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ORIGINAL ARTICLE

INFANT MORTALITY IN THE RURAL SIDAMA ZONE, SOUTHERN ETHIOPIA: EXAMINING THE CONTRIBUTION OF KEY PREGNANCY AND POSTNATAL HEALTH CARE SERVICES

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Abstract

Objectives: This study is aimed at examining the contribution of selected pregnancy and postnatal health care services to Infant Mortality (IM) in Southern Ethiopia.

Method: Data were collected from 10 rural villages of the Sidama Zone, Southern Ethiopia, using a structured interview schedule. The 1,094 eligible women respondents were selected using a combination of simple random and multi-stage sampling techniques. The main outcome variable of the study (IM) was measured by reported infant deaths during the twelve months preceding the survey, and was estimated at 9.6% or 96 infant deaths per 1,000 births. Pregnancy and health care variables were used as the main explanatory variables along with other household and individual characteristics.

Results: The predicted probabilities, using three models of logistic regression analysis, have shown that four pregnancy and postnatal health care variables (antenatal care, immunisation, exclusive breast feeding and wantedness of the pregnancy) and women's age are found to be significant predictors of IM in the study areas.

Conclusions: Finally, based on the key findings, some recommendations are given: promoting of institutional delivery seeking behaviour through behavioural change communications, training more Traditional Birth Attendants (TBAs), and maximising the use of the Health Extension Workers (HEWs) stationed at village level to make a house-to-house visit so as to encourage pregnant women to seek pregnancy and delivery care services.

Key words: *delivery care; infant mortality; immunisation; maternal health care; Southern Ethiopia*

INTRODUCTION

Infant Mortality Rate (IMR) is an accepted global indicator of the health and socioeconomic status of a given population (Sharifzadeh et al. 2008, Hossain and Mondal 2009). Improving maternal health and reducing maternal and infant mortality have been major concerns of many international summits, conferences and conventions since the late 1980's including the Millennium Summit of 2000. One of the eight Millennium Development Goals (MDGs) adopted at the Millennium Summit is improving maternal health and reducing infant mortality (MDG 4 and MDG 5) (WHO 2004).

Worldwide, about 8 million infants die annually before their first birthday (PRB 2006). Each year, 10.7 million children under the age of five die, out of which

4 million die during the first month of life. In the less developed countries, this accounts for 98 per cent of reported neonatal deaths which can be prevented if good qualities of maternal health services were available (WHO 2007, Taddele 2010).

In Ethiopia neonatal mortality has declined by 21%, and mortality under the age of five declined by 26% between 2000 and 2005 (Sathya Susman 2011). According to the results of the last Ethiopian Demographic and Health Survey (EDHS), infant mortality in urban areas was found to be 66 deaths per 1,000 live births compared to 81 deaths per 1,000 live births in rural areas giving an average of 77 infant deaths per 1,000 live births for the country (CSA and ORC Macro 2006). Approximately half of infant deaths in Ethiopia occur during the first month of life (CSA and ORC Macro 2006).

Evidences suggest that while neonatal health is found to be dependent on health care services, post-neonatal health is dependent largely on environmental factors (Sharifzadeh et al. 2008). It is believed that the factors associated with infant mortality are many. Their relative importance varies across populations depending upon the level of socio-economic and environmental set up. Some of the most important factors associated with infant mortality are premature and low birth weight (Sharifzadeh et al. 2008), health problems particularly respiratory infections (Agha 2000, Yassin 2000, Suwal 2001, Sharifzadeh et al. 2008); socio-economic and demographic factors such as class, mother's age, birth weight and interval from previous delivery (Quamrul et al. 2010); and maternal and child health care variables such as breast feeding, nutritional status, place of delivery and type of delivery care (Retherford et al. 1989).

Antenatal care that women receive during pregnancy is an important opportunity providing a pregnant woman with vaccinations to prevent tetanus, screening her for anaemia, enrolling her in the prevention of mother to child transmission of HIV, and providing her with counselling for safe delivery. All these factors help ensure that the mother remains healthy during childbirth and give her the best start in life (Taddele 2010, Hollowell et al. 2011). Antenatal care also increases the likelihood of the presence of a skilled attendant who can detect and manage complications at birth (WHO 2004).

