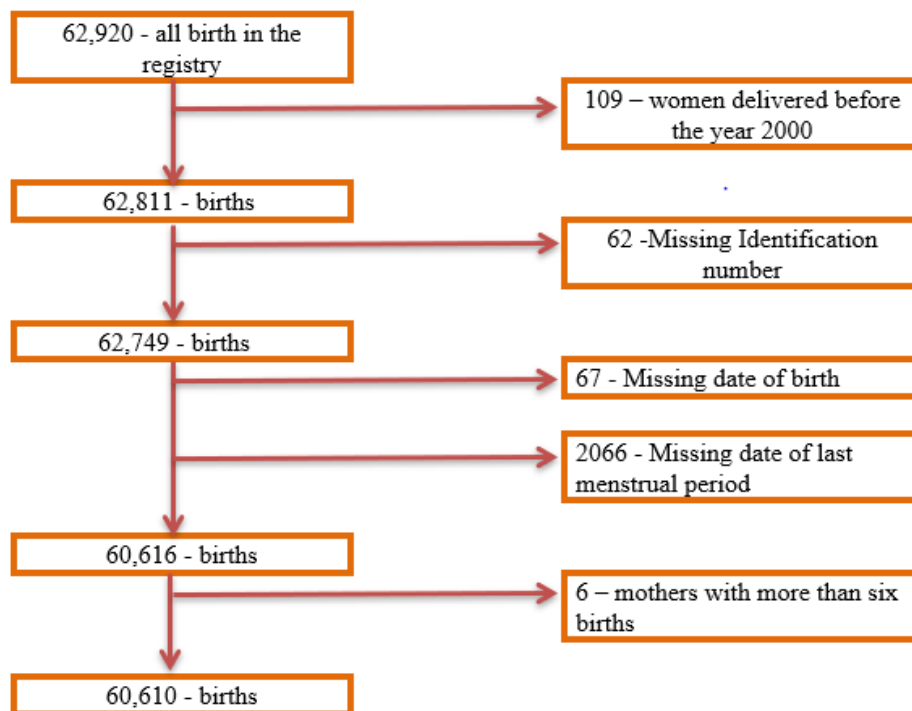


Figure 1. Participants' recruitment flow-charts.

Study variables

In this study, the main outcome variable was preterm birth, defined as birth with less than 37 weeks of gestation or fewer than 259 days since the first day of a woman's last menstrual period [1]. Gestation age at birth (numeric variable) was generated by computing the difference between the date of delivery and date of the first day of a woman's last menstrual period. We then categorized preterm birth into a binary variable, where births with <259 gestation days coded as 1 (preterm birth) and 0 if otherwise (term birth). The proportion of PTB was defined as the number of preterm births per all births in a defined period. Therefore the proportions were calculated by dividing the total count of PTB deliveries by the total number of all deliveries in the specified time points.

The selection and categorization of independent variables in this study were informed by previous literature [16–19] The independent variables included the background and clinical characteristics of mothers and infants.

Mothers' background characteristics include age in years (< 20 years, 20-34 years and ≥ 35years), marital status (in union i.e., married and cohabiting, and not in union i.e., divorced, separated and widowed), occupation (employed i.e., professions, services and unemployed i.e., housewife, farmer, students and business), education levels (formal education, primary level, secondary level and higher level) and residence (rural and urban). Furthermore, maternal body mass index (BMI) was categorized into under-weight (<18.5 kg/m²), normal weight (18.5-24.9 kg/m²) and overweight/obesity (≥ 25 kg/m²) while the use of alcohol during pregnancy was coded as binary variable (Yes and No).

Infants' characteristics include sex of the child (male and female), perinatal status (dead and alive) and birth weight (<2500 and ≥ 2500 grams). Mothers' clinical characteristics include: Pregnancy (singleton and multiple gestation), presence of malaria during pregnancy (Yes and No), ANC visit (<4 visits and ≥ 4 visits), HIV status (negative and positive), premature rupture of membrane (PROM), placenta previa, abruption placenta coded and preeclampsia during pregnancy were all coded as binary (Yes and No).

