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Why Many Women in Arba Minch District Have Short Inter Birth Intervals? Implication to Health Care Workers and District Health Managers in Ethiopia

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Abstract
Background: One of the key strategies to reduce fertility and promote the health status of mothers and their children is adhering to optimal birth spacing. However, women still have shorter birth intervals and studies addressing its determinants were scarce. The objective of this Study, therefore, was to assess determinants of birth interval among women who had at least two consecutive live births.**Methods**: Case control study was conducted from February to April 2014. Cases were women with short birth intervals (<3years); whereas, controls were women having history of optimal birth intervals (3 to 5 years). A pre-tested and structured questionnaire was used. Multivariable analysis was performed to determine independent predictors. For the qualitative study, data were collected through focus group discussions (FGDs) with mothers and their husbands. **Result:** Having no formal education (AOR=2.36, 95%CL: [1.23-4.52]), duration of breast feeding for less than 24 months(AOR: 66.03, 95%CI;[34.60-126]), preceding child being female(AOR: 5.73, 95%CI; [3.18-10.310]), modern contraceptive use (AOR: 2.79, 95%CI: [1.58-4.940]) and poor wealth index (AOR: 4.89, 95%CI; [1.81-13.25]) of respondents were independent predictors of short birth interval. In the qualitative study, lack of information about optimal birth spacing, inaccessibility of health care service, reliance on clean lactation, family & religious influence, previous child being female were indicated as reasons of short birth interval. **Conclusion:** In equalities in education, duration of breast feeding, sex of the preceding child, contraceptive method use and wealth index were markers of the unequal distribution of inter birth intervals. Thus, to optimize birth spacing, strategies of providing information, education and communication targeting predictor variables should be improved.
Key words: Determinants, short inter birth interval, between two live births, Case control study

1. Introduction

Despite slight decrement in total fertility rate (TFR), the world's population remains alarmingly high. Much of this increase comes from high-fertility Africa countries. Sub-Saharan Africa and Asia particularly have population growth rates that are outpacing their economic growth (UNFPA,2011]. Ethiopia, the second most populous country in Africa, has a total population of 79.8 million (MOH Ethiopia,2010).The population of the country is significantly increasing as compared to the previous consecutive censuses periods (1984 and 1994) when it was about 40 and 53.5 million respectively(CSA,2007).

Like many other sub-Saharan African countries(SSA), fertility rate is profoundly higher in Ethiopia (4.8) as compared to the global figure (2.69) (WHO,2005;CSA,2011) and of which rural women have an average of three more births per woman compared to women in urban areas (5.5 and 2.6, respectively)[MOH Ethiopia,2010;CSA,2011). Even with fertility decline, the population is still growing at an annual rate of 2.6% (CSA,2011).

Inter birth interval (IBI) has critical effect on the health status of the mother and her child (University of Florida, 2008; Jhon, 2006). Evidences showed that a relationship exists between shorter IBI and high infant and child mortality (WHO,2005;USAID,2005). It was also indicated that short IBI have been linked to increased risk of preterm birth, low birth weight, small for gestational age (SGA), labor dystocia, maternal morbidity and mortality, premature rupture of membranes, third-trimester bleeding, anemia, and puerperal endometritis[WHO,2005;CSA,2011;USAID,2005). Beyond the health implications, closely spaced birth intervals accelerate population growth and undermining development efforts. It makes difficult for women to become productive members of society, thereby limiting their contribution to economic development(USAID,2005).Moreover, when a newborn comes, it is likely that the family will invest more of its limited resources in the form of care to the newborn, while the other children will receive inadequate share of the resources(USAID,2005).

On the other hand, optimal birth spacing (OBS) yields the greatest health, social, and economic benefits for the family. Although, previous research findings advocate an interval length of 2 years between two consecutive births for a better maternal and child health, (WHO,2005) recent evidence showed that births should be spaced at three to five years apart to ensure maximum health benefits for mothers, newborns, and older

childrenWHO,2005;USAID,2005).

The Federal Ministry of Health (FMOH), reproductive health department and health bureaus of respective regions have made concerted effort to reduce fertility and promote the health of the women and their children. They have been Appling multi-pronged approaches at local and national levels to address optimal birth spacing and decreasing fertility (MOH Ethiopia, 2010). Women in developing countries however, still have shorter birth intervals than they would prefer (WHO, 2005). In Ethiopia, like many other sub Saharan African countries, fertility, maternal mortality and child mortality are still high. Recent estimates showed that the country still experiences higher rates of maternal, neonatal and infant mortality of 767/100,000, 37/1000,59 per 1000 live births respectively(CSA,2011). However, little is known about the determinant factors in Ethiopia and particularly in the study area.

