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Abstract

Postnatal care (PNC) is critical for the survival of newborns. In Zambia, despite emphasis on PNC by the government and international organizations, PNC coverage continues to be low. This study assessed the demographic and socioeconomic factors associated with newborns' receipt of PNC and the timing of first PNC in Zambia. Based on data from the 2013-14 Zambia Demographic and Health Survey (ZDHS), this study used bivariate, binary, and multinomial logistic regression analyses to examine PNC for births at home and at health facilities. The results indicate different factors associated with PNC and timing at which newborns receive their first PNC between births delivered at home and at health facilities. For home births, perceived child size at birth by mothers, region of residence, access or exposure to media, and mothers' numbers of ANC visits are the major determinants of PNC. Regarding timing of first PNC within 2 days of childbirth, among newborns delivered at home the major determinants are perceived child size at birth by mothers, region of residence, mothers' access to media, and number of ANC visits. In contrast, among newborns delivered in a facility, perceived size at birth, region of residence, and mothers' employment status are the only factors associated with receiving PNC within the first 2 days. Therefore, recommendation is made to encourage delivery in a health facility, to emphasize the importance of ANC visits, and to disseminate information through various media and innovative programs such as Information Education and Communication (IEC).

Key words: *Postnatal care, timing of first postnatal checkup, newborn, demographic and socioeconomic factors, home births, facility births, Zambia*

1. Introduction

Worldwide, more than one million babies each year die on their first day of life. The day of birth is the most dangerous day for babies in nearly every country (Save the Children 2013; Singh et al. 2012; Sines et al. 2007). Almost all newborn deaths are in developing countries, with the highest number in South Asia, and the highest mortality rates in sub-Saharan Africa (Save the Children 2013). Most newborn deaths in sub-Saharan Africa occur among children delivered at home or elsewhere outside of a health facility (Sines et al. 2007). Studies have shown that neonatal deaths stem from poor maternal health, inadequate care during pregnancy, inappropriate management of complications during pregnancy and after delivery, poor hygiene during delivery and the first critical hours after birth, and lack of newborn care (Lukonga and Michelo 2015; Barbra 1997).

Studies also show that most of the factors that lead to neonatal deaths could be averted through postnatal checkups (Kearns et al. 2014; Ghosh and Sharma 2010; Titaley et al. 2008). Postnatal care (PNC) is defined as the care given to the newborn baby immediately after birth (within 24 hours) and for the first 6 weeks (42 days) of life, with the aim of ensuring optimum health for the newborn (WHO et al. 2015; Akunga et al. 2014; WHO 2001b, 2013, Save the Children 2007). The care received in PNC includes monitoring for danger signs in the newborn's breathing, temperature, breastfeeding, and movement as well as counselling the mother about health, nutrition, and healthy lifestyle practices (Kante et al., 2015; UNICEF, 2015; Sines et al., 2007).

Based on the World Health Organisation (WHO) recommendation, after an uncomplicated vaginal birth in a health facility, healthy newborns should receive care in the facility for at least 24 hours after birth. If the birth is at home, the first postnatal contact should be as early as possible within 24 hours of birth. Regardless of place of delivery, at least three additional postnatal contacts are recommended for all mothers and newborns, on day 3 (48–72 hours), between days 7 and 14, and 6 weeks after birth (WH, 2013). However, less than a quarter of newborns in less developed countries receive PNC within 2 days of delivery (UNICEF 2015; Sines et al. 2007).

The 2013-14 Zambia Demographic Health Survey (ZDHS) shows some improvement in the survival rates of infants and of children under age 5 in recent years. Statistics show that the under-five mortality rate dropped from 128 deaths per 1,000 live births in 2003 to 75 deaths per 1,000 live births in 2013-14, and infant mortality declined from 76 deaths per 1,000 live births in 2003 to 45 deaths per 1,000 live births in 2013-14. Despite such improvements, there have been only marginal improvements in neonatal mortality (NNM) in the past 10 to 15 years, from 29 deaths per 1,000 live births between 1999 and 2003 to 24 deaths per 1,000 live births between 2009 and 2013. This scenario may be explained in part by the low level of PNC (16%). Moreover, new births delivered at home or elsewhere outside of a health facility are even less likely to receive PNC

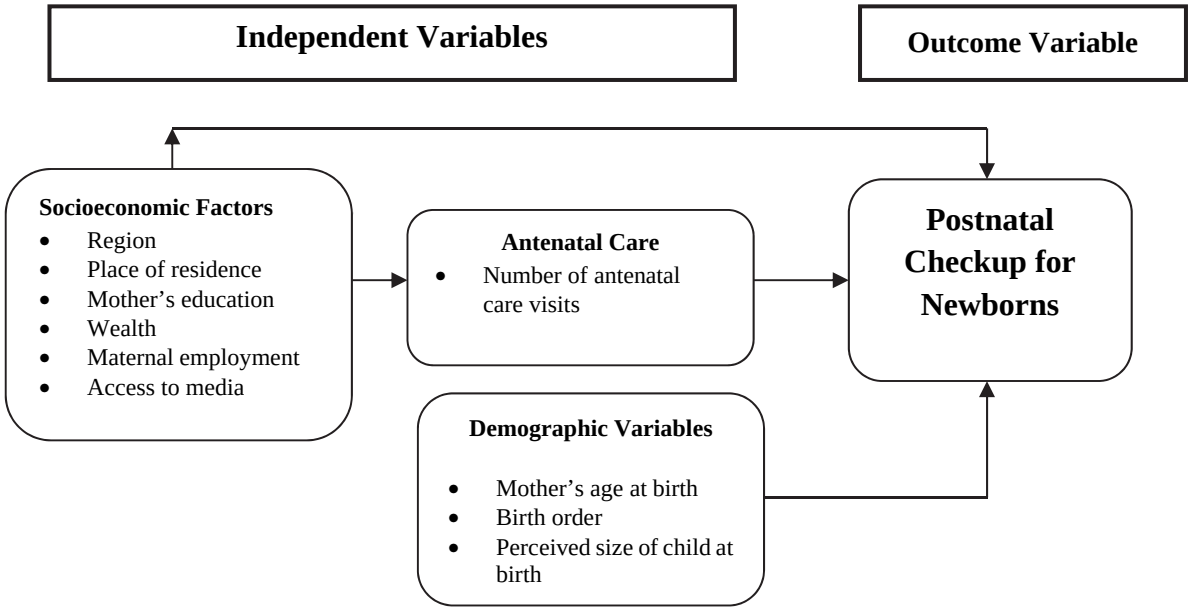
within the first 2 days (8%) than those delivered in a health facility (19%) (CSO et al., 2014). This is despite the fact that the Government of the Republic of Zambia through the Ministry of Health (MoH) and Ministry of Community Development Mother and Child Health (MCDMCH) and other cooperating partners have developed and put in place various policies, programs, and interventions aimed at improving the general welfare and health of children.

