

## ORIGINAL RESEARCH

# Where do women give birth in rural Tanzania?

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## ABSTRACT

**Introduction:** Skilled birth attendance is one of the key factors in improving maternal and neonatal health but coverage is frequently less than 50% in many African and Asian countries, especially in rural areas. This article reports the findings on skilled birth attendance in a remote area with a large nomadic population in northern Tanzania.

**Methods:** In a secondary analysis of data from a retrospective study on immunisation rates, data were compiled on the rates of skilled birth attendance at 8 mobile reproductive and child health clinics run by a rural first-referral hospital in the Mbulu area, covering the years 1998, 1999, 2006 and 2007. These data were analysed according to tribal affiliation and distance from health institutions with obstetric services.

**Results:** Based on 3851 data sets, average rates of skilled birth attendance were 27%, 24%, 28% and 30% in 1998, 1999, 2006 and 2007, respectively ( $p = 0.02$ ). At individual clinics, rates could be as low as 5–10%. Only at one clinic, significant improvement occurred over time ( $p < 0.01$ ). In the univariate analysis, affiliation to the Iraqw tribe was a strong predictor of higher rates of skilled birth attendance in comparison with the nomadic Datoga tribe for all years combined (odds ratio [OR] 2.43 [95% confidence interval {CI} 1.92-3.07]), whereas distance showed only a minor influence (OR 1.02 [95% CI 1.01-1.02]). In the multivariate analysis, only tribal affiliation in 2007 (OR 2.69 [95% CI 1.12-6.46]) and for all years combined (OR 1.65 [95% CI 1.04-2.61]) was a significant factor.

**Conclusions:** This study documented lower than the national average rates of skilled birth attendance in a rural area in Tanzania, especially among the nomadic Datoga tribe, over several years. The effect of distance was not consistent. To increase rates of women giving birth with skilled attendance in rural, remote settings and in populations with large proportions of nomadic people, a



multi-faceted approach involving education in and sensitisation for pregnancy- and delivery-related issues, support for planned and emergency transportation, and improved quality of obstetric and neonatal services needs to be explored.

**Key words:** distance, ethnic background, nomadic pastoralists, place of delivery, skilled birth attendance, Tanzania.

## Introduction

Qualified antenatal care, skilled birth attendance, access to emergency obstetric care and neonatal resuscitation skills are vital components to substantially reduce maternal, perinatal and neonatal mortality in developing countries<sup>1,2</sup>. The level of skilled birth attendance varies markedly among and within regions and countries, being well below 50% in many countries in South-East Asia and Sub-Saharan Africa<sup>3</sup>. Although official nation-wide figures may show high coverage rates, this picture can be misleading. Typically, rates of skilled attendance are lower in rural than in urban areas<sup>4,5</sup>. This situation applies to Tanzania where in 2004/2005 the average rate of skilled attendance was as high as 81% in urban areas and as low as 39% in rural, remote districts<sup>6</sup>. Even within rural regions, marked differences may exist which can be related to cultural norms, socioeconomic circumstances, accessibility of health institutions and service provision<sup>4,5,7</sup>. In the case of nomadic populations, it is even more difficult to provide health services, including obstetric care with skilled birth attendance<sup>8</sup>.

In this context, findings are described from a secondary analysis of data on skilled birth attendance obtained during a large retrospective study on immunisation in a remote, rural area in the Manyara region in northern Tanzania<sup>9</sup>. In this area significant numbers of people belong to a nomadic tribe, and health institutions which provide delivery services are scattered over long distances<sup>10-13</sup>. The authors were especially interested to analyse whether changes would occur between the two periods covered by this study (1998/1999 and 2006/2007), and whether tribal affiliation and/or distance to health institutions with delivery services would affect rates of skilled birth attendance.