Thus, understanding the factors which influence women's birth spacing is critical for countries like Ethiopia with a population policy aiming at reducing fertility. This study therefore aims to fill this gap by assessing the current level of inter birth interval and its determinant factors among rural child bearing age women who have at least two consecutive live births in Arba Minch Zuria district, SNNP, Ethiopia.

2. Methods and Materials

2.1. Study setting and period

This study was conducted from February to April 2014 in Arba Minch Zuria district, having three climatic zones (Highland, Semi-highland and Lowland).Arba Minch Zuria is one of the districts in south nations, nationalities and people's regional state found in Gamo Goffa zone. It is located in the Great Rift Valley. The administrative town of this district, Arba Minch, is located about 502 kilometers to south West of Addis Ababa, the capital city of Ethiopia. The district is situated 1285 meters above sea level. Gamo by ethnicity (69.53%) and Protestants (53.91%) by religion are the dominant ones.

According to the figure from central statistical agency, 2007, this district has a total population of 164,529, of which about 82,199 were men and 82,330 were women (Wikipedia, 2013). In this district, reproductive age women accounted for 45, 912(Gamogofa zone, 2013). Regarding the health care facilities, the district has only three health centers operating currently. It has no hospital of any level.

2.2. Study design and Population

A community based unmatched case-control study was conducted among randomly selected child bearing age women who had at least two consecutive live births and the last delivery occurred within the past five years prior to the data collection. **Controls** were women who gave live birth within the last 5 years and had at least two consecutive live births with birth interval of 3–5years between the latest two successive live births including 3 and 5years.Whereas, **cases** were women who gave live birth within the last 5 years and had at least two consecutive live births with birth interval of less than 3 years between the latest two successive live births. To minimize bias, mentally and/or physically incapable women were excluded from the study even if they fulfill the inclusion criteria.

2.3. Sample size determination

The sample size was determined using Epi Info StatCalc version 6 software. A minimum detectable OR (odds ratio) of 2, a 5% level of precision, a power of 90% and a 2:1 ratio of controls (optimal birth interval) to cases (short birth interval) were assumed. The prevalence of major determinant factor, proportion of mothers who utilized modern contraception among controls was determined to be 68.4% (Begna, Assegid, Kassahun, &Gerbaba, 2013). An additional, non-response rate of 10% was also considered. Based on the above assumptions, the final sample size was calculated to be 636 (212 cases and 424 controls).The proportion of contraception utilization among controls was chosen since it gave the maximum sample size.

For the qualitative study, FGD was conducted until information was saturated. In the study, sixteen FGDs were conducted involving a total of 128 participants (64 males and 64 females). Eight groups were from parents who had short birth interval (four groups of husband and four groups of mothers) and eight groups were from Parents who had optimal birth interval (four groups from each husbands and mothers).

2.4. Sampling procedures

Regarding the sampling procedure, first nine, from a total of thirty one kebeles (smallest administrative unit in Ethiopia), were purposely selected. Then, house to house visit (census) was conducted in all the selected kebeles to identify women who fulfill the inclusion criteria (cases and controls) by having registered the birth date of the last two children of a family with their corresponding house hold identification number. To determine children's birth dates, immunization cards were used. For those who were not immunized, community based health extension workers were consulted. Using respective house hold identification number of mothers, frames of households containing study subjects defined as cases and controls were prepared for each kebele. Then, probability proportional to size allocation technique was employed to determine the study participants from each kebele as

well as cases and controls.

Finally, child bearing age women who had at least two consecutive live births and the last delivery was within the past five years prior to the survey were selected using simple random sampling technique from the existing sampling frame. For participants who were not present at the time of data collection, at least three visits were made to trace them.

2.5. Participant Selection for qualitative study

Study participants were selected purposively in the manner that they can be representative of the mothers with different reproductive history and residence. All the nine rural kebeles found in Arba Minch Zuria district DHS research site were first considered. Then, four kebeles (two from the highland and two from the lowland areas) were selected. Individuals who were believed to be the most informative about the subject under study were selected. Discussants were classified by sex, area of residence and level of birth interval to capture heterogeneity among different sub-groups and homogeneity within a group.

To determine children's birth dates and their respective birth intervals, immunization cards were referred. For participants whose children were not immunized, community based health extension workers were consulted since they have full and up to date document of all vital statistics. Finally, child bearing age women who gave birth within the last five years and had at least two consecutive live births were invited to participate in the FGDs.