Data Management and analysis

Data analysis was performed using STATA version 15 statistical software (StataCorp, College Station, TX). Descriptive statistics were summarized by using frequency and percentages for categorical variables and mean and standard deviation was used for continuous variables. The Joinpoint regression model, (Joinpoint software version 4.8.0.1) was used to evaluate the trends of PTB proportions from 2000 to 2018 in the KCMC Medical birth registry data. The joinpoint regression model analyses proportions, rate or any other measure e.g. counts over time so as identify the possible time points at which any given trend changes. The model has constrained continuity at the change points and it estimates the choice of a number of joinpoints. The minimum and maximum numbers of joinpoints allowed are set before the analysis and the number of joinpoints is established based on a statistical criterion. The model is fitted for each possible position of the joinpoints and the final position of joinpoints is the one that minimizes the sum of squared errors (SSE) of the model [20].

For the proportions of PTB from 2000 to 2018, the minimum of 0 and a maximum of 5 joinpoints were set. The choice of the number of statistically significant joinpoints was made through a scheme of hypothesis tests that compares each time a simpler model (null model) and a complex model (alternative model). The p-value for each time point was calculated by the Monte Carlo Permutation method and the overall significance level was maintained through a Bonferroni correction of the overall alpha level.

To determine factors associated with changes in PTB proportions from 2000 to 2018, data were categorized in five years intervals that were 2000/2004, 2005/2009, 2010/2014 and 2015/2018. Separating data in five years periods were considered to be enough period to observe significant changes of factors and their effect on the outcome (PTB proportions). Then the proportions of each independent variable were summarized independently in each period to observe the variation of each characteristic across periods. Multivariable Poisson decomposition model was used to determine factors associated with changes in PTB proportions between two consecutive periods of five years interval. The change in PTB proportions was explained by changes in population structure (endowments) as well as changes in the effects of the characteristics (coefficients). The Blinder-Oaxaca decomposition (Blinder 1973) was chosen because it analyzes the changes of the outcome of different groups. This method allows displaying the contribution of each variable to the overall difference in characteristics or the effects of characteristics. Therefore at any instance of time, this method allows us to compare the changes of PTB proportions between two time periods.

Hence in this study decomposition was done in three phases; (phase I between 2000/2004 and 2005/2009 period, phase II between 2005/2009 and 2010/2014 and phase III between 2010/2014 and 2015/2018). Additionally, the model partitions the change in PTB proportions between the periods into two components that are attributed to changes in composition, changes in effects and the interaction between them.

The Poisson decomposition model can be represented as follows:

$$\Delta Y^{(2005/9 - 2000/4)} = e^{(x^{2005/9} - x^{2000/4}) \beta^{2005/9} + x^{2000/4}(\beta^{2005/9} - \beta^{2000/4}) + [(x^{2005/9} - x^{2000/4})(\beta^{2005/9} - \beta^{2000/4})]}$$

Where:

ΔY : Difference in mean prediction between 2005/09 and 2000/04.

$X_i \dots X_k$: Different characteristics.

$\beta_i \dots \beta_k$: estimated regression coefficients.

$(X^{2010} - X^{2005})\beta^{2010}$: Represent the difference due to endowments.

$X^{2005}(\beta^{2010} - \beta^{2005})$: Represent the difference due to coefficients.

$[(X^{2010} - X^{2005})(\beta^{2010} - \beta^{2005})]$: Represents the difference in the interaction between endowments and coefficients.

Results

Background characteristics of the study participants

A total of 60,610 deliveries were studied. The mean age of delivered women was 28.0 years (SD: 6.34 years) with 46,345 (76.5%) being aged between (20-34) years. Majority of women 51,914 (85.9%) were in union (married or cohabiting) and 40,344 (71.4%) were unemployed. The overall proportion of preterm birth was 17.3% (Table 1).

The proportion of women aged 19 years and below decreased across the years from 10.2% in 2000/2004, 8.0% in 2005/2009 and 7.7% in 2010/2014 to 3.1% in 2015/2018. At the same time, the proportions of women who use alcohol during pregnancy increased continuously from 55.6% in 2000/2004, 71.5% in 2005/2009 and 81.5% in 2010/2014 to 85.2% in 2015/2018. However, the proportion of women with ≥ 4 ANC visits decreased from 79.3%, 64.6% to 62.9% in 2000/2004, 2005/2009 and 2010/2014 period respectively and the increased to 74.6% in 2015/2018 period (Table 1).