Some of the policies that have been implemented or are still underway include: Expanded Programme on Immunisation (EPI), Integrated Management of Childhood Illnesses (IMCI), scaling up and sustaining high-impact nutrition interventions, including early initiation of breastfeeding, among others (MoH 2011). All these programs aim at reducing the persistent high levels of neonatal and postneonatal mortality in Zambia.

In Zambia, studies based on nationally representative surveys like the ZDHS that are related to PNC among newborns are scarce. This is because data on PNC among newborns had never been collected until recently during the 2013-14 ZDHS. Despite this dearth in empirical literature in Zambia, studies in other countries have shown that, regardless of whether delivery was at home or in a health facility, several factors contribute to low levels of PNC, including mother's age at birth (Kante et al. 2015), perceived size at birth (Sines et al. 2007; Titaley et al. 2009), maternal education (Kante 2015; Kearns et al. 2014), household wealth (Rwabufigiri 2016; Kante 2015; Kearns et al. 2014; Titaley et al. 2009), maternal employment status (Kante et al. 2015), geographic distance, such as household distance to a health facility (Kearns et al. 2014; Titaley et al. 2009), place of delivery, lack of antenatal care, and place of residence, among others (Dutoma et al. 2015; Kearns et al., 2014; Banda 2013; Bhattacherjee et al. 2013; Singh et al. 2012; Titaley et al. 2009).

To increase coverage of PNC in Zambia, a better understanding of its associated factors is important. The objectives of this study were twofold: first, to assess the demographic and socioeconomic factors associated with any PNC for newborns and, second, to examine the demographic and socioeconomic factors associated with the timing of the first PNC. It is envisaged that an understanding of such factors may help develop necessary strategies and interventions to help improve PNC coverage and in turn improve neonatal survival in Zambia.

1.1. Conceptual Framework



The above conceptual framework shows the linkages expected between postnatal checkup for newborns and demographic, socioeconomic, and antenatal care factors. The variables used in this conceptual framework were based on the empirical evidence from other similar studies and also their availability in the 2013-14 ZDHS. As the framework indicates, there could be direct links between socioeconomic factors and postnatal checkups for newborns. For instance, region and place of residence (urban or rural) are important factors as they may affect PNC coverage in that urban residents tend to have higher PNC coverage, as more health facilities are available in urban than rural areas. Mothers' educational level, wealth, and employment status could be positively associated with newborns receiving PNC. Mothers with more education, wealth, and employment may have better understanding of the importance of PNC to their newborn's survival. This, coupled with better access to media, may broaden women's knowledge of how access to PNC can improve the health status and survival of newborn children.

Further, demographic variables may also have some influence on a child's receiving PNC. For example, first-order births and newborns whose mothers made the recommended four or more ANC visits may be more likely to receive PNC.

2. Data and Methods

2.1. Data

This study used data for women from the 2013-14 ZDHS to assess the demographic and socioeconomic factors associated with postnatal care for newborns. The ZDHS used a two-stage cluster sampling method. In the first stage, 722 enumeration areas (EAs)—305 in urban areas and 417 in rural areas—were selected with probability proportional to SEA size. In the second stage, a complete list of households served as the sampling frame in the selection of households for enumeration. On average, 25 households were randomly selected in each cluster. All women age 15-49 in the household were eligible to be interviewed. Women were asked to provide information about pregnancies resulting in a live birth during the 5 years preceding the interview. Data on postnatal care was collected for the most recent birth during that period.

In the 722 selected clusters, 16,258 households were occupied at the time of data collection of which 15,920 were successfully interviewed, yielding a household response rate of 98%. In total, 16,411 women were successfully interviewed. This analysis concentrated on the postnatal care received for the woman's most recent birth in the 5 years preceding the survey. Among the most recent births, 514 caesarean births were excluded from the analysis sample because these births were likely to have received PNC regardless of the mothers' demographic and socioeconomic characteristics. The final sample included 4,777 births, with 1,361 delivered at home and 3,416 delivered in a health facility.

2.2. Outcome and Explanatory Variables Used in the Analysis

In the DHS Woman's Questionnaire, all women who had a birth in the 5 years preceding the survey were asked this question about their most recent birth: *"How long after delivery did the first check take place for last birth?"* Responses to this question were used to construct the two outcome variables for this study. These variables are any postnatal checkup within 6 weeks after delivery (0 = No PNC; and 1=Yes any PNC) and timing of first PNC (0 = no checkup, 1 = less 2 days, and 2 = 2 or more days. The categorization of timing was done in this way because most neonatal deaths usually occur within the 48 hours after the child's birth (UNICEF 2009). The rationale behind using the two measures was based on the fact that not only is receiving any PNC cardinal but also receiving it within the most critical period (within 48 hours) can increase the chances of survival for the newborn.

Demographic variables included in the model were mother's age at the last birth (under age 20, 20-34, and 35-49), birth order (1st, 2nd, 3rd, and 4th or higher), and mother's perception of the size of the child (small, average, or large).

Among the socioeconomic factors, we examined mother's employment status (whether currently working or not), education attainment (none, primary, and secondary or higher), and household wealth status. The DHS wealth quintiles were grouped into a three-category wealth status variable (poor, middle, and wealthy) by combining the top 40% and the bottom 40% of the population. Media access was constructed on a combination of three variables (frequency of reading newspapers or magazines, listening to radio, and watching television). A mother is considered to have access to mass media if she watches TV, listens to radio, or reads a newspaper. Receipt of antenatal care was measured with the number of ANC visits the mother made for the last birth (0 = less than four, 1 = four or more).

2.3. Statistical Analysis

Separate analysis was conducted for home deliveries and facility deliveries because the factors that influence PNC for newborns delivered at home may be different from those for newborns delivered in a health facility (Fadel et al. 2015; Mohan et al. 2015; Sines et al. 2007).

Descriptive statistics (both univariate and bivariate) were used to describe the overall coverage of PNC and timing of PNC, and by demographic and socioeconomic variables, as well as by the number of ANC visits received.

To assess the adjusted associations between the independent variables and receipt of any PNC for newborns, two models were fitted, one for newborns delivered at home and the other for those delivered in a health facility. Odds ratios with 95%, 99%, and 99.9% confidence intervals were reported.

In addition, two multinomial regression models were used to assess the association between timing of the first PNC and the identified correlates, stratifying by place of delivery. In both models, "never received any PNC" was the reference category. All the estimates were weighted to reflect the population. The effect of the complex multistage sampling design that was used in the 2013-14 ZDHS was considered. Data were analyzed using STATA 13.0 software.