2.6. Data collection tool and processing

This study obtained data from mother interviews of sampled households. Structured and pretested questionnaire was employed to obtain information on obstetric history, socio-economic status, contraception use, breast feeding practice, and attitude towards birth spacing and family planning. The questionnaire was adopted from different previously done studies and adapted to the local context of the study area (Begna, Assegid, Kassahun, Gerbaba,2013; Abddelfatah et al. 2007; Exavery et al.,201212). It was prepared first in English and then translated to Amharic by the language expert for the data collection purpose. To check its consistency, the questionnaire was translated back to English by another language expert.

Eight high school graduates who were familiar with the local language and customs were recruited as interviewers. Four BSc holder health care workers supervised the data collection process. Data collectors and supervisors were trained for three days on census procedures, questions included in the questionnaire, interview techniques, importance of privacy and confidentiality of the information obtained from the respondents. Before conducting the main study, pretest was carried out on 5% of the sample size (20 cases and 20 controls) from one kebele, which was not included in the main study. Based on the result, data collectors were reoriented and the questionnaire was modified as appropriate. Data collected from each respondent were checked for completeness, clarity and consistency by the principal investigator and the supervisors at the end of each data collection days.

For the qualitative study, data were collected through focus group discussions (FGDs) with mothers and their husbands to explore their perceptions about inter birth intervals. Open ended semi-structured and flexible questionnaire was used as a guide for the discussion process. Separate FGDs for men and women were held. The discussions were conducted in a quiet room according to the preference of discussants to enable them speak more freely about their perceptions. Two moderators and one field assistant were recruited to collect the desired information. Data were tape recorded by a research assistant after thorough communication had been made with discussants. Each FGD lasted between 90-120 minutes. The number of FGDs was determined by the saturation of ideas.

2.7. Estimation of household wealth index

Household wealth status was estimated by principal component analysis based on fourteen house hold variables (Source of drinking water, presence of own farmland, size of own farm land, type of toilet facility, electricity, radio, mobile phone, roof of house with corrugated iron sheet, sleeping bed, number of cows, oxen, horses/ mules/donkeys , goats/sheep and hens).SPSS version 20 software was used to perform principal component analysis (PCA).Both the Kaiser-Meyer-Oklin (KMO) and Bartlett's Testes were checked. Finally, wealth status was categorized in to five groups and ranked from poorest to wealthiest quintile.

2.8. Outcome and exposure measures

The outcome variable was the birth interval defined as the period from the date of birth of the previous child to the date of birth of the last child. The birth intervals between two consecutive live births were analyzed for women aged 15–49 years who reported that they had at least two deliveries and the last delivery occurred within the past five years prior to the data collection. Dummy variables were created for this variable: Birth interval less than 3 years (short birth interval) and birth interval 3-5years inclusively (optimal birth interval). Short birth interval was coded as "1" and optimal birth interval was coded as "0."

Potential predictors occupational status of the mother, marital status of the mother, educational status of

the mother, religion of the mother, husband's educational status, wealth index, age at first marriage , age at delivery of the index child, parity, male to female ratio of living children ,sex of the index child , survival status of the index child, pregnancy plan of the index child, ANC visit during index pregnancy, women's decision making power, breast feeding practice and attitude towards birth spacing and family planning were included in the analysis.

Mothers were considered as having positive attitude towards optimal birth spacing and contraception if they scored above mean correct answers while, they were considered as having negative attitude towards optimal birth spacing and contraception if they scored mean and below correct answers from attitude measuring questions.

2.9. Data analysis

After appropriate coding, the data were entered using Epi Info version 3.5.3 software and exported to SPSS version 20 software for analysis. Univariate analysis was computed for each independent variable to assess their individual proportion. Then, bivariate analysis was executed to examine crude association of predictors with short inter birth intervals. Finally, variables which had p-value less than 0.3 on bivariate analysis were selected as candidates for multivariable analysis.

In multivariable logistic regression analysis, the independent effect of predictors on short inter birth interval were examined. Backward step wise LR was used to identify variables which had the largest contribution to the model. Odds ratio and 95% CI were used to measure the statistical association. P value 0.05 was used to determine the statistical significance of the tests. Finally, the results were presented in texts, tables and graphs.

For the qualitative data, all the audio taped FGDs were transcribed verbatim. Then, translation was made from Amharic (official and working language) to English. To assure the validity of the translation, another person, proficient in both languages checked and commented on it. Both transcription and translation of FGDs were made by the investigators.

