

Early registration for antenatal care was associated with improved birth outcomes in a low-income community in Harare

Tonderayi Mathew Matsungo (✉ tmatsungo@gmail.com)

University of Zimbabwe <https://orcid.org/0000-0001-9836-7780>

Shingai Mudzuri

University of Zimbabwe

Prosper Chopera

University of Zimbabwe

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TITLE PAGE

Early registration for antenatal care was associated with improved birth outcomes in a low-income community in Harare

Matsungo TM^{1*}, Mudzuri S¹, and Chopera P¹

¹Institute of Food, Nutrition and Family Sciences, Faculty of Science, University of Zimbabwe, P O Box MP 167, Mt Pleasant, Harare, Zimbabwe

*Correspondence: Dr TM Matsungo. Email: tmatsungo@gmail.com

Abstract

Background: The World Health Organization (WHO) recommends early registration, regular and consistent attendance of antenatal care (ANC) sessions for all pregnant women. Specifically, if ANC services promote evidence-based practices this improves pregnancy outcomes and reduce maternal mortality. Yet there are worrying gaps in knowledge of antenatal care services in Zimbabwe. **Objectives:** To determine the relationship between early registration and frequency of ANC visits on birth weight, birth length, head circumference, Apgar score, birth complications, delivery mode, preterm birth and duration of labour among women aged 15-49 from Hatcliffe Polyclinic, Harare. **Methods:** This was a health facility based retrospective cross-sectional study. An interviewer administered questionnaire was used to collect data. Data was entered and analysed using SPSS version 20. Descriptive statistics, and associations between dependent and independent variables were determined using Pearson's Chi-square and Fisher's exact test. Ethical approval was granted from the Medical Research Council of Zimbabwe (MRCZ/B/1438). **Results:** A total of 75 mother child pairs were interviewed. Most (77.3%) had more than four ANC visits. Only 36% registered early (during first trimester). Most of the children had normal birth weight $\geq 2500\text{g}$ (80.3%), birth length $\geq 47\text{cm}$, (76%), head circumference $\geq 33\text{cm}$ (80%), and Apgar score ≥ 7 (96%). A positive association was observed between number of ANC visits and birth weight [Odds ratio (OR) 7.6; 95% Confidence Interval (CI) 1.6, 36.4 ($p=0.013$)], birth length [OR 6.1; 95%CI 1.8, 20.1 ($p=0.010$)], and head circumference [OR 4.3; 95% CI 1.3, 14.8 ($p=0.013$)]. Positive associations were also observed between timing of registration and birth weight [OR 1.2; 95% 1.05, 1.36 ($p=0.045$)], birth length [OR 0.16; 95% CI 0.03, 0.76 ($p=0.012$)]. **Conclusions:** In this study increased frequency and early registration for ANC visits had a positive relationship with birth weight, birth length and head circumference. These findings show the need for improving the uptake of ANC services, early registration for ANC in the first trimester and adoption of community wide strategies to ensure that pregnant women attend all recommended visits for improved birth outcomes in this and related settings.

Keywords: ANC, Prenatal care, Pregnant mothers, low birth weight, stunting, Zimbabwe

Background

Antenatal care (ANC) is one of the core interventions for improving maternal and birth outcomes [1, 2]. According to WHO definition, the components of ANC include: risk identification; prevention and management of pregnancy-related or concurrent diseases; and health education and health promotion in order to ensure the best health conditions for both mother and baby during pregnancy [2]. The overall aim of ANC services is to deliver evidence-based interventions delivered at four critical times during pregnancy [3, 4].

Although, in low- and middle-income countries (LMICs), like Zimbabwe the utilisation of ANC services surged in 2002 due to the introduction of focused ANC, more work needs to be done to address ANC utilisation and quality [2]. This is important considering that the prenatal period is an important component of the 1000 days window of opportunity. The lancet series of 2013 revealed the need for the scaling up of nutrition specific and sensitive interventions including ANC so as to prevent maternal mortality and improve birth outcomes [5, 6]. Early registration and regular access by pregnant mothers to quality ANC services potential to reduce maternal mortality and morbidity in LMIC settings [7]. Therefore, failure by health providers to achieve this often results in rising deaths of mothers during delivery and some poor pregnancy outcomes; preterm birth and low birth weight (LBW) [2, 8]. Nearly 15 million infants worldwide are born preterm each year [9] and over 20 million children worldwide were born with LBW[10]. In 2018 the average proportion of babies born with LBW in Zimbabwe was at 20 percent [11].