3. Results

3.1. Description of the Analysis Sample

Table 1 describes births included in the analysis by mother's characteristics. For both home and facility births, about two-thirds of the mothers were age 20-34 at the time of birth. Newborns delivered at home had a higher proportion of 4th order births (60%) than newborns delivered in a health facility (40%). Less than two-thirds of newborns were perceived by their mothers to have average size at birth (61% delivered at home and 57% delivered in a facility).

By geographic distribution, a larger share of home births took place in Central and Southern regions (18% and 19%), while Eastern, Copperbelt, and Lusaka regions had a larger share of facility births (14%, 15%, and 19%). Nine in every 10 home deliveries were in rural areas (91%) compared with about 6 in every 10 deliveries in a health facility (58%). A majority of mothers had primary education, whether they delivered at home or in a health facility (66% and 50%). Among newborns delivered at home, more than two-thirds were in poor households, while among those delivered at a health facility, poor and rich households accounted for about 40% each. Sixty-three percent of mothers of newborns delivered at home were employed at the time of the survey, as were 53% of mothers of newborns delivered in a health facility. Nearly three-fourths (73%) of the mothers of newborns delivered in a health facility had access to media compared with about half (54%) of mothers of newborns delivered at home.

Overall, more than half (53%) of the mothers of the newborns had four or more ANC visits. Disaggregated by place of delivery, 55% of mothers of newborns delivered in a health facility had four or more ANC visits compared with 46% among those delivered at home.

Table 1: Percent distribution of the sample by demographic, socioeconomic, antenatal care services according to place of delivery, 2013-14 ZDHS

	Home		Facility		Total	
Variable	**%**	**n**	**%**	**n**	**%**	**n**
Mother's Age at Birth						
<20	13.4	183	20.3	694	18.3	877
20-34	66.0	899	66.9	2,286	66.7	3,187
35+	20.6	280	12.8	436	15.0	715
Birth Order						
1st	10.5	143	25.2	860	21.0	1,003
2nd	15.3	208	18.7	640	17.7	847
3rd	14.6	199	16.4	561	15.9	761
4th or more	59.6	811	39.7	1,355	45.4	2,168
Perceived Size at Birth						
Small	13.8	188	9.8	336	11.0	524
Average	60.7	827	57.0	1,946	58.0	2,772
Large	25.5	347	33.2	1,134	31.0	1,483
Region						
Central	18.2	248	7.3	248	10.4	496
Copperbelt	6.5	88	14.9	508	12.5	596
Eastern	10.1	138	13.8	472	12.8	610
Luapula	9.0	123	9.1	310	9.0	432
Lusaka	3.2	44	18.9	646	14.4	689
Muchinga	7.0	95	5.7	196	6.1	291
Northern	14.5	197	6.9	236	9.1	434
North Western	3.7	50	5.4	184	4.9	234
Southern	18.7	255	12.0	410	14.0	667
Western	9.0	123	6.0	206	6.9	329
Type of Place of Residence						
Urban	9.5	130	42.3	1,445	33.0	1,575
Rural	90.5	1,231	57.7	1,971	67.0	3,204
Highest Educational Level						
None	16.7	227	8.5	290	10.8	517
Primary	65.9	895	50.1	1,711	54.6	2,608
Secondary+	17.3	235	41.4	1,415	34.6	1,650
Wealth Index						
Poor	69.5	946	39.7	1,355	48.2	2,304
Middle	21.7	296	20.3	695	20.7	990
Rich	8.8	119	40.0	1,365	31.1	1,485
Mother's Employment Status						
Unemployed	37.1	504	46.8	1,593	44.0	2,099
Employed	62.9	854	53.2	1,813	56.0	2,667
Media Access						
No access	45.8	623	27.1	925	32.4	1,550
Access to media	54.2	739	72.9	2,491	67.6	3,229
Number of ANC visits						
<4	54.1	736	44.6	1,523	47.3	2,261
4+	45.9	625	55.4	1,893	52.7	2,518
Total	**100**	**1,361**	**100**	**3,416**	**100**	**4,777**

3.2. Coverage of Postnatal Care and Timing of the First PNC for Newborns

Figure 1 shows the percentage of newborns who received PNC after birth by place of delivery. Overall, 45% of the newborns received PNC after birth. Disaggregated by place of delivery, 58% of newborns delivered in a health facility received PNC compared with less than half (48%) of newborns delivered at home.

Figure 1: Percentage of newborns who received any postnatal care, by place of delivery

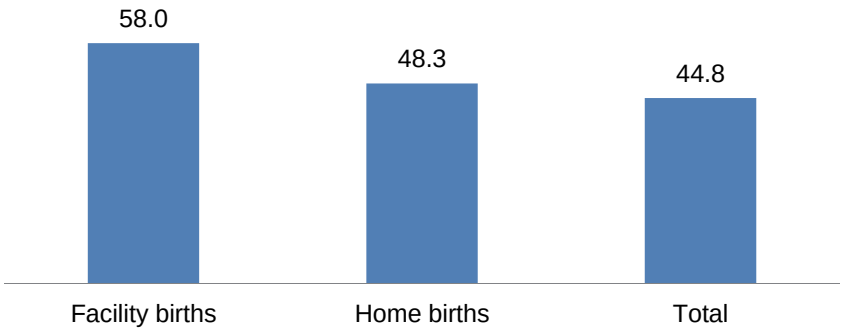
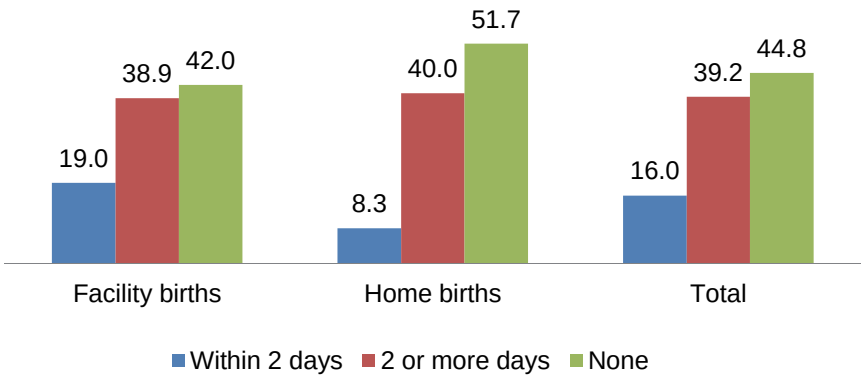


Figure 2 shows the percent distribution of timing of first PNC after birth by place of delivery. Overall, only 16% of newborns received their first PNC within the first 2 days. Among newborns delivered in a health facility, 19% received their first PNC within the first 2 days compared with 8% among newborns delivered at home.