## Methods

### *Setting*

The original retrospective study on immunisation rates was conducted at the facilities of Haydom Lutheran Hospital (HLH), a rural church hospital in northern Tanzania. The HLH is located at the southern edge of Mbulu District, 380 km south-west of Mount Kilimanjaro. The 400 bed hospital serves a population of more than half a million people, and offers surgical, medical, gynaecological, obstetric, and paediatric services<sup>10,12,13</sup>. During the study period, the numbers of in-patients increased from 11 000 to 16 000, and out-patients from 65 000 to 85 000. Deliveries at the hospital increased from 2000 to 4500<sup>12,14-17</sup>. Mobile reproductive and child health (RCH) clinics located up to 100 km from HLH, serve the population on a monthly basis using a four-wheel-drive vehicle or a light aircraft for more remote locations. During 1998-1999 there were such 20 clinics, while by 2006-2007 there were 27 clinics. Annually, these clinics conduct 25 000 to 35 000 antenatal care examinations and 65 000 to 85 000 examinations of children under 5 years<sup>12,14-17</sup>. Eight of these RCH clinics (Endaharghadat, Endanyawish, Endamilay, Getanyamba, Gosamwan, Harbarghet, Labay and Yaeda Chini) were purposively chosen to represent differences in tribal affiliation, geographic location and accessibility for the main parent study<sup>9,14-17</sup>.

### *Population characteristics*

The Mbulu area, located in the southern Karatu district and the Mbulu district, is a rural, difficult to reach area with few roads and little transportation infrastructure<sup>10,12,13</sup>. Its population consists of all four African language groups and significantly differing ways of life: the main tribes are the



Cushitic Iraqw with a population of approximately 500 000, who are mainly subsistence farmers with some domestic cattle<sup>10,13,18,19</sup>; and the Nilotic Datoga, who number approximately 100 000 to 200 000 people and are nomadic pastoralists, moving with their livestock over long distances<sup>10,11,13,20,21</sup>. The Khoisan Hadzabe, being true hunters-gatherers with a non-sedentary lifestyle, number only 1000–1500 people<sup>22</sup>. The Iraqw populate the highland plateau of the Mbulu and Karatu districts where the RCH clinics Endaharghadat, Endamilay, Getanyamba, Gosamwan, Harbarghet, and Labay are located<sup>18,19</sup>. The Datoga and Hadzabe reside in the Yaeda Valley between Lake Eyasi and the eastern escarpment (location of the RCH clinics Endanyawish and Yaeda Chini)<sup>20-22</sup>, with the Datoga additionally occupying areas south of the HLH catchment area in Hanang district<sup>20,21</sup>. The remaining tribes belong to the Bantu who are typically subsistence farmers or small-scale traders<sup>10,13</sup>. The Datoga and the Hadzabe are difficult to reach with any kind of social services, including healthcare provision<sup>10,13,20-22</sup>. The Iraqw and Bantu communities are more easily accessible with social and health services<sup>10,13,18,19</sup>. Traditional birth attendants are present in the Iraqw and Datoga tribes, but they are not trained in modern obstetric care and co-operate only to a limited degree with the official health system<sup>18-21</sup>.

## Data collection

Data on all infants from the 8 RCH clinics who were registered at these sites in the years 1998, 1999, 2006 and 2007, were included in the retrospective analysis. For the purpose of this secondary analysis, the following variables were included:

1. Major tribal affiliation at each RCH clinic. Data on tribal affiliation were not provided on an individual basis in the records because Tanzanian national policy does not favour collection of individual data with regard to tribal affiliation. Thus, major tribal affiliation was defined as the tribe to which the vast majority of infants seen at the particular RCH clinic belonged.
2. Average distance from the catchment area of the respective RCH clinic to main healthcare provider, typically HLH or another health institution where obstetric services with skilled birth attendance were provided (Mbulu district hospital; Labay dispensary and Maretadu Juu dispensary).
3. Status of skilled birth attendance for each infant (at a hospital, health centre, dispensary, or at home) registered at the respective RCH clinic. Births in health institutions (dispensary, health centre, hospital) were deliveries with skilled attendance. This information was self-reported by the mothers when attending the RCH clinics for the first time with their infants.

Information about the variables tribal affiliation and distance was provided by the RCH staff. The data on skilled attendance were taken from the respective records of each single RCH clinic, which had been compiled by the RCH staff as part of the reporting requirements for the national immunisation program. All data were entered manually in data collection sheets, checked for inconsistencies and then entered into SPSS v15.0 ([www.spss.com](http://www.spss.com)) for analysis.