Finally, the principal investigator double-checked against the original recordings and the research team analyzed using content analysis. Then, final themes were compared among various groups' discussants to know the differences and similarities according with their perspectives about factors influencing short birth intervals. The findings were finally presented in the form of narratives.

3. Ethical Consideration

After approval, ethical clearance was obtained from institutional Review Board (IRB) of College of Medicine and Health sciences, Arba Minch University. Permission letters from district health office were processed before starting data collection. At the beginning of the data collection, informed consent was obtained from each respondent after through explanation of the purpose and the procedures of the study. Mothers were also informed that all the data obtained from them would be kept confidential and anonymous. To ensure confidentiality, names of respondents were replaced by code numbers.

4. Result

4.1. Quantitative.

4.1.1. Socio-economic characteristics of participants

Six hundred thirty six child bearing age women who had at least two live births were interviewed making a response rate of 100%. The mean age of the respondents was 31 years (SD±5.16). Eighty one (38.1%) of the cases and 181(42.7%) of the controls were within the age range of 25-29 years. Majority 107(50.5%) of the cases and 226(53.3) of the controls were married at the age of 18 years or less. Regarding educational status, one hundred sixty nine (79.7%) of the cases and 203(48.0%) controls had not attended formal education. The poorest wealth index was computed at 63(29.7%) and 64 (15.1%) in the cases and controls respectively (table1).

Among the above socio-economic factors Ethnicity, educational status of both parents, and wealth index of the respondents showed crude statistical association with short inter birth interval. The odds of experiencing short inter birth interval was higher for mothers who were illiterate or unable to read and write as compared to those who attended formal education. Similarly, as wealth index of respondents decreased, the likelihood of having short birth inter birth interval was high (table1).

Table 1. Socio-economic characteristics of child bearing age mothers in Arba Minch Zuria district, Gamogofa zone, Ethiopia, 2014

Variables	Cases Number (%)	Controls Number (%)	Crude odds ratio(95%CI)	P-Value
Age at last delivery				
17-24	29(13.7)	76(17.9)	0.61(0.38-1.09)	0.095
25-29	81(38.2)	181(42.7)	0.71(0.44-1.15)	0.163
30-34	63(29.7)	105(24.8)	0.95(0.57-1.60)	0.855
>=35	39(18.4)	62(14.6)	1	
Age at first marriage				
12-18	107(50.5)	226(53.3)	0.56(0.24-1.10)	0.173
19-24	94(44.3)	185(43.6)	0.60(0.26-1.39)	0.234
25-29	11(5.2)	13(3.1)	1	
Religion				
Protestant	150(70.8)	284(67.0)	0.88(0.157-4.949)	0.887
Orthodox	60(28.3)	136(32.1)	1.06(0.197-5.83)	0.950
Others*	2(0.9)	4(0.9)	1	
Ethnicity				
Gamo	158(74.5)	363(85.6)	2.07(0.69-6.18)	0.193
Zeysie	50(23.6)	42(9.9)	5.65(1.78-17.92)	0.003
Others**	4(1.9)	19(4.5)	1	
Marital status				
Married	204(96.32)	414(97.6)	0.61(0.24-1.58)	0.315
widowed/divorced	8(3.8)	10(2.4)	1	
Educational level of mothers				
No formal education	169(79.7)	203(48)	4.28(2.91-6.29)	0.000
Has formal education	43(20.3)	221(52)	1	
Mothers' occupation				
House wife	195(92.0)	369(87.0)	1.81(0.81-9.79)	0.101
Merchant	9(4.2)	22(5.20)	2.18(0.51-9.36)	0.294
Farmer	5(2.4)	17(4.00)	1.57(0.32-7.66)	0.578
Others***	3(1.4)	16(3.8)	1	
Husbands' educational level				
No formal education	132(64.7)	200(48.3)	2.01(1.42-2.83)	0.000
Has formal education	72(35.3)	214(51.7)	1	
Husband's occupation				
Farmer	171(83.8)	342(82.6)	0.77(0.421-1.42)	0.403
Daily laborer	15(7.4)	43(10.4)	0.53(0.233-1.22)	0.134
Others****	18(8.8)	29(7.0)	1	
Wealth index				
Poorest	63(29.70)	64(15.10)	5.27(2.92-9.51)	0.000
Second	48(22.60)	79(18.60)	3.25(1.79-5.91)	0.000
Middle	41(19.30)	87(20.50)	2.52(1.38-4.62)	0.003
Fourth	40(18.90)	87(20.50)	2.46(1.34-4.51)	0.004
Richest	20(9.40)	107(25.20)	1	