Figure 2: Percent distribution of newborns by timing of the first postnatal checkup



3.3. Bivariate Analysis Results of Postnatal Care for Newborns

Table 2 shows the percentage of newborns who received PNC after birth according to demographic and socioeconomic characteristics. Overall among newborns, PNC coverage varied significantly across geographic regions for both home and facility deliveries.

Similarly, PNC coverage varied significantly across place of residence, with newborns delivered at health facilities in rural areas less likely to receive PNC than newborns delivered at health facilities in urban areas (55% versus 62%). In addition, PNC coverage varied significantly by whether mothers of newborns had access to media. Among newborns whose mothers had access to media, a higher proportion received PNC compared with newborns whose mothers did not have access to media—at 53% versus 42% for home deliveries and 60% versus 53% for deliveries in a health facility.

Table 2: Percentage of newborns who received any postnatal checkups after birth, according to demographic and socioeconomic characteristics by place of delivery, 2013-14 ZDHS

	Home births			Facility births		
Variable	**%**	**CI**	**p-values**	**%**	**CI**	**p-values**
Mother's Age at birth						
<20	42.4	[34.3,50.9]		56.2	[51.3,61.0]	
20-34	49.7	[45.8,53.5]	0.266	58.9	[55.7,62.1]	0.422
35+	47.7	[40.8,54.6]		55.8	[49.6,61.8]	
Birth Order						
1st	49.2	[40.5,57.9]		58.0	[53.5,62.5]	
2nd	45.4	[37.6,53.4]	0.879	58.9	[53.6,63.9]	0.968
3rd	49.4	[41.7,57.1]		58.1	[52.7,63.3]	
4th or more	48.6	[44.0,53.2]		57.5	[53.6,61.2]	
Perceived Size at Birth						
Small	42.6	[35.0,50.6]		57.4	[51.3,63.3]	
Average	50.6	[45.8,55.3]	0.195	57.8	[54.5,61.1]	0.946
Large	45.9	[39.4,52.5]		58.4	[53.8,62.9]	
Province						
Central	69.9	[60.9,77.6]		75.0	[67.0,81.7]	
Copperbelt	50.7	[37.1,64.2]		55.8	[47.4,63.9]	
Eastern	58.9	[47.7,69.1]		62.2	[55.7,68.3]	
Luapula	29.0	[21.1,38.4]		44.4	[37.8,51.2]	
Lusaka	61.5	[44.6,76.1]	**<0.001**	71.0	[62.1,78.5]	**<0.001**
Muchinga	50.8	[40.3,61.3]		72.5	[65.8,78.2]	
Northern	67.9	[60.2,74.8]		69.8	[61.8,76.8]	
North Western	62.2	[51.0,72.3]		63.0	[55.6,69.8]	
Southern	11.7	[7.6,17.5]		12.7	[8.9,17.9]	
Western	42.2	[33.2,51.8]		71.0	[62.8,78.1]	
Type of Residence						
Urban	56.7	[47.9,65.1]	0.054	62.0	[56.9,66.8]	**0.027**
Rural	47.4	[43.7,51.1]		55.0	[51.6,58.4]	
Highest Educational Level						
None	48.0	[40.8,55.3]		61.1	[54.4,67.3]	
Primary	47.2	[42.9,51.6]	0.428	59.1	[55.7,62.5]	0.259
Secondary +	52.6	[45.5,59.6]		55.9	[51.5,60.3]	
Wealth Index						
Poor	47.7	[43.7,51.7]		56.4	[52.9,59.9]	
Middle	50.8	[43.1,58.4]	0.710	55.9	[50.7,61.0]	0.244
Rich	46.6	[36.9,56.6]		60.6	[55.4,65.5]	
Womens Employment Status						
Unemployed	49.3	[43.1,55.5]	0.662	59.3	[55.0,63.4]	0.342
Employed	47.5	[43.1,52.0]		56.9	[53.5,60.3]	
Media Exposure						
No access	42.2	[37.3,47.2]	**0.002**	53.3	[49.2,57.3]	**0.009**
Access to media	53.4	[48.7,58.0]		59.7	[56.2,63.1]	
ANC visits						
<4	45.6	[41.2,50.0]	0.060	57.8	[54.2,61.4]	0.912
4+	51.4	[46.7,56.2]		58.1	[54.5,61.6]	
Total	**48.3**	**[44.8,51.7]**		**58.0**	**[55.1,60.8]**	

3.4. Bivariate Analysis Results of Timing of the First Postnatal Checkups

Table 3 shows the percentage of newborns by timing of first PNC according to demographic and socioeconomic characteristics. Among home deliveries, Copperbelt region had the highest proportion of newborns who received their first PNC within 2 days (20%), while Northern region had the lowest (2%). Among facility deliveries, Eastern region had the highest proportion of newborns who received their first PNC within 2 days (32%), while North Western region had the lowest (3%).

In addition, among newborns delivered at home, the proportion receiving their first PNC within 2 days after birth was twice as high in urban areas as in rural areas (15% versus 8%). For facility deliveries, newborns in urban areas had a slightly higher proportion receiving their first PNC within 2 days compared with those in rural areas (41% versus 38%).

Among home deliveries, a lower proportion of newborns of mothers with a primary education received their first PNC within 2 days of delivery compared with those newborns of mothers with secondary or more education (7% versus 15%). Among newborns delivered at home, the proportion receiving first PNC within 2 days increased as household wealth increased. Newborns in households classified as rich had twice as high a proportion receiving their first PNC within the first 2 days as newborns in poor households (14% versus 7%).

Also among home deliveries, newborns whose mothers had access to media had about twice the proportions with first PNC within 2 days compared with newborns whose mothers had no access to media (11% vs. 6%). Likewise, among newborns delivered in a health facility, those whose mothers had access to media were more likely to receive their first PNC within 2 days compared with newborns whose mothers did not have access to media (20% versus 17%).