Table 1. Background characteristics of the study participants, 2000-2018 (N=60,610)

Characteristics	Overall		5 years interval			
	2000 - 2018		2000-2004 ^a	2005-2009 ^b	2010-2014 ^c	2015-2018 ^d
	n	%	%	%	%	%
Mother's Age (years)*						
<20	4,560	7.5	10.2	8.0	7.7	3.1
20 – 34	46,345	76.5	77.5	78.1	75.8	74.2

≥35	9,676	16.0	12.3	13.9	16.5	22.7
(Mean ± SD)	(28.0 ± 6.34)					
Residence*						
Rural	24,598	40.7	49.3	38.6	41.0	32.0
Urban	35,864	59.3	50.7	61.4	59.0	68.0
Marital status*						
In union	51,914	85.9	90.0	89.2	86.3	75.2
Not in union	8,517	14.1	10.0	10.8	13.7	24.8
Education level*						
None	947	1.6	1.9	1.5	1.5	1.4
Primary	31,814	52.6	66.6	59.6	48.6	32.3
Secondary	8,835	14.6	4.8	4.8	20.7	29.8
Tertiary	18,905	31.2	26.7	34.2	29.2	36.5
Alcohol use during pregnancy*						
No	44,668	73.8	55.7	71.5	81.5	85.2
Yes	15,847	26.2	44.3	28.5	18.5	14.8
BMI*						
Normal	22,046	53.2	57.6	54.8	52.8	45.1
Underweight	2,228	5.4	5.0	5.9	5.7	4.6
Overweight/Obesity	17,146	41.4	37.4	39.3	42.6	50.3
Preeclampsia						
No	58,010	95.7	95.7	96.1	95.9	94.8
Yes	2,600	4.3	4.3	3.9	4.1	5.2
ANC visit*						
≥4	41,156	69.0	79.3	64.6	62.9	74.6
<4	18,493	31.0	20.7	35.4	37.1	25.4

Pregnant type*						
Singleton	57,268	94.7	94.4	95.2	94.7	94.2
Multiple	3,206	5.3	5.6	4.8	5.3	5.8
HIV status*						
No	45,748	95.0	92.0	94.1	95.5	96.1
Yes	2,435	5.0	8.0	5.9	4.5	3.9
PROM						
No	59,405	98.0	97.3	98.2	97.8	99.0
Yes	1,205	2.0	2.7	1.8	2.2	1.0
Abruption placenta						
No	60,414	99.7	99.4	99.9	99.7	99.7
Yes	196	0.3	0.6	0.1	0.3	0.3
Placenta previa						
No	60,482	99.8	99.5	99.9	99.8	99.8
Yes	128	0.2	0.5	0.1	0.2	0.2
Gestation age categories						
Preterm birth	10,509	17.3	15.1	16.2	17.3	22.0
Term birth	50,101	82.7	84.9	83.8	82.7	78.0

Key

a - n = 13,418

b - n = 15,950

c - n = 20,464

d - n = 10,778

* Frequencies (n) do not tally to the total due to missing values in these variables.

Trends in proportions of PTB at KCMC from 2000 to 2018

The proportions of PTB in the study period ranged from 11.5% in 2000 to 25.6% in 2016. However, a significant increase in proportions of PTB with the annual percentage change (APC) of 5% was observed in the period between 2010 and 2018 ($P < 0.001$) (Figure 2).