According to Macro International (2007), about 28% of pregnant women in Ethiopia received antenatal care, and about 5% received delivery at health care facilities. The proportion receiving ANC, for example, is very low when compared to sub-Sahara African countries like Ghana (92%), Kenya (88%), Eritrea (70%) and Tanzania (78%). Non-utilisation of ANC and delivery care may result in missed opportunities that could have helped in identifying and managing the conditions that threaten the life of mothers and babies and affect maternal and child health.

Once the child is born, the access they will have to internationally recommended types and levels of vaccination is an important determinant of survival, especially during the first year of life (WHO 2004). Increasing vaccination rates means that fewer children will be vulnerable to vaccine preventable diseases such as measles which will invariably result in a substantial drop in infant mortality and morbidity rates (Bassey et al. 2010).

In a situation where general health status is poor, ANC, delivery and immunisation services are potentially effective health interventions for preventing infant and maternal mortality (Taddele 2010). Zacharia and Cochrane (1984) identified that medical attention at the time of delivery and antenatal care are significant factors in the survival chance of the new born. Despite their importance in improving pregnancy outcomes and postnatal survivals, the effectiveness of these health care programmes as means of reducing infant mortality in socioeconomically disadvantaged and vulnerable groups of women has not been rigorously studied. This study therefore examines the contribution of these pregnancy and postnatal health care factors to infant mortality in the Sidama Zone of Southern Ethiopia.

DATA SOURCES AND METHODOLOGY

The study was conducted in Southern Ethiopia by taking a representative sample of 1094 women from the Sidama Zone, one

of the most populous administrative zones of Southern Ethiopia. According to the recent census (CSA 2007), the total population of the zone was 2,954,136. With an area of 6,538 square kilometres, Sidama has a population density of 452 km² with an average household size of 4.99 persons. Of the total population, only 5.51% are urban inhabitants (CSA 2007).

The 1,094 households were selected from two agro climatic zones; highland and low land areas of the study zone using a statistical estimation given by (Cochran 1977):

$$n = \frac{\frac{Z^2 p(1-p)}{d^2}}{1 + \frac{1}{N}\left(\frac{Z^2 p(1-p)}{d^2} - 1\right)}$$

Where Z is the upper α/2 points of standard normal distribution with α = 0.05 significance level, which is Z = 1.96, d is the degree of precisions (0.04), p is taken as 0.5. The estimated sample size, using the above mentioned formula yields 600 and is weighted by 1.5 to get a total size of 900, then a 20% contingency was added. Probability sampling in a form of simple random and two-stage sampling methods was employed for selecting the required size from the study areas. Since the two sub-districts (the low and high land) were decided in advance, the first stage of the sampling started by selecting five kebeles (small villages) from the list of 38 and 36 kebeles in the lowland and highland districts respectively using simple random sampling. The two districts were of similar size and samples were not weighted. In the second stage, households were selected from the available list using random sampling, giving a total of 1,094 households.

The data for this study were generated through a structured interview schedule. With regards to addressing ethical issues, the approval of Hawassa University Research and Development Directorate and the concerned zonal administrations was sought prior to data collection. In addition, informed consent of each eligible respondent was taken just prior to the interview.

The key variables used in this study (pregnancy, postnatal health care service factors and IM) were investigated using simple and universally accepted questions. Information on 'death of infants under age one', for instance, was collected by asking respondents if a child born during the reference period has died. Because a large majority of the respondents were illiterate, it was difficult to collect some demographics on exact age of death (month). The unit of analysis was women of reproductive age who had at least one live birth in the past two years preceding the survey.

Both bivariate and multivariate analyses were employed to examine the association between the study variables and selected household and individual characteristics. In the bivariate analysis, Pearson's Chi-square test of independence was performed to test the existence of a significant association between categories of reported infant death and selected predictors.