Table 3: Percent distribution of newborns delivered at home and in a health facility by timing of the postnatal checkups according to demographic and socioeconomic characteristics, 2013-14 ZDHS

	Home births							Facility births						
	None		PNC within 2 days		PNC ≥2 days			None		PNC within 2 days		PNC ≥2 days		
Variable	**%**	**CI**	**%**	**CI**	**%**	**CI**	**p-value**	**%**	**CI**	**%**	**CI**	**%**	**CI**	**p-value**
Mother's age at birth														
<20	57.6	[49.1,65.7]	5.8	[3.2,10.2]	36.6	[28.8,45.1]		43.8	[39.0,48.7]	18.7	[15.3,22.8]	37.5	[33.1,42.1]	
20-34	50.3	[46.5,54.2]	9.3	[7.3,11.8]	40.4	[36.8,44.0]	0.314	41.1	[37.9,44.3]	19.5	[17.4,21.9]	39.4	[36.4,42.5]	0.687
35+	52.3	[45.4,59.2]	6.6	[4.0,10.8]	41.0	[34.7,47.7]		44.2	[38.2,50.4]	17.0	[13.1,22.0]	38.8	[33.0,44.9]	
Birth Order														
1st	50.8	[42.1,59.5]	10.4	[5.9,17.7]	38.8	[30.7,47.5]		42.0	[37.5,46.5]	21.4	[17.9,25.3]	36.7	[32.6,40.9]	
2nd	54.6	[46.6,62.4]	6.4	[3.6,11.2]	39.0	[31.4,47.1]	0.922	41.1	[36.1,46.4]	19.9	[16.4,24.0]	38.9	[34.0,44.1]	0.628
3rd	50.6	[42.9,58.3]	9.2	[5.7,14.6]	40.2	[33.0,47.8]		41.9	[36.7,47.3]	17.5	[13.6,22.3]	40.6	[35.1,46.3]	
4th or more	51.4	[46.8,56.0]	8.1	[6.3,10.5]	40.4	[36.1,44.9]		42.5	[38.8,46.4]	17.8	[15.3,20.6]	39.7	[36.2,43.2]	
Perceived Size at Birth														
Small	57.4	[49.4,65.0]	5.3	[2.6,10.5]	37.3	[29.9,45.3]		42.6	[36.7,48.7]	25.8	[20.2,32.3]	31.6	[26.1,37.8]	
Average	49.4	[44.7,54.2]	9.0	[6.9,11.6]	41.6	[37.3,46.0]	0.358	42.2	[38.9,45.5]	17.8	[15.5,20.5]	40.0	[36.9,43.1]	0.076
Large	54.1	[47.5,60.6]	8.1	[5.4,12.1]	37.8	[31.9,44.0]		41.6	[37.1,46.2]	19.1	[15.8,22.9]	39.3	[34.7,44.1]	
Province														
Central	30.1	[22.4,39.1]	16.0	[11.3,22.2]	53.9	[46.2,61.4]		25.0	[18.3,33.0]	27.9	[19.3,38.6]	47.1	[33.7,61.0]	
Copperbelt	49.3	[35.8,62.9]	19.5	[11.7,30.8]	31.2	[19.9,45.4]		44.2	[36.1,52.6]	25.5	[19.3,32.9]	30.3	[24.0,37.3]	
Eastern	41.1	[30.9,52.3]	18.3	[11.4,27.9]	40.6	[31.0,50.9]		37.8	[31.7,44.3]	31.7	[26.9,37.0]	30.5	[24.8,36.8]	
Luapula	71.0	[61.6,78.9]	2.2	[0.6,7.7]	26.8	[19.5,35.6]		55.6	[48.8,62.2]	5.1	[2.9,8.8]	39.3	[33.1,46.0]	
Lusaka	38.5	[23.9,55.4]	10.0	[2.8,30.1]	51.6	[35.9,66.9]		29.0	[21.5,37.9]	22.2	[16.8,28.6]	48.8	[41.2,56.4]	
Muchinga	49.2	[38.7,59.7]	3.1	[1.2,8.1]	47.7	[37.1,58.5]	**<0.001**	27.5	[21.8,34.2]	16.4	[9.5,26.7]	56.1	[45.3,66.3]	**<0.001**
Northern	32.1	[25.2,39.8]	1.7	[0.6,4.4]	66.3	[58.3,73.4]		30.2	[23.2,38.2]	18.0	[12.3,25.5]	51.8	[44.0,59.6]	
North Western	37.8	[27.7,49.0]	12.8	[7.6,20.8]	49.4	[39.3,59.5]		37.0	[30.2,44.4]	2.9	[1.6,5.3]	60.0	[52.6,67.0]	
Southern	88.3	[82.5,92.4]	1.8	[0.7,4.9]	9.9	[6.0,15.7]		87.3	[82.1,91.1]	5.0	[2.6,9.2]	7.8	[4.8,12.3]	
Western	57.8	[48.2,66.8]	5.1	[2.3,10.9]	37.2	[27.7,47.7]		29.0	[21.9,37.2]	20.7	[15.6,26.8]	50.4	[43.0,57.6]	
Type of Residence														
Urban	43.3	[34.9,52.1]	15.0	[8.9,24.1]	41.7	[33.7,50.2]	**0.019**	38.0	[33.2,43.1]	21.2	[17.8,25.1]	40.7	[36.3,45.3]	**0.046**
Rural	52.6	[48.9,56.3]	7.6	[6.0,9.5]	39.8	[36.4,43.3]		45.0	[41.6,48.4]	17.5	[15.2,20.0]	37.6	[34.3,41.0]	
Highest Educational Level														
None	52.0	[44.7,59.2]	8.2	[5.0,13.2]	39.8	[32.5,47.7]		38.9	[32.7,45.6]	23.8	[18.4,30.2]	37.3	[30.9,44.2]	
Primary	52.8	[48.4,57.1]	6.6	[5.0,8.7]	40.7	[36.6,44.8]	**0.011**	40.9	[37.5,44.3]	17.9	[15.7,20.3]	41.2	[37.9,44.7]	0.091
Secondary +	47.4	[40.4,54.5]	14.9	[10.5,20.7]	37.6	[30.8,45.0]		44.1	[39.7,48.5]	19.5	[16.6,22.8]	36.4	[32.9,40.1]	

(Continues…)