ANC services has long been endorsed as a major means to identify and to reduce the risks of pre-term, low-birth weight, and other adverse pregnancy conditions and birth outcomes [2, 12]. However, there is limited evidence on the effectiveness of ANC services in LMICs to inform programme and policy decisions [13]. Zimbabwe adopted the 2002 WHO Focused ANC (FANC) recommendations of at least four ANC visits during a woman's pregnancy, including urine testing for bacteriuria and proteinuria, blood pressure measurement, blood grouping and Rhesus factor, blood testing to detect syphilis, HIV and anaemia and weight and height measurements [14].

However, the 2015 demographic health survey results showed that only 39% had registered or attended ANC session in their first trimester of pregnancy (<4 months), while 76% reported to have had achieved the recommended 4 or more ANC visits [14]. In addition, among women aged 15-49 years who gave birth in period 2010-2015, 93% had received ANC from a skilled

health worker during pregnancy [14]. This shows the need to expand the coverage and utilisation of ANC services in Zimbabwe. Furthermore, we still have worrying gaps in knowledge of antenatal care services in Zimbabwe. Consequently, this study investigated the relationship between frequency and timing of ANC visits and birth outcomes among women aged 15-49 years in Hatcliffe suburb, Harare, Zimbabwe.

Methods

Study design and setting

A facility based retrospective cross-sectional study was conducted at Hatcliffe Polyclinic in Harare, Zimbabwe to establish the relationship between ANC visits and birth outcomes. Hatcliffe suburb is a peri urban low-income community in North East of the capital city Harare. The area has the following geographical coordinates 17° 41' 18" South, 31° 6' 35" East and enjoys subtropical highland climate or temperate oceanic climate with dry winters. Based on the results of the 2012 national census Hatcliffe has an estimated 11 658 households and a population exceeding 45 000 people [15].

Sampling and sample size determination

The sample size consisted of women (n=75) with children below 2 years. This is reflective of the Zimbabwe situation where there is low uptake of postnatal care services (PNC), as mothers tend to disappear from the health system radar soon after giving birth. Convenient sampling method was used to select mothers attending the ANC sessions at the clinic. Mothers always bring the child health cards for ANC visits and this ensured collection of correct information on birth weight, birth length and Apgar score.

Data collection and tools

An interviewer administered questionnaire adapted from the multiple indicator cluster survey (MICS) tool was used to collect data on [16]on the number and timing of ANC visits, type of ANC service provider, content of ANC which include blood pressure measurement, blood and urine samples taken and iron and folate supplementation. Birth outcomes (the child's length, weight, Apgar score and head circumference) were recorded from the child health card.

Definitions and cut-offs

Early registration for ANC was defined in this study as registering within the first 12 weeks of pregnancy and registration after 12 weeks of pregnancy was regarded as late registration based

on WHO guidance [2]. The definitions of normal birth weight ($\geq 2500\text{g}$), length ($\geq 46.9\text{ cm}$) and head circumference ($\geq 32.9\text{ cm}$) were based on standard recommended cut-offs [17]. While, birth complications was defined as presence of any of the following, birth by Caesarean section, longer duration of labour (> 7 hours) and preterm birth (delivery before 37 completed weeks of gestation based on the last self-reported menstrual period) [7]. Adequate ANC visits was based on WHO guidelines, where four or more visits are considered as adequate [2].

Data analysis

Data collected was entered and analysed using SPSS v 25 (IBM Inc). Normality of data was assessed using the Shapiro-Wilk test and visualisations via Q-Q plots. Continuous data was presented as mean \pm standard deviation (SD) while categorical data was presented as frequencies and percentages. Pearson's Chi-square test was used to compare categorical data, when cell counts were less than 5, Fisher's exact test was used instead. Level of significance was set at $P < 0.05$.

Results

Sociodemographic characteristics of participants

A total of 75 mothers of children aged 0-24 months consented to participate in this study. **Table 1** presents a summary of the sociodemographic variables of the participants of the study. The youngest mother interviewed was 18 years old and the oldest was 45 years. Most of the women were married (84%), and most had achieved at least secondary level of education (70%). We observed that 93.2% of the times nurses had attended to the mothers during ANC visits and a smaller number (6.8%) were attended to by a doctor. Similarly, regarding delivery assistance a high proportion (74.7%) had been attended to by a midwife and 21.3% were assisted by a doctor. Most of the women had the basic ANC assessments; blood pressure assessed (74%), urine sample collected to confirm the pregnancy (74%), iron and folate supplementation provided or prescribed (76%). Almost all infants of interviewed mothers had been delivered at a health facility (94%). The mean \pm SD duration of labour was 7.6 ± 4.77 hours and the prevalence of normal delivery was 89.3%. The mean \pm SD birth weight was $2804 \pm 3.96\text{g}$, birth length was $48.44 \pm 3.92\text{ cm}$, head circumference was $33.91 \pm 1.91\text{cm}$.