In the logistic regression analysis, further analysis of the predictors was done controlling for the effects of confounding factors. The response variable (Infant Death) had two outcomes depending on whether or not a woman reported the death of an infant during the reference period. The outcome variables were coded as 1 if the woman had faced infant mortality and as 0 if she didn't encounter infant death. The co-linearity effect was tested using the variance inflation factor (VIF) for all independent variables; given by VIF (X_i) = $1/1\text{-}R^2_i$. The multicollinearity effect computed for each independent variable ranged between 1.031 and 1.122 which is less than the cut-off value (≥4).

RESULTS

The distribution on household characteristics of the respondents is presented in Table 1. It is shown that nearly an equal proportion of sample women were taken to represent two agro-ecological zones (the lowland and highland sub-districts with varied climates and livelihood). The large majority of the respondents (60.6%) were living in households with 4–7 members, 22.1% of the households surveyed had greater than 7 members, giving an average household size

of 5.87. About 15.3% of the women reported to have engaged in polygamous marriage arrangements, where their husbands have two or more wives at different or same locations.

More than half of the households had access to piped or protected water sources which includes private or public piped water, and protected wells and spring water. The wealth status of the households was computed from the reported ownership of nine well recognised household assets such as a radio, flash light, corrugated iron roofing, mobile phone and others. The distribution of the summary index suggested that a large proportion of the households (76.3%) have low economic status followed by medium (21.2%) and high (2.5%) wealth index (see Table 1).

The percentage distribution of respondents by ANC, place of delivery and level of immunisation coverage is shown in Table 2.

Table 1. Percentage distribution of respondents by selected household characteristics, Sidama Zone, 2011 (n=1,094)

Household characteristics	Per cent
Agro climatic zone	
Low land	51.0
High land	49.0
Household size	
2–3 persons	17.3
4–7 persons	60.6
Greater than 7 persons	22.1
Marital form	
Polygamous	15.2
Monogamous	84.8
Sources of drinking water	
Piped or protected	55.4
Unprotected	44.5
*Wealth status**	
Low	76.3
Medium	21.2
High	2.5

* Sum of ownership of nine common household assets: electricity, sewing machine, cart, mobile phone, flashlight, corrugated iron roofing, bike, radio and kerosene lamp.

Table 2. Percentage distribution of respondents by ANC services received, place of delivery and immunisation coverage, Sidama Zone, 2011

Characteristics	Per cent
Received ANC services (from trained health professionals)	
Yes	77.4
No	22.6
Place of delivery (last child)	
Home	86.1
Institutional delivery	13.9
*Complete immunisation**	37.2
Complete	62.8
Partial	

* Measured by the WHO recommended definition (WHO 2004).

For ANC, a dichotomous variable is created whether a woman had visited a skilled health care provider at least once during the last pregnancy. The measure is adopted from the World Health Organisation's definition of antenatal care (WHO 2004): visiting health professionals at least once during her pregnancy. Accordingly, 77.4% of them reported getting ANC service by trained health professionals.

Table 2 also shows that professionally assisted deliveries/institutional deliveries accounted for only 13.9% whereas a large proportion of birth occurs at home with little or no professional care services. The level of PNC was measured by the universally accepted indicator (i.e. complete immunisation). It was measured by synchronising the affirmative responses if the last child got the universally recommended vaccinations (WHO 2004): *the*

Table 3. Results of bivariate analysis (Chi-square) for selected maternal and service related factors, Sidama Zone, 2011 (n=1,094)