Table 3—*Continued*

	Home births							Facility births						
	None		PNC within 2 days		PNC ≥2 days			None		PNC within 2 days		PNC ≥2 days		
Variable	**%**	**CI**	**%**	**CI**	**%**	**CI**	**p-value**	**%**	**CI**	**%**	**CI**	**%**	**CI**	**p-value**
Wealth Index														
Poor	52.3	[48.3,56.3]	6.5	[5.0,8.5]	41.1	[37.4,45.0]		43.6	[40.1,47.1]	17.2	[14.8,20.0]	39.2	[35.8,42.7]	
Middle	49.2	[41.6,56.9]	11.6	[8.0,16.5]	39.2	[32.4,46.5]	**0.037**	44.1	[39.0,49.3]	18.7	[15.1,22.8]	37.2	[32.2,42.5]	0.323
Rich	53.4	[43.4,63.1]	13.9	[7.8,23.4]	32.8	[24.7,42.0]		39.4	[34.5,44.6]	21.0	[17.6,25.0]	39.5	[35.2,44.0]	
Women's Employment Status														
Unemployed	50.7	[44.5,56.9]	10.9	[8.0,14.6]	38.4	[33.1,44.0]	0.142	40.7	[36.6,45.0]	18.3	[15.7,21.3]	41.0	[37.1,44.9]	0.270
Employed	52.5	[48.0,56.9]	6.8	[5.1,9.0]	40.7	[36.4,45.2]		43.1	[39.7,46.5]	19.7	[17.2,22.5]	37.2	[34.0,40.5]	
Media Access														
No access	57.8	[52.8,62.7]	5.5	[3.8,7.9]	36.7	[32.1,41.7]	**0.001**	46.7	[42.7,50.8]	16.5	[13.6,19.8]	36.8	[33.0,40.9]	**0.020**
Access to media	46.6	[42.0,51.3]	10.6	[8.3,13.5]	42.7	[38.4,47.2]		40.3	[36.9,43.8]	20.0	[17.7,22.5]	39.7	[36.6,42.9]	
ANC visits														
<4	54.4	[50.0,58.8]	7.2	[5.2,10.0]	38.3	[34.2,42.6]	0.135	42.2	[38.6,45.8]	18.6	[16.1,21.4]	39.3	[35.8,42.9]	0.878
4+	48.6	[43.8,53.3]	9.5	[7.3,12.2]	41.9	[37.4,46.6]		41.9	[38.4,45.5]	19.4	[16.9,22.3]	38.6	[35.4,42.0]	
Total	**51.7**	**[48.3,55.2]**	**8.3**	**[6.7,10.1]**	**40.0**	**[36.8,43.3]**		**42.0**	**[39.2,44.9]**	**19.0**	**[17.1,21.2]**	**38.9**	**[36.2,41.7]**	

3.5. Binary Logistic Regression Results for Postnatal Care

Table 4 presents the adjusted odds ratios of the association between PNC coverage and demographic and socioeconomic characteristics, separately for newborns delivered at home and in a health facility. Among home births, newborns whose mothers perceived their size at birth to be average had 90% higher odds of having a PNC visit compared with newborns perceived to be small. The odds of home-born newborns having a PNC visit were 80% and 90% lower in Luapula and Southern regions, respectively, compared with Lusaka province. Home-born newborns whose mothers had access to media had 40% higher odds of having a PNC visit compared with newborns whose mothers did not have access to media. Among home births, newborns whose mothers had four or more ANC visits during pregnancy had 50% higher odds of having a PNC visit compared with newborns whose mothers had fewer than four ANC visits.

Among newborns delivered in a health facility, there is no evidence of association between perceived size at birth, access to media, or number of ANC visits during pregnancy and the odds of the newborn having any postnatal care. However, the odds of having PNC were 50%, 60%, and 90% lower, respectively, for newborns delivered in a health facility in the Copperbelt, Luapula, and Southern provinces compared with Lusaka province.

Table 4: Adjusted regression results on the demographic and socioeconomic factors associated with receipt of any postnatal care among the most recent newborns by place of delivery, 2013-14 ZDHS

	Home births (Model 1)		Facility births (Model 2)	
Variable	**AOR**	**CI**	**AOR**	**CI**
Mother's Age at birth				
<20	1		1	
20-34	1.4	0.7 - 2.9	1.1	0.8 - 1.5
35+	1.6	0.7 - 3.5	0.9	0.6 - 1.4
Birth Order				
1	1		1	
2	0.9	0.5 - 1.8	1.0	0.8 - 1.4
3	0.8	0.4 - 1.6	0.9	0.7 - 1.2
4 or more	0.8	0.4 - 1.6	1.0	0.7 - 1.4
Perceived Size at Birth				
Small	1		1	
Average	**1.9****	1.2 - 2.9	1.1	0.8 - 1.4
Large	1.5	1.0 - 2.3	1.1	0.9 - 1.5
Province				
Central	1.4	0.5 - 3.6	1.3	0.8 - 2.4
Copperbelt	0.6	0.2 - 1.5	0.5	0.3 - 0.9
Eastern	0.7	0.3 - 1.9	0.7	0.4 - 1.2
Luapula	**0.2****	0.1 - 0.6	**0.4*****	0.2 - 0.6
Lusaka	1		1	
Muchinga	0.7	0.3 - 1.8	1.2	0.7 - 2.0
Northern	1.4	0.5 - 3.8	1.1	0.6 - 1.8
North Western	1.1	0.4 - 2.9	0.8	0.5 - 1.3
Southern	**0.1*****	0.0 – 0.2	**0.1*****	0.0 - 0.1
Western	0.5	0.2 - 1.3	1.1	0.6 - 2.0

(Continues…)

Table 4—*Continued*

	Home births (Model 1)		Facility births (Model 2)	
Variable	**AOR**	**CI**	**AOR**	**CI**
Type of Residence				
Urban	1			
Rural	0.7	0.5 - 1.1	0.8	0.6 - 1.1
Mother's educational Level				
None	1		1	
Primary	1.1	0.8 - 1.6	1.0	0.7 - 1.4
Secondary +	1.3	0.8 - 2.2	0.8	0.6 - 1.1
Wealth status				
Poor	1		1	
Middle	1.2	0.8 - 1.7	1.1	0.9 - 1.4
Rich	0.9	0.5 - 1.6	1.0	0.7 - 1.4
Womens Employment Status				
Unemployed	1		1	
Employed	0.9	0.6 - 1.3	1.0	0.8 - 1.2
Media Exposure				
No access/exposure	1		1	
Access to media/exposed	**1.4***	1.0 - 2.0	1.2	1.0 - 1.5
ANC visits				
<4	1		1	
≤4+	**1.5*****	1.2 - 2.0	1.1	0.9 - 1.3

*p<0.05, **p<0.01, *** p<0.001

3.6. Multinomial Regression Results for the Timing of the First Postnatal Checkup

Table 5 presents the adjusted relative risk ratios of the association between timing of first PNC and demographic and socioeconomic characteristics. Separate models were run for home deliveries and deliveries in a health facility. The results show that among home deliveries the relative risk for attending first PNC within 2 days after delivery relative to not attending PNC for newborns whose perceived size was average, was 150% higher than for newborns perceived to be small. The relative risk for attending first PNC within two days after birth relative to not attending PNC was 90% lower for newborns in Southern region compared with Lusaka. Similarly, the relative risk for attending first PNC with 2 days after delivery relative to not attending PNC for newborns whose mothers had four or more ANC visits was 80% higher than for newborns whose mothers had fewer than four ANC visits. Among newborns delivered in a health facility, the relative risk for attending first PNC within two days after birth relative to not attending PNC was 90% lower in Luapula, North Western, and Southern regions than in Lusaka. In addition, the relative risk for attending first PNC within two days after delivery relative to not attending PNC for newborns whose mothers were employed was 40% higher than for newborns whose mothers were unemployed.