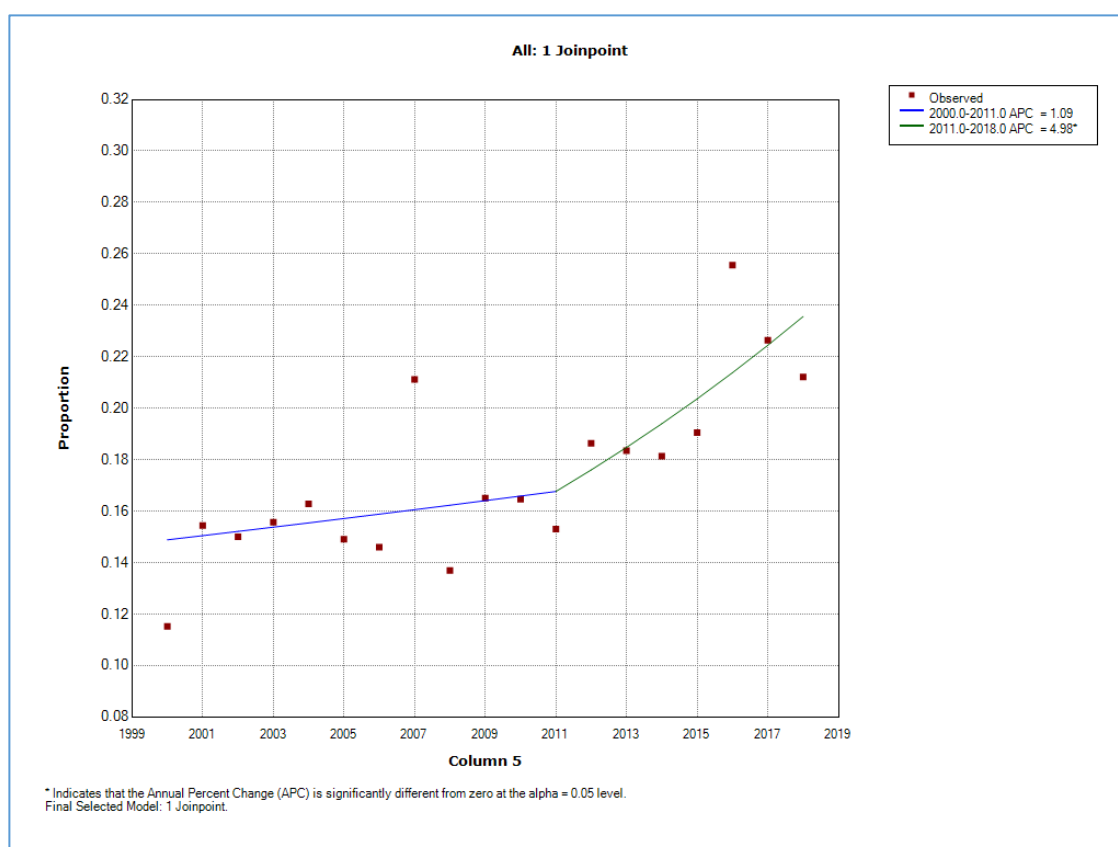


Figure 2. Trends of proportions Preterm birth at KCMC from 2000 to 2018

Factors associated with changes in PTB proportions

Phase I: 2000/2004 and 2005/2009

Between 2000/2004-2005/2009, 81.2% of overall change in PTB proportions was contributed by differences in characteristics (compositional factors). Alcohol consumption during pregnancy and ANC visits had significant contributions to a positive change in PTB proportions, while preeclampsia and type of pregnancy had a significant contribution to a negative change in PTB proportions. A decrease in the proportion of women with four and above ANC visits from 79.3% to 64.6% (Table 1) resulted to a significant positive contribution (84.7%, p -value: <0.001) to the change in PTB proportions during this period Table 2). Similarly increase in the proportion of women consumed alcohol during pregnancy from 55.6% to 71.5% (Table 1) resulted in a positive contribution (7.51%, p -value: 0.041) to the change in PTB proportions (Table 2).

Table 2. Factors associated with changes in PTB proportions among women delivered at KCMC in Phase I (N=29,368)

Characteristics	Due to differences in characteristics (E)			Due to differences in coefficients (C)		
	Coeff (x10 ⁻³)	%	p-value	Coeff (x10 ⁻³)	%	p-value

Mother's age (years)						
<20	0.05	0.21	0.528	-0.20	-0.76	0.718
20 – 34	1			1		
≥35	0.15	0.59	0.250	0.79	3.08	0.306
Residence						
Rural	1			1		
Urban	-0.14	-0.54	0.444	-1.56	-6.06	0.536
Marital status						
In union	1			1		
Not in union	0.33	1.29	0.145	0.42	1.63	0.457
Alcohol use in pregnancy						
No	1			1		
Yes	1.94	7.51	0.041	-0.59	-2.27	0.744
Preeclampsia						
No	1			1		
Yes	-0.68	-2.64	<0.001	-0.36	-1.40	0.246
ANC visit						
≥4	1			1		
<4	21.84	84.68	<0.001	-2.08	-8.07	<0.001
Pregnant type						
Singleton	1			1		
Multiple	-0.33	-1.28	<0.001	0.08	0.29	0.810
HIV status						
No	1			1		
Yes	-0.38	-1.48	0.159	-0.61	-2.35	0.261
PROM						
No	1			1		
Yes	-0.45	-1.73	0.045	-0.49	-1.92	0.068
Abruption placenta						
No	1			1		
Yes	-0.47	-1.82	0.063	-0.07	-0.28	0.426
Placenta previa						
No	1			1		
Yes	-0.92	-3.56	0.086	-0.01	-0.51	0.934
Constant				9.52	36.92	0.015
Total	20.96	81.24	<0.001	4.84	18.76	0.014