## Data analysis

Differences in rates of skilled birth attendance at delivery among the RCH clinics and among the 4 years of the study were analysed using the  $\chi^2$  test. In order to correlate the dependent variable (rate of skilled birth attendance) at the different clinics and over the time periods with possible underlying factors, both univariate and multivariate logistic regression analyses were performed using the independent variables of major tribal affiliation and distance to health institution. Odds ratios (OR) with 95% confidence intervals (CI) were calculated. The level of significance (two-sided) was defined as  $p < 0.05$ .

## Ethical approval

Ethical approval for the main study was obtained from the National Institute of Medical Research (NIMR) and the



Commission for Science and Technology (COSTECH) in Tanzania and the Human Research Ethics Committee at Curtin University of Technology in Australia, while permission to use the RCH records was obtained from HLH.

## Results

A total of 3868 infants (1941 male, 1927 female;  $p = 0.82$ ) were included in the data base. Because information on the method of delivery was missing for 17 infants, 3851 data sets were analysed.

Throughout the years, rates of skilled birth attendance above 40% among all attendants registered at the RCH clinic were reported from only 2 clinics (Endaharghadat 2007 & Gosamwan 2006). At some sites, the rate could be as low as 5-10% (Harbarghet 1998/1999, Endanyawish 1999/2006/2007, Yaeda Chini 1999). Average rates of skilled attendance were 27%, 24%, 28% and 30% in 1998, 1999, 2006 and 2007, respectively ( $p = 0.02$ ) (Table 1, Fig1). The significant difference in the yearly average rates of skilled attendance was attributable to the difference between the years 1999 and 2007.

In 3 clinics (Getanyamba, Endaharghadat, Endamilay), no significant changes occurred during the 4 study years (Table 1, Fig1). In 2 clinics (Harbarghet, Gosamwan), there was a trend for higher rates of skilled birth attendance during the second period but this did not reach significance. At only one site (Labay), attendance rates improved significantly over time which was mainly related to higher numbers of women giving birth in the local Labay Dispensary (Table 1, Fig1). All these clinics were attended predominantly by the Iraqw people, and distance to a hospital was not more than 30 km; in the case of Labay and Gosamwan the distance was less than 5–10 km to the next dispensary with obstetric facilities as an alternative to the hospital.