Name	Category	Yes	No	Total	$\chi 2$
Age of the women	15–24	2.2	37.2	39.4	13.3** (p=0.001)
	25–34	5.5	39.2	44.7	
	35–49	1.9	14.0	15.9	
	Total	9.6	90.4	100.0	
Parity	1–3	6.0	46.8	52.8	8.013* (p=0.046)
	4–6	3.3	32.2	35.5	
	7–10	3.3	32.2	13.7	
	Total	9.6	90.4	100.0	
Pregnancy reaction	Wanted	4.9	38.4	43.3	4.505* (p=0.034)
	Wait	2.7	24.6	27.2	
	Never wanted	2.0	27.4	29.4	
	Total	9.6	90.4	100.0	
Literacy status of the women	Literate	2.4	32.7	35.1	5.450* (p=0.012)
	Illiterate	7.2	57.7	64.9	
	Total	9.6	90.4	100.0	
Anti-natal care (from health professionals)	Yes	6.1	71.8	77.9	13.346*** (p=0.000)
	No	3.5	18.6	22.1	
	Total	9.6	90.4	100.0	
Complete immunisation	Yes	3.0	34.2	37.2	4.658* (p=0.118)
	No	6.6	56.2	62.8	
	Total	9.6	90.4	100.0	
Practiced exclusive breast feeding	Yes	6.9	77.7	84.6	13.437*** (p=0.000)
	No	2.7	12.7	15.4	
	Total	9.6	90.4	100.0	
Place of delivery	Home	8.0	78.1	86.1	0.512 (p=0.279)
	Institution	1.6	12.3	13.9	
	Total	9.6	90.4	100.0	

NB: * = p<0.05; ** = p<0.01; *** = p<0.001

Bacillus Calmette Guerin (BCG) Polio and Diphtheria Pertussis and Tetanus (DPT), and measles vaccination. The computed level of complete immunisation at each expected age is very low (32.7%).

Prior to examining the net contribution of each predictor to the response variable, it was important to see the existence of promising association among the variables by a bivariate analysis using Pearson's Chi-square. As Table 3 shows, with the exception of place of delivery, all remaining eight variables have an association with infant death with different levels of significance. The strongest associations are observed for ANC and practicing exclusive breastfeeding (p=0.000) (see Table 3).

In Table 4, all eight maternal and service related variables and key household variables were entered into the logistic regression analysis under three independent models.

The odds ratios (Exp /B/), which are determined from the logistic regression coefficients, indicate the increased or decreased chance of IM given a set level of an independent variable while controlling for the effects of the other variables in the model. Estimates of odds greater than 1.0 indicate that the probability of the event happening is greater than the value for the reference category. Estimates less than 1.0 indicate that the risk is less than the value for the reference category of each variable.

In model 1, only key pregnancy and postnatal health care service variables (ANC, PNC, exclusive breast feeding, and wantedness of the pregnancy) were included. In model 2, certain female variables which showed significant associations in the Chi-square analysis were included such as age of the women, parity, and literacy status. In the third model, additional household variables were included to form the full regression model.

In model 1, all the pregnancy and health care variables have become significantly associated with IM with different p values. The risk of IM is 1.439 times more for women who did not receive ANC service from health professionals at least once during the time of pregnancy compared to those who received the service (p=0.000). Similarly, those who did not complete immunisation are 1.059 times more likely to face IM compared to the reference category. The risk of IM is higher by 2.005 times for women who never wanted to become pregnant than those who wanted to become pregnant. Those who did not practice exclusive breast feeding for the first 4–5 months after birth of the child are 1.410 times more likely to encounter infant death compared to those who practiced exclusive breast feeding (p=0.000).

In model 2, additional variables (women's characteristics) were added to further examine the changes occurring in the contribution of the pregnancy and postnatal health care variables in model 1. Among the three main female characteristics (age, children ever born and literacy status), only the women's age has become a significant predictor, where the odds of IM decreased as the age of women increased. Women in the age group 25–34 and 35–49 are 57.2% and 50.5% less likely to face the risk of IM compared to the reference category. The four pregnancy and postnatal health care variables have still become important predictors of IM in model 2.

In model 3, three additional household level variables are included; namely, the major source of drinking water, wealth index, and marital form (polygamous vs. monogamous). None of these additional variables showed significant association with the response variable. Among the variables appearing significant in model 1 and 2, PNC (complete immunisation) showed no significant association with IM in model 3 (see Table 4).