*Hawariya, Ahzab, Yehiwamisikiroch;**Welayta, Konso, Amhara, Oromo;***Daily laborer, student, Employed; ****Employed, merchant, Fisher

4.1.2. **Obstetrics, breast feeding and contraception history of mothers**

Ninety nine (46.7%) of the cases and 216(50.9%) controls were reported to have three up to four live children. Five (2.3%) of the cases and 11(2.6%) of the controls had still birth between the last two live births. Ninety nine (46.7%) and 299 (70.5%) of cases and controls respectively had planned pregnancy. Twenty two (10.4%) of the case and 57(13.4%) of the controls gave birth in health institution for their preceding child. Majority 178(84.0%) of the cases breast for less than months, while 383(90.3%) of the controls breast fed for 24 months or above. Sixty six (31.1%) of the cases and 283(66.7%) of the controls utilized modern contraceptive method after the delivery of the preceding child but before they got pregnant for the last child (table2).

On Bivariate analysis, sex of the preceding child, pregnancy plan for the last child, antenatal care follow up during the preceding pregnancy, contraceptive utilization before getting pregnant for the last child, and duration of breast feeding for the preceding child had showed significant statistical association with short birth interval. Female sex of the preceding child was positively associated with experiencing short birth interval.

Similarly, the odds of experiencing short birth interval was about 3 times higher for mothers who did not have pregnancy plan for their last child than those who had a plan to get pregnant. The likelihood of having short birth interval was 3 times higher for mothers who did not attend ANC follow up during the preceding pregnancy as compared to those who attended. Mothers who did not use modern contraceptive method before getting pregnant

for the last child were 4 times more likely to experience short birth interval as compared to those who used. Duration of breast feeding of the preceding child had also showed significant statistical association. The odds of having short birth interval was about 49 times higher for mothers who breast feed their preceding child for less than 24 months as compared to their counter parts who breast fed for 24 months or more(table2).

Table 2. Obstetric, breast feeding and contraception history of child bearing age mothers in Arba Minch Zuria district, Gamogofa Zone, Ethiopia, 2014

Variables	Cases Number (%)	Controls Number (%)	Crude odds ratio (95%CI)	P-Value
Number of living children				
0-2	23(10.8)	48(11.3)	1	
3-4	99(46.7)	216(50.9)	0.957(0.551-1.66)	0.874
>=5	90(42.5)	160(37.7)	1.17(0.670-2.055)	0.575
Sex of the preceding child				
Female	149(70.3)	151(35.6)	**4.27(2.99-6.10)**	0.000
Male	63(29.7)	273(64.4)	1	
Still birth before last child				
No	207(97.6)	413(97.4)	1.10(0.378-3.215)	0.858
Yes	5(2.4)	11(2.6)	1	
Abortion before the last child				
No	206(97.2)	411(96.9)	1.09(0.41-2.90)	0.869
Yes	6(2.8)	13(3.1)	1	
Status of the preceding Child				
Alive	212(100) 0	420 (99)	90.96(0.000-5.1)	0.504
Dead	0(0)	4(0.9)	1	
Previous pregnancy plan				
No	113(53.3)	125(29.5)	**2.73(1.94-3.84)**	0.000
Yes	99(46.7)	299(70.5)	1	
ANC in preceding pregnancy				
No	107(50.5)	103(24.3)	**3.18(2.24-4.50)**	0.000
Yes	105(49.5)	321(75.7)	**1**	
Place of previous delivery				
Health institution	22(10.4)	57(13.4)	0.75(0.442-1.26)	0.270
Home	190(89.6)	367(86.6)	1	
Contraceptive use before last pregnancy				
No	146(68.9)	141(33.3)	**4.44(3.12-6.33)**	0.000
Yes	66 (31.1)	283(66.7)	1	
Decision maker about F/P				
Self (Mother)	49(23.10)	86(20.30)	1	
Both husband and wife	143(67.5)	294(69.30)	0.798(0.423-1.50)	0.485
Husband only	20(9.40)	44(10.40)	0.854(0.57-1.28)	0.442
Husband's attitude towards optimal birth spacing				
Negative	17(8.30)	24(5.80)	1	0.178
Positive	187(91.7)	390(94.2)	0.648(0.342-1.22)	
Mothers' attitude towards optimal birth spacing & FP				
Negative	78(36.80)	158(37.3)	0.98(0.696-1.379)	0.908
Positive	134(63.2)	266(62.7)	1	
Mother correctly defines optimal birth spacing	55(25.90)	122(28.8)	0.87(0.60-1.258)	0.453
No	157(74.10)	302(71.2)	1	
Yes				
Duration of Breast feeding				
0-11 Months	22(10.40)	4(0.90)	**61.95(20.18-190.18)**	0.000
12-23months	156(73.6)	37(8.70)	**47.49(28.76-78.42)**	0.000
>=24months	34(16.00)	383(90.30)	1	