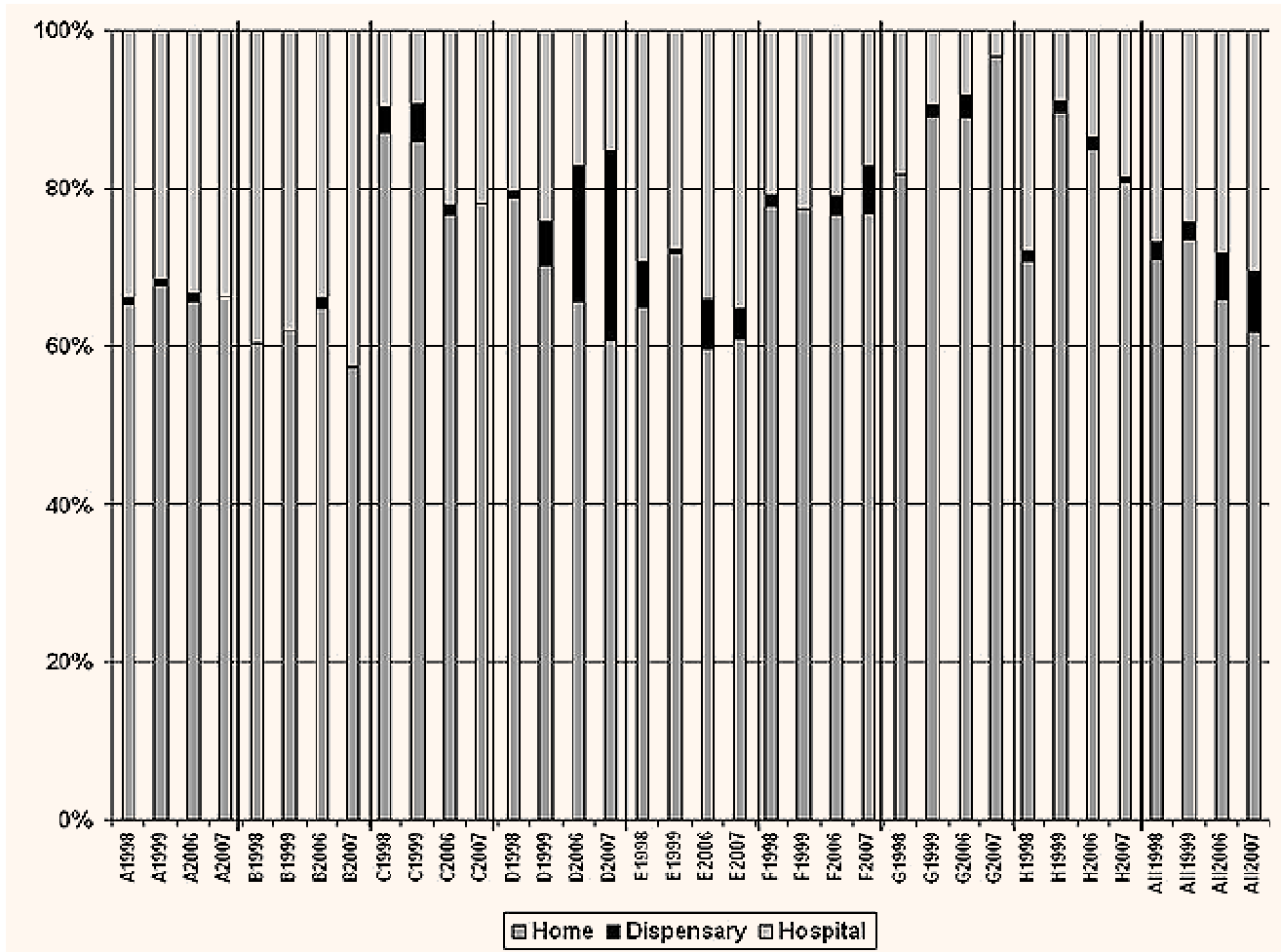
Skilled birth attendance rates decreased over time at 2 clinics, more markedly at Endanyawish than at Yaeda Chini. This was significant for Yaeda Chini but not for Endanyawish, probably due to low numbers (Table 1, Fig1).

These 2 clinics were visited by the Datoga people and were located more than 50 km from the next health institution with obstetric services.

Differences of skilled attendance rates among the clinics were significant in each year when applying the  $\chi^2$  test (Table 2). In univariate logistic regression, affiliation to the Iraqw tribe was a strong predictor for higher rates of skilled birth attendance (OR 2.99-3.11), except in 1998 when tribal affiliation played no significant role. Shorter distance to a health institution with obstetric services was a significant predictor in 1999, 2006 and 2007 and for all years combined (OR 1.02-1.03), but not in 1998 in the univariate analysis. In multivariate logistic regression, distance did not remain a significant predictor, and the effect of tribal affiliation was reduced but still significant in 2007 (OR 2.69 [95% CI 1.12-6.47]) and for all years combined (OR 1.65 [95% CI 1.04-2.61]).

## Discussion

The retrospective analysis revealed that rates of skilled birth attendance varied markedly among different RCH sites in a rural, remote and difficult-to-reach area and were, with a maximum mean of 30% in 2007, considerably lower than national rural figures from corresponding survey years (1999 and 2004/2005). Only on the island of Pemba and in northern Zanzibar did less than 30% of women give birth with skilled attendance<sup>6,23</sup>. The national average for rural areas (39%) and for the administrative region of Manyara (36%) was rarely reached<sup>6,23</sup>. Only at one clinic (Labay) was there significant improvement over time, where a marked increase in women giving birth at the local dispensary contributed to this development. These findings are in contrast with another study from the same area which reported a rate of 57% of skilled birth attendance for the year 2000<sup>24</sup>. The data in the latter study were derived from facility records, and the high percentage was due to influx of women giving birth from neighbouring districts in search for quality delivery services. An earlier prospective study, conducted in 1995 and 1996, reported that 43% of women gave birth with skilled attendance; this study used a representative sample of the whole area and not only of more remote locations, thus the average rate was higher<sup>25</sup>.