DISCUSSION

This cross sectional retrospective survey has examined the effects of pregnancy and postnatal health care service variables on infant mortality in one of the most populated zones of Southern Ethiopia. The reported level of IM, although may suffer from some truncations due to recall bias on certain demographics, is 9.6% or the death of 96 infants below age 1 for every 1,000 births during the reference period preceding the survey date. The rate is much higher than the figure reported for the whole country in the last DHS, which was 77 per 1,000 births (CSA and Macro 2006). At the small population level, this figure is consistent with a study conducted in South-western Ethiopia by Taddele who computed IM of the Limu district as 8.8% (Taddele 2010).

Table 4. Results of logistic regression (odds ratio) for selected predictors (pregnancy and health care services, maternal and household variables) and Infant Mortality, Sidama Zone, 2011 (n=1,094)

	Pregnancy and health care variables		Women's variables added		Household variables added	
	Model 1		*Model 2*		*Model 3*	
Predictors	B	Exp (B)	B	Exp (B)	B	Exp (B)
ANC received from health professional						
Yes[(RC)]	–	–	–	–	–	–
No	0.822	1.439***	0.719	1.487**	0.738	1.478**
PNC (Immunisation)						
Complete[(RC)]	–	–	–	–	–	–
Partial	0.471	1.059*	0.282	1.021*	0.269	0.933
Pregnancy intention						
Wanted[(RC)]	–	–	–	–	–	–
Wanted to wait	0.287	1.333	0.199	1.220	0.246	1.279
Never wanted	0.695	2.005*	0.706	2.027*	0.695	2.004*
Exclusive breast feeding practices						
Yes[(RC)]	–	–	–	–	–	–
No	0.891	1.410***	0.844	1.430**	0.834	1.434**
Age of women						
Age 15–24[(RC)]			–	–	–	–
Age 25–34			–0.849	428**	–0.839	0.432**
Age 35–49			–0.704	495*	–0.735	0.479*
Parity						
1–3[(RC)]			–	–	–	–
4–6			–0.767	465	–0.718	0.488
7–10			–1.186	306	–1.129	0.324
Literacy status						
Literate[(RC)]			–	–	–	–
Illiterate			0.240	1.787	0.259	1.772
Sources of drinking water						
Piped or protected					–	–
Unprotected					–0.107	0.899
Wealth index						
Low[(RC)]					–	–
Medium					–0.185	0.831
High					–0.045	0.956
Marital form						
Polygamous[(RC)]					–	–
Monogamous					272	1.313
Constant	2.508		4.065	–	3.893	–

– 2 Log likelihood 660.272, 642.509 and 640.927 for the three models respectively
NB: * = p<0.05; ** = p<0.01; *** = p<0.001

The result has shown that quite a good proportion of the women (77.2%) had received ANC service during the most recent pregnancies. The fact that the measurement of ANC in this study considered "service received from health professionals at least once during the last pregnancy", may not make it possible to make comparisons across different studies which considered varied measurements.

Deliveries which take place at homes and assisted by non-health personnel, are likely to be more unsafe and unhygienic and may result in delivery-related complications leading to both maternal and infant mortality. The overwhelming deliveries in the area took place at home and only 13% at health facilities. Most infant deaths occurred in households where mothers gave their last birth at home. Even though the cultural impediments can have substantial effects on health seeking behaviours, the acute shortage of facilities and staff in many sub districts also contributed to the low level of institutional delivery in the study area. For instance, Ethiopia is one of the 57 countries with a critical shortage of health workers at every level especially in rural areas where 85% of the population live (GHWA and WHO 2006).

It has generally been assumed that factors that affect foetal and neonatal deaths are primarily endogenous (i.e. biological or demographic), while those which affect post-neonatal deaths are primarily exogenous i.e. socio-economic (Kumar et al. 2006). In view of addressing the other objective of the study i.e. identifying the effects of maternal and health care service factors on IM, three different models of logistic regression analyses were done as presented in Table 4. The results of the analysis have shown that the four pregnancy and health care factors, namely: ANC, PNC (measured by complete immunisation), exclusive breast feeding and wantedness of the pregnancy have become important predictors of IM among the study population.