4.1.3. Multivariable analysis of factors affecting short inter birth interval

To determine the factors independently affecting inter birth interval of the last two children born to the study participants, multivariate analysis was carried out. In multivariable logistic regression analysis, educational status of the mother, contraceptive utilization, duration of breast feeding, sex of the preceding child, age during delivery of the last child and wealth index were found to be independent predictors of short birth interval (table3).

Level of education showed strong statistical association with short inter birth interval. Mothers with no formal

educational were about 3 times (AOR=3.40, 95%CL: [**1.80-6.43**]) more likely to have short inter birth interval as compared to those who attended formal education. The other strong predictor of inter birth interval was utilization of contraceptive methods. The odds of having short birth interval was higher among mothers who did not use modern contraceptive method before getting pregnant for the last child (AOR: 3.01, 95%CI: [**1.68-5.39**]) than those who used this method.

Similarly, mothers who breast fed for the preceding child for less than 24 months were more likely to have short inter birth interval than their counter parts of mothers who breast fed for 24 months or more (AOR:60.19,95%CI;[**31.61-114.59**]). Sex of the preceding child has also revealed a significant association with inter birth interval. Mothers whose preceding birth was female were about 7 times (AOR: 6.79, 95%CI; [**3.65-12.63**]) more likely to experience short birth interval than those whose child was male. Wealth index of the mother was also a strong predictor of short birth interval. The odds of having short inter birth interval was higher for mothers who belong to the poorest wealth index than the richest ones (AOR: 14.33, 95%CI; [**4.65-44.15**]).

Table 3. Multivariate analysis of determinant factors among child bearing age mothers in Arba Minch Zuria district, Gamogofa zone, Ethiopia, 2014

Variables	Crude odds ratio (95%CI)	Adjusted odds ratio (95%CI)	P-value
Educational status of respondents			
No formal education	4.28(2.91-6.29)	**3.40(1.80-6.43)**	**0.000**
Has formal education	1	1	
Occupational status of respondents			
House wife	1.81(0.81-9.79)	1.00(0.17-5.86)	1.00
Merchant	2.18(0.51-9.36)	1.46(0.16-13.24)	0.737
Farmer	1.57(0.32-7.66)	2.68(0.31-23.23)	0.372
Others♣	1	1	
Age at delivery of the last child			
17-24	0.61(0.38-1.09)	0.98(0.36-2.66)	0.965
25-29	0.71(0.44-1.15)	0.90(0.40-2.00)	0.789
30-34	0.95(0.57-1.60)	2.58(1.08-6.15)	0.032
>=35	1	1	
Contraceptive use before the last pregnancy			
No	4.44(3.12-6.33)	**3.01(1.68-5.39)**	**0.000**
Yes	1	**1**	
Sex of the preceding child			
Female	4.27(2.99-6.10)	**6.79(3.65-12.63)**	**0.000**
Male	1	**1**	
Breast feeding duration of the preceding child			
<24 Months	48.9(30.02-79.68)	**60.19(31.61-114.59)**	**0.000**
>=24 Months	1	**1**	
Place of previous delivery			
Health institution	0.75(0.442-1.26)	1.53(0.61-3.80)	0.364
Home	1	1	
Wealth index			
Poorest	5.27(2.92-9.51)	**14.33(4.65-44.15)**	**0.002**
Second	3.25(1.79-5.91)	**6.46(2.26-8.48)**	0.001
Middle	2.52(1.38-4.62)	**3.98(1.39-11.38)**	0.010
Fourth	2.46(1.34-4.51)	**3.96(1.41-11.13)**	0.009
Richest	1	1	
Previous pregnancy plan			
No	2.73(1.94-3.84)	1.44(0.90-2.61)	0.225
Yes	1	1	