**Figure 1: Levels of skilled birth attendance at the different reproductive-and-child-health clinics over the years (relative percentages). A, Getanyamba; B, Endaharghadat; C, Harbarghet; D, Labay; E, Gosamwan; F, Endamilay; G, Endanyawish; H, Yaeda Chini; All, all clinics.**

In the 2 clinics attended by Datoga people (Endanyawish, Yaeda Chini), the rates of skilled birth attendance were considerably reduced. Hence, in univariate analysis tribal affiliation was a strong predictor of coverage rates in 1999, 2006 and 2007 and for all years combined. In 1998 the influence of tribal affiliation was not significant, which could have been due to the low levels of skilled birth attendance at the Iraqw sites of Harbarghet, Labay and

Endamilay. In another study from northern Tanzania which included mainly the Maasai tribe, who are comparable in culture to the Datoga, rates of skilled birth attendance were as low as 7% and similar to our results for this nomadic group<sup>26</sup>.



**Table 1: Deliveries with skilled birth attendance at the 8 reproductive-and-child-health clinics**

Clinic and year		Skilled attendance <i>n</i> (%)		Chi-square (df=3)	Tribal affiliation	Distance <sup>†</sup> (km)
		Yes	No	<i>P</i> -value		
Getanyamba	1998	44	83	0.98	Iraqw	8 (HLH)
	1999	41	86			
	2006	37	71			
	2007	36	71			
	All	158 (34)	311			
Endaharghadat	1998	17	26	0.85	Iraqw	10 (HLH)
	1999	11	18			
	2006	25	46			
	2007	26	35			
	All	79 (39)	125			
Harbarghet	1998	8	54	0.19	Iraqw	20 (Mbulu hospital) (60 to HLH)
	1999	15	92			
	2006	20	66			
	2007	19	68			
	All	62 (18)	280			
Labay	1998	52	194	<0.01*	Iraqw	22 (HLH)
	1999	64	151			
	2006	74	142			
	2007	103	160			
	All	293 (31)	647			
Gosamwan	1998	55	102	0.09	Iraqw	25 (HLH)
	1999	50	127			
	2006	58	86			
	2007	70	109			
	All	233 (35)	424			
Endamilay	1998	31	108	0.99	Iraqw	30 (HLH)
	1999	34	116			
	2006	39	128			
	2007	42	139			
	All	146 (23)	491			
Endanyawish	1998	2	9	0.27	Datoga	50 (Mbulu hospital) (>100 to HLH)
	1999	7	57			
	2006	8	65			
	2007	2	57			
	All	19 (9)	188			
Yaeda Chini	1998	21	51	0.02*	Datoga	70 (HLH)
	1999	8	70			
	2006	19	107			
	2007	23	96			
	All	71 (18)	324			

HLH, Haydom Lutheran Hospital; df, degree(s) of freedom.

\**P* < 0.05; †Distance to main health institution with obstetric services





**Table 2: Tribal affiliation and distance to health institutions compared with rates of skilled birth attendance at all reproductive-and-child-health sites**

All clinics, year	Skilled birth attendance		Chi-square (df=7) P-value	Tribal affiliation (Iraqw vs Datoga)	Distance <sup>†</sup> (km)	Tribal affiliation & distance
	Yes	No		OR (95% CI)	OR (95% CI)	AOR (95% CI)
1998	230	627	0.01*	0.95 (0.57-1.58)	1.00 (0.99-1.01)	0.38 (0.13-1.11) 1.02 (0.99-1.04)
1999	230	717	< 0.01*	3.09 (1.77-5.39)*	1.03 (1.01-1.04)*	1.60 (0.61-4.19) 1.02 (0.99-1.04)
2006	280	711	< 0.01*	2.99 (1.94-4.61)*	1.02 (1.01-1.03)*	2.18 (0.92-5.17) 1.01 (0.99-1.03)
2007	321	735	< 0.01*	3.11 (1.99-4.86)*	1.02 (1.01-1.03)*	2.69 (1.12-6.47)* 1.00 (0.99-1.02)
All	1061	2790	0.02*	2.43 (1.93-3.07)*	1.02 (1.01-1.02)*	1.65 (1.04-2.61)* 1.01 (0.99-1.02)

AOR, Adjusted odds ratio; CI, confidence interval; df, degree(s) of freedom; HLH, Haydom Lutheran Hospital; OR, odds ratio.