Table 1: Socio-demographics of study participants

Variable	Frequency (n)	Percentage (%)	
Mother`s age (years):	15–19	5	6.7
	20–34	53	70.6
	35–45	17	22.7
Marital status:	Single	2	2.7
	Married	63	84
	Divorced/ Separated	10	13.4
Education level:	No formal education	2	2.7
	Primary	5	6.7
	Secondary	53	70.7
	Tertiary	15	20
Sex of child:	Boys	36	48
	Girls	39	52
Child`s age in months:	0-6	29	38.7
	7-12	21	28
	13-24	25	33.3
Child`s birth order:	1 st born	21	28
	2 nd to 5 th born	54	72
ANC staff consulted:	Doctor	5	6.8
	Nurse	68	93.2
Blood pressure measured	74	98.6	
Urine sample assessed	74	98.6	
Iron and folate supplementation	57	76	
Tetanus injection	67	89.3	
Birth delivery by:	Doctor	16	21.3
	Nurse	56	74.7
	Relative or friend	3	4
Place of delivery:	Home	4	5.3
	Health facility	71	94.7
Mode of delivery:	Normal	67	89.3
	C-Section	8	10.0
Duration of labour (hrs), mean±SD (n=67)			7.6±4.8
Birth weight (g), mean±SD (n=75)			2804±396
Birth length (cm), mean±SD (n=75)			48.4±3.9
Head circumference (cm), mean±SD (n=75)			33.9±1.9

Relationship between number of ANC visits and birth outcomes

An association was observed between number of ANC visits and birth weight [Odds ratio (OR) 7.6; 95% Confidence Interval (CI) 1.6, 36.4 (p=0.013)], birth length [OR 6.1; 95%CI 1.8, 20.1 (p=0.010)], and head circumference [OR 4.3; 95% CI 1.3, 14.8 (p=0.013)]. There was no relationship between the number of ANC visits and Apgar score (p=0.127) (**Table 2**)

Table 2: Relationship between number of ANC visits on birth weight, length, head circumference and Apgar score

Variable	ANC visits			P-value	OR (95% CI)
	Total n=75	less than 4 n=17 n (%)	4 or more n=58 n (%)		
Birth weight (<2.5kg)	8 (10.6)	5 (42.1)	3 (5.4)		
Normal	67 (80.3)	12 (57.9)	55 (94.6)	0.013*	7.6 (1.6, 36.4)
Birth length (<47cm)	18 (24.0)	9 (57.9)	8 (14.3)		
Normal	57 (76.0)	8 (42.1)	49 (85.7)	0.01*	6.1 (1.8, 20.1)
Head circumference (<33cm)	15 (20)	7 (42.1)	8 (12.5)		
Normal	60 (80)	10 (18.3)	50 (81.7)	0.013*	4.3 (1.3, 14.8)
Apgar Score (<7 points)	3 (4)	2 (10.5)	1 (1.8)		
Normal	72 (96)	15 (89.5)	57 (98.2)	0.127	7.6 (0.6, 89.6)

¹Chi-square test of association was used to obtain P values and Odds ratios except where cell count is <5 Fisher's exact test was used. *P value significant at P<0.05

Early compared to late registration for ANC and birth outcomes

Table 3 presents a summary of the relationship between early compared to late registration for ANC by birth outcomes. The results revealed that there was a significant association between timing of registration and birth weight [OR 1.2; 95% 1.05, 1.36 (p=0.045)], birth length [OR 0.16; 95% CI 0.03, 0.76 (p=0.012)]. While, in the contrary, we observed no significant association between early registration of ANC and infant Apgar score (p=0.293).

Table 3: Relationship of early vs. late registration for ANC with the birth outcomes

Variable	Total n=75, n (%)	Registration for ANC		P- value	OR (95% CI)
		Before 1 st trimester n=27 (36)	After 1 st trimester n=48 (64)		
Birth weight (<2.5kg)	8 (10.6)	0	8	0.045*	1.2 (1.05, 1.36)
Normal	67 (80.3)	27	40		
Birth length (<47cm)	18 (24.0)	2	16	0.012*	0.16 (0.03, 0.76)
Normal	57 (76.0)	25	32		
Head circumference (<33cm)	15 (20)	2	13	0.070	0.2 (0.04, 1.04)
Normal	60 (80)	25	35		
Apgar Score (<7 points)	3 (4)	2	1	0.293	3.7 (0.32, 43.5)
Normal	72 (96)	25	47		

¹Fisher's test of association was used to obtain P values and Odds ratios. *P value significant at P<0.05

Discussion

This study sought to investigate the relationship between frequency and timing of ANC visits with birth weight, birth length, head circumference, Apgar score, birth complications, delivery mode, preterm birth and duration of labour in women aged 15-49 at Hatcliffe Polyclinic, Harare. In this study increased frequency and early registration of ANC visits had a significant relationship with birth weight and length. Only for head circumference was the relationship significant for number of ANC visits. Similarly a study conducted to identify a broad range of interventions that positively affect pregnancy outcomes and reduce infant mortality found that increased frequency and proper timing of ANC visits were found to be effective in producing positive birth outcomes [18]. Other studies have come to the same conclusion that ANC visits are an instrumental factor in improving birth outcomes [19, 20].