*** Daily laborer, student, Employed

4.2. Qualitative result

4.2.1. Perceived disadvantages of short inter birth spacing

Majority of the discussants noted birth interval as a period for parents and children to make adequate preparations to receive a new born child and give appropriate care. It is the time when the mother primarily gets ready physically, mentally and economically. Unless this interval is planned and sufficient preparation is made, the outcome will be devastating to the health of the mother, the fetus in the womb, the father and the rest of the children at home. ***"Those who have closely spaced births are nutritionally deprived and not healthy. Besides, it decreases the productivity of the family, particularly the mother."(A 30 years old husband from short birth spacing group).***

4.2.2. Decision making process about birth spacing

There was no real consensus as to who makes the ultimate decisions regarding spacing. Almost all of the mothers and their husbands who were conforming to the recommended rang of birth spacing (optimal birth interval) reported that decision about when to have the next birth is shared between the couples (Husband and wife). Regardless of who has the upper hand in decision-making, it was reported that planning and discussion accompany the final decision. Even if opinions differ, each partner has to persuade the other when pregnancy should not occur.

On the other hand, majority of discussants who had short birth intervals indicated that the decision-making power is vested in the hands of the husband. The majority of husbands and mothers believed that the husband had the decision-making role regarding the timing of subsequent pregnancies. Based on his financial position within the family he had the final say.

Discussants added that husbands view their decision as the final word and the wives' role as trying to persuade him is unlikely. Thus, decision-making is skewed in favor of the man. Some optimal birth spacing mothers noted that, when the mother lives in an extended family, the decision making power is mainly vested in the mother. It is the mother or sometimes the father who had the final say as when to the woman should get pregnant.

4.2.3. Reasons for choosing short birth intervals

Discussants from the qualitative study also indicated that community and health care service factors deter women from adhering to optimal birth spacing. Lack of information about the benefit of contraceptive methods and optimal birth spacing was noted as the major obstacle by majority of the discussants from both categories. ***"The major reason why women are experiencing short birth interval is lack of information about family planning methods and birth spacing" (A 34 years old husband from short spacing group).***

Moreover, inaccessibility of the reproductive health care service was repeatedly underlined by short spacing mothers and their husbands from the high land areas. Shortage of public transportation service and road infrastructures compounded by the difficult topography of the district makes family planning utilization impossible in the area. The other factors preventing women from having optimal birth spacing are reliance on "clean lactation" and the negative side effects of contraceptive use, which tend to make women partially or completely stop using and experience method failure. ***"As the contraceptive method I was using is not comfortable for me I stopped using it and give birth at a short period of time." (A 30 years old woman from short spacing group).*** Some of the discussants from short spacing group mentioned that husband, parent and religious influence could also prevent women from using contraception and practicing optimal birth spacing. ***"Fear of being divorced makes women experience short birth spacing. Lack of education prevents me from influencing my husband and my life." (29 years old mother from short spacing group).*** Few discussants mentioned that if the preceding child is a female they have an intention to give birth frequently until they get a boy

5. Discussion

Understanding the determinants of short inter birth interval is critical for many sub Saharan African countries like Ethiopia, where perinatal mortality and fertility remains alarmingly high. Thus, this community based case control study identified factors influencing short inter birth interval among mothers who had at least two live births with their last child born within the last five years in Arba Minch Zuria district, Ethiopia.

In this study, the odds of having short inter birth interval was higher among mothers who had no formal education as compared to their women counter parts who attended formal education. *Similarly qualitative study discussants reported similar conclusion.* This finding is consistent with evidences from study conducted in Saudi, Nepal, Jordan and Pakistan (Abddelfatah et al. ,2007; V.sual,2001; Youssef,2005; Asifa ,&Muhammad, 2012). This can be partly explained by the fact that educated women are well informed about optimal health care choices and have greater autonomy to make decisions and use quality healthcare services.

In line with evidences from studies done in Jordan, Manipur, Ahvaz-Iran ,Egypt , Ethiopia (Youssef,2005; Singh, Singh, &Narendra,2010; Abdurrahman, & Majid, 2007; Angela, &Andrew,2007; Yohanneset,Wondafrash, Abera, & Girma,2011), the finding of the present study indicated that mothers who utilized modern contraceptive method before they got pregnant for their last child were more likely to experience short inter birth interval than mothers who used. Sex of the preceding child has also revealed a significant association with birth interval. The finding of the present study revealed that the odds of having short inter birth interval increased for mothers whose preceding birth was female than mothers who had male. Study findings from Saudi, Jordan, Manipur, Babol and Tanzania provided similar evidence (Abddelfatah et al.,2007; Youssef, 2005; Singh, Singh, Narendra,2010; Hajian, Asnafi,& Aliakbarnia ,2009).; Akim ,&Mtur,1997). This may be attributed to the reason that son is considered as a potential economic asset to the family as whole and it is therefore less likely for mothers to exercise long time breast feeding or utilize modern contraceptive method as a means of birth control until they get the desired number of sons.