In the regression analysis results given in model 1–3, the strongest association with IM is observed for ANC and exclusive breast feeding practice ($p<0.001$). In fact, immunisation appeared to have significant association in model 1 and 2 until its influencing power is reduced due to the addition of household variables in model 3. In model 2 and 3, the age of women became an additional predictor of IM with p-value less than 0.05.

Controlling for the effects of other variables in model 1, ANC has become a very strong predictor of IM. This finding is consistent with many other studies conducted in different parts of the world. For instance, a recent study in Bangladesh (Hossain and Mondal 2009) confirmed that the risk of infant mortality was 95.1% lower among those who had to take their treatment from a specialist doctor.

Due to the fact that a larger proportion of mortality among infants occurs during the first 4–5 months, the role of immunisation in reducing IM is very important. In the present study, those who completed immunisation at each appropriate age are less likely to die during infancy. A Study done in Bangladesh (2009) shows that children who were immunised had a 62.5% lower risk of death than those who were never immunised (Hossain and Mondal 2009).

The results shown in model 3 and 4 revealed a decreased risk of IM among older women compared to younger ones. Older women have already better experience of birth and have developed the confidence of giving birth at home with support of traditional birth attendants and other household members. Analysis of the national DHS data has asserted that the relationship between maternal age at birth and child mortality is U-shaped indicating a relatively higher IM among children born to mothers under age 20 and over age 40 than among mothers in the middle age groups (CSA and ORC Macro 2006). A local population based study conducted in the Amhara Regional State at Maqdella and Tenta (South Wollo districts) also revealed that infants born to teenage mothers and older mothers (35–49) die proportionally higher when compared to those born to mothers aged 20–34 (Asfaw 1996). This finding is also consistent with other studies conducted elsewhere in the world (Kumar et al. 2006, USAID 2009).

The breast feeding variable, measured by the practice of exclusive breast feeding to the most recently born child, has become one of the strongest predictors of IM. Because regular breast feeding is universal (i.e. only about 5% never breast fed their child), the exclusive breast feeding variable was used in the analysis. It was observed that women

practicing exclusive breast feeding (i.e. breast feeding the child until 4–5 months after birth) are less likely to encounter IM compared to those not practicing exclusive breast feeding. The International Baby Food Action Network (IBFAN) of Africa emphasises the key role of breast feeding in reducing IM in developing countries, stating that there is 14 times greater risk of death from diarrhoea and 3 times greater risk of exposure to acute respiratory infections (ARI) in babies not breastfed (IBFAN Africa 1999). Analysis of the Ethiopian DHS 2005 confirmed that those infants who were never breastfed had an 8 times higher child mortality risk than those breastfed for less than 6 months during the neonatal period who had in turn 3 times higher mortality risk than those breastfed for less than 12 months during the post neonatal period (Sathya Suman 2011). Other population based studies conducted in other parts of Ethiopia also confirmed the significant effects of breast feeding on IM (Deribew et al. 2007, Mustafa 2008).

It is noted that certain variables which were found significantly associated with IM in other studies are documented in this study as insignificant variables. For instance, educational status is documented by some studies as an important predictor of IM (Hagos 1991, Tesfaye 1993, Bekele 1997, Deribew et al. 2007, Kumar et al. 2007, Mustafa 2008). On the contrary, in a study conducted by Tesfu (2006) among a selected population of Afar (North-eastern Ethiopia) found that mother's education has no significant relation with infant death. Similarly, the source of drinking water, which appeared as an insignificant predictor of IM in the present study, was documented as good predictor in studies conducted in the Arusi Zone (central Ethiopia) and the Afar Region (Tesfu 2006, Berhane 2006).