\* $P < 0.05$ ; †Distance to main health institution with delivery services.

Distance to health facilities exerted only a minor influence in 1999, 2006 and 2007 and for all years combined; in 1998 it was not significant. This latter result could be related to the Iraqw-dominated RCH site Harbarghet. Although the distance to the district hospital at Mbulu was only approximately 20 km, many women may have gone elsewhere to give birth due to concerns with the quality of obstetric care. Thus the effective distance to a well-functioning health unit with obstetric services (HLH) was more than 50 km. It has been found that rates of skilled birth attendance may not be a linear function of distance, but most likely also of perceived quality of care at the institution<sup>4,5,7</sup>. This is regularly affected by the state of the health facilities, staff availability, their skills and practices, drug supply, and the level of user fees. If quality of care is regarded as low, women will not attend even geographically close sites to give birth<sup>27,28</sup>.

The improving figures for 2006 and 2007 at Harbarghet may indicate changes in the obstetric services at the district hospital in Mbulu. The example of Labay demonstrates that provision of a functioning health institution close to the population (Labay Dispensary) can contribute significantly to improved rates<sup>5,7</sup>. Low rates of skilled birth attendance at the Endamilay Clinic, which was predominantly used by the Iraqw people, may have contributed to the low OR during

the years 1999, 2006 and 2007. It appeared that rates of skilled birth attendance were only close to national averages for rural areas where the distance to functioning health facilities (hospital or dispensary) was less than 20–25 km.

In the multivariate analysis, tribal affiliation in 2007 and for all years combined was the only remaining significant predictor. These results may reflect the fact that clinics that were mainly attended by Iraqw people and had low rates of skilled birth attendance for various reasons, were sometimes located close to health institutions with obstetric services (Harbarghet and Endamilay), thus diminishing the influence of tribal affiliation, especially in 1998 and 1999.

Tribal affiliation must be viewed as a proxy for the cultural differences between the Iraqw and Datoga and their approaches and access to health care<sup>5,7,10,18-21</sup>. As the Datoga are mainly nomadic pastoralists, their ability and willingness to attend health institutions to give birth is restricted as they move with their cattle from one place to another<sup>10,20,21</sup>. At times official health services may be perceived as intimidating<sup>5,7,27,29</sup>. Furthermore, due to strong cultural traditions, childbirth is seen as a matter for the family, and the presence during childbirth of people outside the Datoga culture may be viewed unfavourably<sup>10,20,21</sup>. It is only during recent years that this cultural view has changed slightly, so it



is not surprising that the rates at their sites are among the lowest in this study, and probably nationwide. However, the Iraqw encompass the concept of 'foreign healers' in their approach to seeking health care, so they more easily adjust to the modern approach to obstetric care<sup>10,18,19,30,31</sup>.

Although traditional birth attendants are present in both tribes, one study from Tanzania indicated some level of dissatisfaction with the services provided by traditional birth attendants<sup>32</sup>. To improve this situation it may be more appropriate to train community health workers from within the tribe in delivery skills<sup>8,32</sup>. Another approach could be to offer free or subsidised, planned and/or emergency transportation from home to a facility with obstetric services, in order to increase rates of institutional deliveries with skilled attendance. This approach was chosen by HLH, the major hospital in the area, and the number of deliveries at the hospital has increased considerably since this strategy was introduced<sup>16,17</sup>. In 2009, more than 4500 women gave birth at the hospital<sup>17</sup>.

### *Limitations of the study*

A shortcoming of this study was the retrospective approach which made it impossible to collect information on other relevant factors, such as education, household wealth, health knowledge, and actual or perceived quality of care<sup>5,7</sup>. Although it is commonly assumed that skilled birth attendance contributes to improved maternal and neonatal outcomes, the evidence for this assumption has to be questioned in the light of some recent studies<sup>33,34</sup>. No qualitative data for the reasons to give birth at home could be collected. Following the 2009 review by Gabrysch and Campbell<sup>7</sup>, it was only possible to investigate some aspects of sociocultural factors (tribal affiliation) and physical accessibility (distance), and aspects of economic accessibility or perceived need could not be analysed. Another disadvantage was that only the data of women registered at the RCH clinics could be collected. This group may not have been representative of the whole population. Those not registered at the RCH clinics may have had even lower rates of skilled birth attendance at delivery, although

the two other studies from the area do not confirm this assumption<sup>24,25</sup>.