Similarly, mothers who breast fed the preceding child for less than 24 months were more likely to have short inter birth interval than their counter parts of mothers who breast fed for 24 months and above. This study

finding was congruent with evidences from Jordan, Pakistan, Manipur, Ahvaz-Iran, Egypt, Iran and Nigeria (Youssef, 2005; Asifa ,&Muhammad,2012; Singh, &Singh, Narendra,2010; Abdurrahman, &Majid,2007; Angela, &Andrew,2007; Hajian, Asnafi,& Aliakbarnia ,2009; Odu, &Ogunlade, 2011). This may be due to the fact that breast feeding extends period of inter birth interval through negative hormonal feedback.

Wealth index of the mother was also a strong predictor of short inter birth interval. Consistent with evidence from study done in Saudi & Ethiopia (Abddelfatah et al.,2007, Yohanneset ,Wondafrash, Abera, & Girma,2011), the length of inter birth interval increased with increasing wealth index. This can be partly explained by the fact that wealthy women are more likely to access health care information, afford health care services and materials and thus can easily apply scientifically recommended inter birth spacing.

Statistically significant association was also seen between short birth interval and age of the mother. In line with study from Tanzania, Saudi, Nepal, Pakistan, Babol, northern Iran, Denmark, and Jordan(Exavery et al.,2012; V.sual,2001; Youssef, 2005; Asifa,& Muhammad,2012; Hajian, Asnafi, & Aliakbarnia,2009; Rasheed, &Aldabal,2007; Frank, Svend,&Olga,20011), this study revealed that mothers who belonged to the age range of 30-34 years were more likely to have short birth interval as compared to those whose age was 35 years and above. Evidence from EDHS showed similar conclusion (CSA,2011). This can be partly explained by the notion that recovery of ovarian function was faster among youngsters than older mothers. In addition, younger mothers are less likely to have exposure to health care information about family planning and optimal birth spacing than older mothers.

Discussants from the qualitative study indicated that community and health care service factors such as lack of information about the benefit of optimal birth spacing , inaccessibility of the reproductive health care service, reliance on clean lactation, the negative side effects of contraceptive use,& the influence of husband, parent and religion deter women from adhering to optimal birth spacing. Besides, discussants mentioned that if the preceding child is a female they have an intention to give birth frequently until they get a boy.

When interpreting the finding of the present study, the following limitations should be considered. The source of data for this study was based on the self-report of mothers, and immunization cards of their children. But respondents were critically informed about the importance of giving accurate information by assuring the confidentiality of their responses and it is logical to assume that biases are less likely in birth interval as compared to other sensitive issues.

Finally, there could be a recall bias since women were asked for information already happened in the distant past though different life events were used to memorize them.

6. Conclusion and recommendation

Optimal inter birth interval has significant role in reducing fertility, and maternal and child mortality. However, birth interval of children varied with different biological and socio economic factors of their families. Educational status of the mother, contraceptive utilization, duration of breast feeding, sex of the preceding child, age during delivery of the last child and wealth index of respondents were independent predictors of short inter birth interval between the last two live births.

Thus, the Ethiopian Ministry of Health together with its stalk holders should redesign the existing strategies of providing information, education and communication in the form of counseling giving critical attention to women, and their husbands to advance their awareness about the importance of modern contraceptive utilization, breast feeding and optimal birth spacing. Policy should also see new strategies to encourage women to pursue their education to at least primary school level. Moreover, this study considered only a single birth interval and therefore further researches, involving more than two inter birth intervals should be done to make these findings more informative.

Abbreviations

EMOH: Ethiopian Ministry of Health; EDHS: Ethiopian Demographic and Health Survey; SSA: Sub-Saharan African countries; TFR: Total fertility rate; WHO: World Health Organization; IBI: Inter birth interval; OBS: Optimal birth spacing; ANC: Antenatal care

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Competing interests
The authors declare that they have no competing interests.

Authors' contributions
DH conceived the study, participated in data collection, performed analysis and interpretation of the data and drafted the paper and prepared all versions of the manuscript. **TG** assisted in the design, participated in data collection, analysis and revised subsequent drafts of the paper. All authors read and approved the final manuscript.

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