In this study, early registration for ANC had a positive relationship with the birth weight. Our findings agree with a study from Uruguay that also showed that early registration had a positive relationship with the birth weight [21]. Likewise, having the first ANC visit during the first trimester was found to improve birth weight by 304 grams [19]. From these results, promotions to encourage mothers to register early for ANC will be useful so as to reduce the risk of LBW babies.

From this study, there was no relationship between the number of ANC visits and the Apgar score of the newborn. In the contrary, a study by colleagues from Grand Valley State University in Michigan, USA in 1999 that examined the relationship between the number of ANC visits and infant Apgar scores found a positive relationship between ANC visits and infant Apgar scores [22]. This difference with our results could not be due to different sample sizes, were the latter assessed 90 women whilst we had a sample size of 75 women. It may be reflective of the differences in the quality of care in our low income vs. the high income setting in America. The use of the Kessner's index [23] to evaluate the adequacy of prenatal care is recommended for future studies.

Despite the different sample sizes our results are similar to the study conducted in Nigeria which examined the role of ANC on small size at birth based on the 2003 Nigeria Demographic and Health Survey data [24]. The Nigerian study found that ANC visits were associated with lesser chances of giving birth to small sized babies [24]. Although only 10.6% of children in our study had low birth weight, community awareness campaigns are recommended as strategy to prevent adverse birth outcomes in line with the World Health Assembly (WHA) target to achieve a 30% reduction in low birth weight in communities by 2025 [25].

Birth complications used in this study were delivery by C-section, preterm birth and longer duration of labour. Our study found that ANC visits had a positive relationship with the birth outcomes but no relationship with the birth complications. This is similar to a study which concluded that ANC visits improved birth weight although they failed to reduce the possibility of preterm birth in the urban areas [10]. It can be assumed that birth complications are due to many other factors beyond ANC visits.

A study that explored parent-offspring data from the Medical Birth Registry of Norway (MBRN) to investigate the genetic and environmental influences on birth weight, birth length, head circumference, and gestational concluded that 50% of the variation in birth weight, birth length, and head circumference may be explained by genetic factors [26]. These Norwegian investigators also reported that an increase in maternal age was associated with birth complications such as prolonged labour [26].

In our study, most women received care from certified nurses and the mean duration of labour was found to be 7.6 hours. This is comparable to a study conducted in nine hospital settings in

the USA in 1996 among women who received care from certified nurse-midwives found that the mean length of labour was 7.7 hours [27]. Our study had some limitations. It was facility based therefore only capturing women with health seeking behavior and ignoring those who may have delivered in the households. This could have had influenced the seemingly low sample size, considering that normally mothers fail to come for postnatal care services (PNC) after giving birth. Furthermore, we may have underestimated the negative birth outcomes and complications as most women are quickly referred to referral hospitals or private institutions and after delivery may continue with growth monitoring activities at the same place. Although our study was localized in an urban setting hence findings may not be representative to those in rural areas and those in urban areas who seek services in the private sector, this was a low resource area and findings may be comparable to other low resource settings and the urban poor. These findings can be used to design appropriate messages for awareness campaigns aimed at to improving ANC attendance in similar settings.

Conclusions

In this study increased frequency and early registration for ANC visits had a positive relationship with birth weight, birth length and head circumference. These findings show the need for improving the uptake of ANC services, early registration for ANC in the first trimester and adoption of community wide strategies to ensure that pregnant women attend all recommended visits for improved birth outcomes in this and related settings. Therefore, nutrition and health education programmes targeting all women of childbearing age are warranted.

Abbreviations

ANC – Antenatal care

CI – Confidence Interval

LBW - Low Birth Weight

LMICs - Low-and middle-income countries

OR -Odds Ratio

SD -Standard Deviation

Declaration

Ethics approval and consent to participate

The study was conducted in agreement with the Helsinki Declaration, and approved by the Hatcliffe Polyclinic Administrator management. Ethical approval was granted by the Medical

Research Council of Zimbabwe (MRCZ/B/1438). Written informed consent was obtained from the study participants and for participants below 16 years old, after they had assented written informed consent was obtained from a parent or legal guardian.

Consent for publication

No previously published material has been used in this study.

Availability of data and material

The anonymised datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests. All authors declare no competing interests.

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Author' contributions

TM and SM designed the study and wrote the initial draft. PC contributed to data analysis and subsequently reviewed manuscript drafts. All authors read and approved the final manuscript.

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