## Conclusions

This study documented lower than the national average rates of skilled birth attendance over several years in a rural area, especially among the nomadic Datoga tribe. Distance to a functioning health institution with obstetric services did not play a consistent role. To increase rates of skilled birth attendance in rural, remote settings and among populations with large proportions of nomadic people, a multi-faceted approach with education in and sensitisation to pregnancy- and delivery-related issues, support for planned and emergency transportation, and improved quality of obstetric and neonatal services needs to be explored<sup>26,35-37</sup>.

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## References

1. Starrs AM. Delivering for women. *Lancet* 2007; **370(9595)**: 1285-1287.
2. Lawn JE, Lee AC, Kinney M, Sibley L, Carlo WA, Paul VK et al. Two million intrapartum-related stillbirths and neonatal deaths: where, why, and what can be done? *International Journal of Gynaecology Obstetrics* 2009; **107(Suppl1)**: S5-S19.
3. Countdown to 2015 Coordinating Committee. *Countdown to 2015 decade report (2000–2010): taking stock of maternal, newborn and child survival*. New York, NY: UNICEF, 2010. Available: <http://www.countdown2015mnch.org/reports-publications/2010-report/2010-report-downloads> (Accessed 31 March 2011).





4. Say L, Raine R. A systematic review of inequalities in the use of maternal health care in developing countries: examining the scale of the problem and the importance of context. *Bulletin of the World Health Organization* 2007; **85(10)**: 812-819.
5. Thaddeus S, Maine D. Too far to walk: maternal mortality in context. *Social Science and Medicine* 1994; **38(8)**: 1091-110.
6. National Bureau of Statistics, and ORC Macro. *Tanzania Demographic and Health Survey 2004-05*. Daressalaam, Tanzania: NBS and ORC Macro, 2005.
7. Gabrysch S, Campbell OM. Still too far to walk: literature review of the determinants of delivery service use. *BMC Pregnancy and Childbirth* 2009; **9**: 34.
8. Sheik-Mohamed A, Velema JP. Where health care has no access: the nomadic populations of sub-Saharan Africa. *Tropical Medicine and International Health* 1999; **4(10)**: 695-707.
9. Krüger C. Immunization status of infants in a remote area in rural Tanzania. Masters thesis. Perth, Australia: Curtin University of Technology, 2009.
10. Olsen BE. Motherhood - a hazardous endeavour. Maternal deaths and urinary tract infections in pregnancy in rural northern Tanzania. Doctoral thesis. Bergen, Norway: University of Bergen, 2002.
11. Mulder MB. Demography of pastoralists: preliminary data on the Datoga of Tanzania. *Human Ecology* 1992; **20(4)**: 383-405.
12. Evjen-Olsen B, Olsen OE, Kvåle G. Achieving progress in maternal and neonatal health through integrated and comprehensive healthcare services – experiences from a programme in northern Tanzania. *International Journal of Equity in Health* 2009; **8**: 27.
13. Hinderaker SG. Perinatal mortality and anaemia in pregnancy in rural northern Tanzania. Doctoral thesis. Bergen, Norway: Centre University of Bergen, 2003.
14. Haydom Lutheran Hospital. *Haydom Lutheran Hospital – Annual reports 1998/1999*. Haydom, Tanzania: Haydom Lutheran Hospital, 1999 & 2000.
15. Haydom Lutheran Hospital. *Haydom Lutheran Hospital – Annual reports 2000-2005*. Haydom, Tanzania: Haydom Lutheran Hospital, 2001, 2002, 2003, 2004, 2005 & 2006.
16. Haydom Lutheran Hospital. *Haydom Lutheran Hospital – Annual reports 2006/2007*. Haydom: Haydom Lutheran Hospital, 2007 & 2008.
17. Haydom Lutheran Hospital. *Haydom Lutheran Hospital – Annual reports 2008/2009*. Haydom: Haydom Lutheran Hospital, 2009 & 2010.
18. Rekdal OB. Kulturell kontinuitet og sosial endring. En studie av iraqw-folket i det nordlige Tanzania [Change and continuity in Iraqw society and culture]. Masters thesis. Bergen, Norway: University of Bergen, 1991.
19. Rekdal OB. The invention by tradition: creativity and change among the Iraqw of northern Tanzania. Doctoral thesis. Bergen, Norway: University of Bergen, 1999.
20. Blystad A. The pastoral Barabaig: fertility, recycling and the social order. Dissertation thesis. Bergen, Norway: University of Bergen, 1992.
21. Blystad A. Precarious procreation. Datoga pastoralists at the late 20th century. Doctoral thesis. Bergen, Norway: University of Bergen, 2000.
22. Madsen A. *The Hadzabe of Tanzania. Land and human rights for a hunter-gatherer community (IWGIA document no 98)*. Copenhagen: International Work Group for Indigenous Affairs, 2000.
23. National Bureau of Statistics, and Macro International. *Tanzania Reproductive and Child Health Survey 1999*. Calverton, MD: National Bureau of Statistics and Macro International, 2000.