There are also some variables, which are assumed to affect the outcome variable, but were not used or excluded in the present study due to some technical reasons. Such variables include; toilet facility, religion, child's health status, and birth interval. The exclusion of the first two variables (toilet facility and religion) is mainly due to the fact that the data were collected from a relatively homogenous population. More than 75% of the respondents are of the protestant faith, and all respondents were drawn from rural villages with little or no toilet facility. Information collected on child health status and birth interval was not reliable due to refusal and recall biases, and hence were excluded during the analysis. Misreporting on death of the child (especially the age and sex of the child) is also one of the limitations worth mentioning.

Finally, the strengths of this study are worth mentioning. First, the study was based on a large sample (1,094 women) selected randomly from the Sidama Zone of Southern Ethiopia, and hence its findings can be generalised to a larger population. Second, an attempt was made to emphasise the most important pregnancy and health care variables which are usually fused and/or undermined in other studies. In view of the fact that many of the previous studies are either national or regional level secondary data analysis, this study is believed to give better insight into the problems at population level.

CONCLUSION AND RECOMMENDATIONS

The study has examined the contribution of pregnancy and postnatal health care factors to infant mortality in Southern Ethiopia taking a randomly selected representative sample of 1,094 women in the conventional reproductive age group.

It is evident from the previous discussion that the pregnancy and maternal health care factors are strong predictors of IM among the study population. While the ANC service utilisation is generally found to be good compared to other zones in the region, the level of complete immunisation is far below the WHO's recommended standard. The findings imply that further reductions in infant mortality will largely depend on improving the pre and postnatal maternal health care through boosting the coverage and quality of the services for the most underserved rural villages in the region.

In view of the very low level of institutional delivery care services, concerned authorities at both local and zonal levels should give attention to the promotion of institutional delivery seeking behaviour through behavioural change communications, training of local women as Traditional Birth Attendants

(TBA), and maximising use of the Health Extension Workers (HEW) stationed at village level to make house-to-house visits to encourage pregnant women to seek pregnancy and delivery care. It is also important to ensure the integration of MCH, FP, ANC, PNC and other similar services in the local areas. Finally, it is needless to mention that such moves should target high risk pregnancies and young inexperienced mothers who have higher incidence of infant deaths.

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REFERENCES

1. Agha S (2000). The determinants of infant mortality in Pakistan. Soc. Sci. Med. 51(2): 199–208.
2. Asfaw G (1996). The effect of maternal factors on infant mortality: A survey of rural households in the Maqdella and Tenta districts, south Wello, Ethiopia. Addis Ababa University (unpublished master thesis).
3. Bassey EB, Moses AE, Udo SM, Umo AN (2010). The Impact of immunisation control activities on measles outbreaks in the Akwa Ibom State, South-South Nigeria. Online J Health Allied Scs. 9(1): 3.
4. Bekele M (1997). Levels, trends and differentials in infant mortality in rural Ethiopia. Addis Ababa University (unpublished master thesis).
5. Berhane Y (2006). Development Projects to improve maternal and child health: Assessing the impact. PLOS Med. 3(4): e192.
6. Central statistical Agency (Ethiopia) and ORC Macro (2006). Ethiopia Demographic and Health Survey 2005; Addis Ababa, Ethiopia and Calverton, Maryland, USA: Central Statistical Agency and ORC Macro.
7. Central Statistical Authority (CSA) (2007). Summary and Statistical Report of the 2007 Population and Housing Census Results. Addis Ababa, Ethiopia.
8. Cochran S (1977). Sample Size Determination. John Winley & Sons, Inc., New York.
9. Deribew A, Tessema F, Girma B (2007). Determinants of under-five mortality in the Gilgel Gibe Field Research Centre, Southwest Ethiopia. Ethiopia Journal of Health Development. 21(2): 117–124.
10. GHWA & WHO (2006). Country case study: Ethiopia's human resource for health Programme. Task force on scaling up education and training for health workers. Geneva, Switzerland accessed on March 8 2011 at http://www.who.int/workforcealliance/knowledge/case_studies/Ethiopia.pdf
11. Hagos A (1991). Infant and early childhood mortality in the Shewa Region: An investigation into the levels and differentials. Addis Ababa University. (Unpublished Master thesis).
12. Hollowell J, Oakley L, Kurinczuk JJ, Brocklehurst P, Gray R (2011). The effectiveness of antenatal care programmes to reduce infant mortality and preterm birth in socially disadvantaged and vulnerable women in high-income countries: a systematic review. Pregnancy and Childbirth 11:13 doi: 10.1186/1471-2393-11-13.
13. Hossain K, Mondal NI (2009). A study on the Health Factors of Infant and Child Mortality in Rajshahi, Bangladesh. Asian Journal of Medical Sciences. 1(3): 82–87.
14. IBFAN (1999). IBFAN Africa statement on HIV and infant feeding. The IBFAN Africa Regional Workshop on policy Guidelines for Infant Feeding and HIV. Pretoria, South Africa.
15. Kumar DD, Verma CK, Goel AAK, Sehagal VK (2006). Demographic and socio-economic correlates of infant mortality in a primitive tribe of Chhattisgarh.
16. Macro International Inc. (2007). Trends in demographic and reproductive health indicators in Ethiopia, Calverton, Maryland, USA: Macro International Inc.
17. Mustafa EH (2008). Socio-economic determinants of infant mortality in Kenya: Analysis of Kenyan DHS (2003). Accessed in April 2011 at: http://www.scientiificjournals.org/journals 2008 articles/1409.pdf.