Coeff - coefficient

Phase II: 2005/09 and 2010/14

The results of Phase II (2005/2009 to 2010/2014) indicate that 44.1% of the overall change of PTB proportions was due to differences in characteristics (compositional factors). Factors that contributed to positive changes in proportions of PTB are pregnancy type, preeclampsia, ANC visit, PROM, placenta abruption, placenta previa and young maternal age (≤ 19 years). The study shows that decrease in the proportion of women with less than 20 years from 8.0% to 7.7% (Table 1) resulted in a slightly significant positive contribution (0.03%, p -value: <0.001) to change in proportions of PTB between 2005/2009 and 2010/2014 (Table 3). Furthermore, the decrease in the proportion of women with four and above ANC visits from 64.6% to 62.9% (Table 1) resulted in a significant positive contribution (24.57%, p -value: <0.001) to change of PTB proportions in this period (Table 3).

Table 3. Factors associated with changes in PTB rates among women delivered at KCMC in Phase II (N=36,414)

Characteristics	Due to differences in characteristics (E)			Due to differences in coefficients (C)		
	Coeff (x10 ⁻³)	%	p-value	Coeff (x10 ⁻³)	%	p-value
Mother's age (years)						
<20	-0.01	0.03	0.001	4.07	21.87	0.246
20 – 34	1			1		
≥ 35	0.13	0.69	0.600	-1.96	-10.55	0.561
Residence						
Rural	1			1		
Urban	0.63	3.41	0.020	-8.56	-46.04	0.488
Marital status						
In union	1			1		
Not in union	0.13	0.69	0.711	-2.64	-14.23	0.390
Alcohol use during pregnancy						
No	1			1		
Yes	0.50	2.68	0.580	6.31	33.96	0.336
Preeclampsia						
No	1			1		
Yes	0.03	1.41	<0.001	2.31	12.43	0.251
ANC visit						
≥ 4	1			1		
<4	4.57	24.59	<0.001	9.40	50.58	0.355
Pregnancy type						
Singleton	1			1		

Multiple	1.14	6.11	<0.001	0.28	1.53	0.822
HIV status						
No	1			1		
Yes	-0.57	-3.09	0.014	1.20	6.45	0.590
PROM						
No	1			1		
Yes	0.57	3.05	<0.001	1.14	6.15	0.327
Abruption placenta						
No	1			1		
Yes	0.50	2.70	<0.001	-0.05	-0.27	0.657
Placenta previa						
No	1			1		
Yes	0.36	1.91	<0.001	-0.01	-0.02	0.956
Constant				-1.11	-5.99	0.954
Total	8.21	44.13	<0.001	10.39	55.87	0.006

Coeff – coefficient

Phase III: 2010/14 and 2015/18

The results of Phase III (2005/2009 to 2010/2014) indicate that the overall difference in characteristics (compositional factors) contributed to 53.4% of the decrease in proportions of PTB. These characteristics included ANC visits, preeclampsia, pregnancy type, HIV status, PROM, placenta previa and abruptio placenta. The increase in the proportion of women with four and above ANC visits from 62.9% to 74.6% (Table 1) resulted in a significant positive contribution (23.05%, p -value: <0.001) to change of PTB proportions in the period between 2010/2014 and 2015/2018 (Table 4). The increase in the proportion of women who had preeclampsia during pregnancy from 4.1% to 5.2% (Table 1) resulted in a significant positive contribution (3.31%, p -value: <0.001) to the change of PTB proportions in the period between 2010/2014 and 2015/2018 (Table 4).

Table 4. Factors associated with changes in PTB rates among women delivered at KCMC in Phase III (N=31,242).