24. Olsen ØE, Ndeki S, Norheim OF. Availability, distribution and use of emergency obstetric care in northern Tanzania. *Health Policy and Planning* 2005; **20(3)**: 167-175.
25. Olsen BE, Hinderaker SG, Lie RT, Bergsjø P, Gasheka P, Kvåle G. Maternal mortality in northern rural Tanzania: assessing the completeness of various information sources. *Acta Obstetrica et Gynecologica Scandinavica* 2002; **81(4)**: 301-307.
26. Magoma M, Requejo J, Campbell OM, Cousens S, Filippi V. High ANC coverage and low skilled attendance in a rural Tanzanian district: a case for implementing a birth plan intervention. *BMC Pregnancy and Childbirth* 2010; **10**: 13.
27. Mrisho M, Schellenberg JA, Mushi AK, Obrist B, Mshinda H, Tanner M et al. Factors affecting home delivery in rural Tanzania. *Tropical Medicine and International Health* 2007; **12(7)**: 862-872.
28. Kruk ME, Mbaruku G, McCord CW, Moran M, Rockers PC, Galea S. Bypassing primary care facilities for childbirth: a population-based study in rural Tanzania. *Health Policy and Planning* 2009; **24(4)**: 279-288.
29. Young AG. *Vaccination, harm reduction, and vulnerability among children in a northern Datoga community*. In: Proceedings, 2007 American Anthropology Association Annual Meeting; 28 Nov–2 Dec 2007; Washington DC; 2007.
30. Rekdal OB. Cross-cultural healing in east African ethnography. *Medical Anthropology Quarterly* 1999; **13(4)**: 458-482.
31. Vaga BB. The search for care and cure: exploring health seeking behaviour in Mbulu district, Tanzania. Thesis. Bergen, Norway: University of Bergen, 2004.
32. Mbaruku G, Msambichaka B, Galea S, Rockers PC, Kruk ME. Dissatisfaction with traditional birth attendants in rural Tanzania. *International Journal of Gynaecology and Obstetrics* 2009; **107(1)**: 8-11.
33. Scott S, Ronsmans C. The relationship between birth with a health professional and maternal mortality in observational studies: a review of the literature. *Tropical Medicine & International Health* 2009; **14(12)**: 1523-1533.
34. Sorensen BL, Elsass P, Nielsen BB, Massawe S, Nyakina J, Rasch V. Substandard emergency obstetric care - a confidential enquiry into maternal deaths at a regional hospital in Tanzania. *Tropical Medicine & International Health* 2010; **15(8)**: 894-900.
35. Campbell OM, Graham WJ, Lancet Maternal Survival Series steering group. Strategies for reducing maternal mortality: getting on with what works. *Lancet* 2006; **368(9543)**: 1284-1299.
36. Koblinsky M, Matthews Z, Hussein J, Mavalankar D, Mridha MK, Anwar I et al. Going to scale with professional skilled care. *Lancet* 2006; **368(9544)**: 1377-1386.
37. Filippi V, Ronsmans C, Campbell OM, Graham WJ, Mills A, Borghi J et al. Maternal health in poor countries: the broader context and a call for action. *Lancet* 2006; **368(9546)**: 1535-1541.