Table 5 further shows that among newborns delivered at home the relative risk for attending first PNC at two or more days after delivery to not attending PNC for newborns whose perceived size at birth was average was 80% higher than for newborns whose weight was small. The relative risk

for attending first PNC at 2 or more days after birth relative to not attending PNC for newborns in Southern and Luapula regions was, respectively, 90% and 80% lower than in Lusaka region. Further, the relative risk for attending first PNC at two or more days after delivery compared with not attending PNC for newborns whose mothers had media exposure was 40% higher for newborns whose mothers had no media exposure. Similarly, for newborns whose mothers made four or more ANC visits the relative risk for attending first PNC at two or more days after delivery versus not attending PNC was 50% higher than for newborns whose mothers made fewer than four ANC visits. In contrast, among facility-delivered newborns the relative risk for attending first PNC at two or more days after delivery relative to not attending PNC was 40% and 50% higher, respectively, for newborns whose perceived size at birth was average and larger than for newborns whose perceived size was small. Similarly, the relative risk for attending first PNC at ‘ or more days after birth relative to not attending PNC for newborns in Copperbelt, Eastern, Luapula, and Southern regions was 60%, 50%, 50%, and 90% lower, respectively, than for newborns in Lusaka region.

Table 5: Adjusted relative risk ratios (RRR) results on the demographic and socioeconomic factors associated with timing of the first postnatal checkups among the most recent newborns by place of delivery, 2013-14 ZDHS

	Home births (Model 1)				Facility births (Model 2)			
	PNC within 2 days		PNC ≥2 days		PNC within 2 days		PNC ≥ 2 days	
Variables	**RRR**	**95% CI**	**RRR**	**95% CI**	**RRR**	**95% CI**	**RRR**	**95% CI**
Mothers Age at Birth								
<20	1		1		1		1	
20 – 34	2.9	0.8 - 11.1	1.3	0.6 - 2.6	1.3	0.8 - 1.9	1.0	0.8 - 1.4
35+	2.7	0.6 - 12.6	1.4	0.6 - 3.2	1.1	0.6 - 1.9	0.9	0.6 - 1.4
Birth Order								
1	1		1		1		1	
2	0.4	0.1 - 1.5	1.1	0.5 - 2.2	0.9	0.6 - 1.3	1.1	0.8 - 1.6
3	0.5	0.1 - 2.0	0.9	0.4 - 1.9	0.7	0.4 - 1.0	1.1	0.8 - 1.5
4 or more	0.6	0.2 - 2.1	0.9	0.4 - 1.8	0.7	0.5 - 1.2	1.1	0.8 - 1.6
Perceived Size at Birth								
Small	1		1		1		1	
Average	**2.5***	1.0 - 6.0	**1.8***	1.1 - 2.8	0.7	0.5 - 1.1	**1.4***	1.0 - 1.9
Large	1.7	0.6 - 4.6	1.5	0.9 - 2.3	0.8	0.5 - 1.2	**1.5***	1.0 - 2.1
Region								
Central	2.3	0.5 - 11.0	1.2	0.5 - 3.1	1.5	0.8 - 2.8	1.2	0.6 - 2.4
Copperbelt	1.5	0.3 - 7.2	0.4	0.1 - 1.1	0.7	0.4 - 1.4	**0.4****	0.2 - 0.7
Eastern	1.7	0.4 - 8.3	0.5	0.2 - 1.5	1.2	0.7 - 2.1	**0.5***	0.3 - 0.9
Luapula	0.1	0.0 - 1.1	**0.2****	0.1 - 0.7	**0.1*****	0.1 - 0.3	**0.5****	0.3 - 0.8
Lusaka	1		1		1		1	
Muchinga	0.3	0.1 - 2.0	0.7	0.3 - 1.9	0.8	0.4 - 1.7	1.4	0.8 - 2.4
Northern	0.3	0.1 - 1.7	1.5	0.6 - 4.0	0.8	0.4 - 1.6	1.2	0.7 - 2.1
North Western	1.6	0.3 - 8.8	0.9	0.3 - 2.6	**0.1**	0.0 - 0.2	1.1	0.7 - 1.9
Southern	**0.1****	0.0 - 0.4	**0.1*****	0.0 - 0.2	**0.1*****	0.0 - 0.2	**0.1*****	0.0 - 0.1
Western	0.5	0.1 - 2.9	0.5	0.2 - 1.3	0.9	0.5 - 1.8	1.2	0.7 - 2.2

(Continues…)

Table 5—*Continued*

	Home births (Model 1)				Facility births (Model 2)			
	PNC within 2 days		PNC ≥2 days		PNC within 2 days		PNC ≥ 2 days	
Variables	**RRR**	**95% CI**	**RRR**	**95% CI**	**RRR**	**95% CI**	**RRR**	**95% CI**
Type of Place of Residence								
Urban	1		1		1		1	
Rural	0.5	0.2 - 1.0	0.8	0.5 - 1.3	0.8	0.5 - 1.1	0.8	0.6 - 1.2
Highest Educational Level								
None	1		1		1		1	
Primary	1.0	0.5 - 2.0	1.1	0.8 - 1.6	0.8	0.5 - 1.2	1.1	0.8 - 1.6
Secondary +	2.0	0.9 - 4.6	1.2	0.7 - 2.0	0.7	0.4 - 1.1	0.9	0.6 - 1.3
Wealth Index								
Poor	1		1		1		1	
Middle	1.3	0.7 - 2.4	1.1	0.7 - 1.7	1.1	0.8 - 1.6	1.1	0.8 - 1.5
Rich	1.0	0.4 - 2.6	0.8	0.4 - 1.5	1.0	0.6 - 1.5	1.1	0.7 - 1.5
Mothers Employment Status								
Unemployed	1		1		1		1	
Employed	0.8	0.5 - 1.4	0.9	0.6 - 1.4	**1.4***	1.1 - 1.8	0.9	0.7 - 1.1
Media Exposure								
No Access/Exposure	1		1		1		1	
Access/Exposed to Media	1.5	0.8 - 2.8	**1.4***	1.0 - 1.9	1.2	0.9 - 1.6	1.2	1.0 - 1.6
Number of ANC visits								
< 4	1		1		1		1	
4+	**1.8***	1.1 - 3.1	**1.5****	1.1 - 1.9	1.1	0.9 - 1.4	1.1	0.9 - 1.4

*p<0.05, **p<0.01, *** p<0.001

4. Discussion, Conclusion, and Policy Implications

4.1. Discussion

The objectives of this study were to assess the demographic and socioeconomic characteristic associated with PNC coverage and also to examine the factors associated with the timing of first PNC among newborns delivered at home and newborns delivered in a health facility. Our study found that, overall, 55% of newborns received PNC. However, there was a substantial difference by place of delivery. Newborns delivered at home were less likely than newborns delivered at a health facility to receive PNC, at 48% versus 58%. This finding is supported by similar studies elsewhere (Singh et al. 2012; Fadel et al. 2015; Yunus et al. 2013. The difference may be attributed to the fact that births delivered in a health facility are attended by skilled personnel, who may encourage and educate mothers on the importance of PNC. In addition, only 16% of the newborns received PNC within the first two days, according to the 2013-14 ZDHS (CSO 2014). Disaggregated by place of delivery, our study found that the timing of PNC within the first 2days after birth was more than twice as high among newborns delivered in a health facility compared with newborns delivered at home (19% versus 8%).