Characteristics	Due to differences in characteristics (E)			Due to differences in coefficients ©		
	Coeff (x10⁻³)	%	p-value	Coeff (x10⁻³)	%	p-value
Mother's Age						
<20	-2.63	-5.81	0.034	0.11	0.23	0.955
20 – 34	1			1		
≥35	1.03	2.29	0.182	1.36	3.02	0.528
Marital status						
In union	1			1		
Not in union	2.26	5.00	0.082	1.77	3.91	0.340

Alcohol use during pregnancy						
No	1			1		
Yes	0.27	0.59	0.605	-0.23	-0.51	0.931
Preeclampsia						
No	1			1		
Yes	1.49	3.31	<0.001	-0.80	-1.78	0.273
ANC visit						
≥4	1			1		
<4	-23.05	-50.99	<0.001	-1.50	-3.31	0.705
Pregnant type						
Singleton	1			1		
Multiple	0.96	2.13	<0.001	-1.43	-3.16	0.073
HIV status						
No	1			1		
Yes	-0.34	-0.75	0.020	0.30	0.66	0.783
PROM						
No	1			1		
Yes	-1.18	-2.60	0.020	-0.59	-1.31	0.458
Abruption placenta						
No	1			1		
Yes	-0.10	-0.22	0.010	-0.11	-0.22	0.634
Placenta previa						
No	1			1		
Yes	0.02	0.05	0.008	-0.13	-0.28	0.308
Constant				77.78	172.0	<0.001
Total	-24.14	-53.40	<0.001	69.35	153.4	<0.001

Coeff – coefficient

Discussion

The study aimed to determine the trends and factors associated with changes in PTB among deliveries recorded in the medical birth registry at the KCMC referral hospital in the Northern zone of Tanzania from 2000 to 2018.

The trend of PTB proportion increased significantly between the years 2010 and 2018 with the annual percentage change of 5%. These results highlight an increase in PTB proportions among all deliveries at KCMC referral hospital in Northern zone in Tanzania, which is similar to previous studies [5, 21, 22] A possible explanation for this increase in trends could be due to an increase in proportions of women with comorbid conditions such as hypertension, diabetes and cardiovascular diseases among women of reproductive age. These conditions increase the risk of adverse

pregnancy outcomes including PTB. However, these findings differ with those from Bangladesh where there was a decrease in trend of PTB rate between the year 1990 to 2014 [23]. The authors revealed that the observed decrease was contributed by a massive decrease in proportions of women with no formal education and those with parity of ≥ 3 [23].

The change in population structure during the study period mainly influenced the increase in PTB proportions. The number of ANC visits were the main contributor to the change in PTB proportions across all time periods.

The study revealed that Changes in proportions of women with four and above ANC visits highly contributed to changes in proportions of PTB, Similar to finding in China [19]. Adequate ANC visits are recommended for pregnancy monitoring to capture and help in early management of risk factors for adverse pregnant outcomes related such as PROM, preeclampsia, and placenta abnormality. Also during these visits, nutrients supplements can be provided to pregnant women with poor nutrition status. Moreover, reproductive health education can be provided for healthy pregnancy experience. These findings emphasize the need for concerted efforts to increase uptake and quality of ANC services.

Conclusion

The trends in PTB proportions gradually increased in Northern Tanzania from 2000 to 2018. Factors that contribute to the change in PTB proportions are changing with time with ANC visits being the main contributors for changes across the study period. Efforts to increase uptake and quality of ANC services should be strengthened and highly recommended within the country and region.

Abbreviations

ANC	Antenatal Care
KCMC	Kilimanjaro Christian Medical Center
MoHCDGEC	Ministry of Health, Community Development, Gender, Elderly and Children.
PROM	Premature Rupture of Membranes
PTB	Preterm Birth
UNICEF	United Nations International Children's Emergency Fund
WHO	World Health Organization

Declarations

Ethical approval and consent to participate

Ethical approval to carry out the current study was obtained from Kilimanjaro Christian Medical College Research Ethics and Review Committee (KCMU-CREC) with clearance number PG. 011/2019. Interviews for data collection in the Medical Birth Registry were administered just after the woman had given birth and informed consent was given orally to all participants.

Consent for publication

The midwife-nurse gave every woman oral information about the birth registry, the data needed to be collected from them and the use of data for research purposes.

Participation was voluntary and had no implication on the care women would receive. Following consent, mothers were free to refuse to reply to single questions. For privacy and confidentiality, unique identification numbers were used to both identify and then link mothers with child records.

Availability of Data and Materials

All data (Medical Birth registry) and materials concerning this research article are available for sharing if needed. In case needed please contact:

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Competing interests

All authors have no competing interests on the findings of this study

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Authors' contributions

SA – developed the concept, design the methodology, conducted data analysis and wrote the manuscript.

IBM – review the concept, methodology design and data analysis

MAN – conducted data analysis and manuscript writing

MJM – Review the manuscript

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