18. Population Reference Bureau (2006). Human Population: fundamentals of growth. World health. 40(1) January–March: 20–21.
19. Quamrul HC, Islam R, Hossain K (2010). Effects of Demographic characteristics on neonatal, post neonatal, infant and child mortality. Current Research. Journal of Biological Sciences 2(2): 132–138.
20. Retherford RD, Choe MK Choe S, Thapa, Gubhaju BB (1989). To what extent does breastfeeding explain birth interval effects on early children mortality? Demography. 26(3): 439–450.
21. Sathya Suman A (2011). Neonatal and post-neonatal mortality decline in Ethiopia: evidence from DHS 2005. Review of research and social intervention. 32: 44–62.
22. Sharifzadeh GR, Namakin K, Mehrjoofard H (2008). An epidemiological Study on Infant Mortality and Factors Affecting it in Rural Areas of Birjand, Iran. Iran J. of Pediatrition. 18(4): 335–342.
23. Suwal JV (2001). The main determinants of infant mortality in Nepal. Soc. Sci. Med. 53(12): 1667–1681.
24. Taddele T (2010). Infant mortality and maternal health care services in Limu-Seka Woreda, Oromiya. Addis Ababa University (unpublished master thesis).
25. Tesfaye M (1993). Demographic determinants of infant and child mortality in an Ethiopian community: The case of Sebeta town. Addis Ababa University (unpublished master thesis).
26. Tesfu A (2006). Assessment of the relationship between infant death and high risk Fertility behaviour among married women of Afar zone four. Addis Ababa University Master degree of public health (unpublished).
27. USAID (2009). Health related research and development activities at USAID. An update on the five year strategy, 2006–2010. Accessed in June 2011 at http://pdf.usaid.gov/pdf-docs/PDACN515.pdf
28. World Health Organisation (2004). Making pregnancy safer: The critical role of a skilled attendant: A joint statement by the WHO, ICM and FIGO. Geneva, Switzerland. Accessed in May 2011 at http://whqlibdoc.who.int/publications/2004/924159169
29. World Health Organisation (WHO) (2004). World report on knowledge for better health: Strengthening health systems. Geneva: World Health Organisation.
30. World Health Organisation (2007). Maternal Mortality in 2005: Estimates Developed by WHO, UNICEF, UNFPA, and the World Bank. Geneva, Switzerland. Accessed in April 2011 at WWW. Safemotherhood.org: 2002
31. Yassin KM (2000). Indices and socio-demographic determinants of childhood mortality in rural Upper Egypt. Soc. Sci. Med. 51(2): 185–197.
32. Zacharia K, Cochrane S (1984). Infant and Child Mortality as a Determinant of Fertility: The Policy Implication in Fertility and Family, United Nations (UN), New York.

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