Newborns delivered at home whose size at birth was average as perceived by their mothers had higher odds of having a PNC visit, and having it within the first days after birth compared with newborns perceived as small. This finding agrees with other studies (Titaley et al. 2009). The finding is counterintuitive, because studies also show that small-sized newborns need extra care after birth compared with newborns of average size (Lawn et al. 2005). Various factors may help to explain this finding; for example, women in rural areas and women with little education may not know the problems that having a low birth-weight child could bring in the immediate or near future and thus do not see the need for the newborn to be taken for PNC.

Region of residence is an important factor that has been cited as influencing whether newborns receive PNC and the timing of their first PNC. Studies show that in poorer regions of a country lower odds of early PNC after delivery may be attributable to high levels of early neonatal deaths, and these deaths are much more common among newborns delivered at home (Fadel et al. 2015). In addition, according to a study in Nigeria by Dahiru and Oche (2015), newborns in regions that were predominantly rural in nature had lower odds of having PNC compared with those in predominantly urban regions. A recent study in Rwanda by Rwabufigiri (2016) also found that the Western Province (a poorer region) had lower odds of having PNC than Kigali, the capital city. Similarly, in Bangladesh Yunus et al. (2013) found that the region of residence had a significant relationship with newborns' receipt of PNC and also the timing of first PNC. These studies agree with the results of our study, which found that some regions of Zambia had lower odds of newborns

having PNC and the timing of first PNC regardless of whether the births were delivered at home or in a health facility.

Besides, among newborns delivered at home, only in Luapula and Southern regions were there significantly lower odds of PNC than in Lusaka region. Among newborns delivered in a health facility, Copperbelt, Luapula, and Southern regions exhibited lower odds than Lusaka region. Further, with regard to timing of first PNC within two days of delivery, only Southern region had lower odds for newborns delivered at home compared with Lusaka region. Among newborns delivered in a health facility, Luapula, North Western, and Southern regions had lower odds of PNC than Lusaka region. The reason for the observed lower odds in receiving PNC and timing of the first PNC may be rooted deeply in the cultural practices in these regions, which may be beyond the data used in our study. In addition, this could further be explained by the reference category that was used in the analysis, which was Lusaka, the capital city, where almost every mother is expected to deliver in a health facility and where ANC is almost universal (99%) (CSO et al., 2014).

Further, this study reveals that among newborns delivered in a health facility those whose mothers' were employed at the time of the survey had higher odds of receiving their first PNC within the first 2 days compared with those whose mothers were not employed. This finding is comparable to the study in Nigeria by Dahiru and Oche, which found that newborns whose mothers were employed had higher odds of receiving a PNC within the recommended time period (Dahiru and Oche 2015). The finding may be attributed to the fact that women who are employed tend to make decisions on the use of their resources and on what health services they can provide for their newborns for them to grow as a healthy child.

Our study shows that newborns, whether delivered at home or in a health facility, were more likely to receive PNC if their mothers had access to media. However, logistic regression models reveal that only newborns delivered at home and whose mothers had access to media had higher odds of having a PNC compared with those whose mothers did not have media access. Access to media by mothers to newborns has been found to have a positive association with the use of PNC services among newborns. For instance, women who have access to media have been found to have increased antenatal care visits, and as such they tend to know the benefits of a child having PNC after birth, as they are aware of what problems they encounter if the child does not receive PNC (Acharya et al. 2015; Mumtaz et al. 2012; Aqha and Carton 2011; Titaley et al. 2009; WHO 2005).

Our study found that newborns whose mothers had four or more ANC visits had higher odds of having PNC. Similarly, newborns delivered at home and whose mothers had four or more ANC visits had higher odds of having first PNC within the first 2 days. This finding is similar to results

of other studies, where the number of ANC visits is an important determinant of PNC use (Dahiru and Oche 2015; Yunus et al. 2013; Titaley et al. 2009).

4.2. Conclusions

Based on the nationally representative 2013-14 ZDHS, this study identified differences that exist in the factors associated with receipt of PNC and the timing of first PNC among newborns delivered at home and newborns delivered in a health facility. The study shows low levels of PNC among newborns regardless of place of delivery but some differences by demographic and socioeconomic characteristics. For home births, perceived child size at birth by mothers, region of residence, access to media, and mothers' number of ANC visits are the major determinants of PNC. For facility births, however, only region of residence is associated with receipt of PNC.

Regarding timing of PNC within the first two days after birth, for newborns delivered at home the major determinants are perceived child size at birth by mothers, region of residence, mothers' access to media, and number of ANC visits. Among newborns delivered in a health facility, region of residence and mothers' employment status are associated with receiving PNC within the first 2 days.

4.3. Policy Implications

This study demonstrates that policies related to newborns and the timing of when newborns receive their first PNC are cardinal. Therefore, emphasis should be placed on encouraging women to deliver in a health facility, where they will be attended by qualified personnel who know the importance of PNC. This may help reduce the high neonatal mortality rate in the future.

The association between receipt of PNC and access to media implies that Information Education and Communication (IEC) programs can play a critical role in encouraging women to take their newborns for PNC. Therefore, this calls for coordinated efforts by all stakeholders involved in the provision of child health services at all levels of society to include IEC activities in their programming and implementation of their activities.

The study also shows that mothers' attendance of the recommended number of ANC visits plays a fundamental role in ensuring that mothers take their newborns for PNC, especially among those delivered at home. As such, emphasis should be placed on ensuring that healthcare services are taken as close as possible to the people to stimulate increased use of PNC and the timing of first PNC.

Finally, more research is required to understand the factors that cause low levels of PNC and influence its timing in certain regions like Luapula, Southern, North Western, and Copperbelt regions and among newborns perceived to be small at birth.

5. Limitations

This study had three major limitations: First, the study was limited to only the variables collected in the ZDHS. Factors that may affect PNC care but are not available in DHS could not be examined. For example, we observed differences in receiving PNC among regions but were not able to explore the factors that account for the differences. Second, not only is receipt of PNC important; so is the content of PNC. However, content could not be assessed because of data unavailability. Third, due to the cross-sectional nature of the survey, it was impossible to infer causality in the associations between the covariates in this study and the outcome variables.

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