Original Article

Association Between Sociodemographic Characteristics and Assisted Childbirth by Qualified Personnel in Madagascar

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Abstract

Objective: This study aims to analyze the association between the likelihood of giving birth in a healthcare facility and various sociodemographic characteristics in Madagascar.

Materials and methods: This study utilized data from the 2021 Madagascar Demographic and Health Survey which included a representative sample of women of reproductive age (15-49 years). The sociodemographic variables analyzed included age, birth order, education level, region residence and economic status with the place of delivery being the primary dependent variable. Data analysis was conducted using R software. A chi-square test was applied to assess associations between variables, with a significance threshold set at 5%.

Results: The prevalence of institutional childbirth services usage in Madagascar was 37.4% (35.1-39.7). The results showed that women under 20 years had an assistance rate of 36.7% (33.9-39.4), while the rate for primiparas reached 49.9% (48.5-51.3). Prenatal visits, mother's age, birth order, region, residence, education level, and economic quintile significantly influenced access to care, with p-values < 0.0001. Only 17.5% (15.6-19.4) of women in the lowest quintile received qualified assistance at childbirth.

Conclusion: The results highlight the impact of age, birth order, residence, education level, region and socioeconomic status on access to childbirth services, necessitating a multisectoral approach to improve equity.

Keywords: Assisted Childbirth; Equity; Madagascar; Maternal Mortality; Prenatal Visits

Introduction

Equitable access to maternal health services is a major global challenge, particularly in developing countries (1), where maternal mortality rates remain concerning despite significant progress. In 2020, the World Health Organization (WHO) estimated that approximately 287,000 women died due to complications related to pregnancy or childbirth. A substantial portion of these deaths could have been prevented through appropriate and timely obstetric care (1-3). The connection between quality obstetric care and universal access to maternal health services in reducing maternal mortality is well documented (2). Indeed, assisted childbirth by qualified personnel is significantly associated with a reduction in

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maternal mortality, as the presence of competent health professionals helps prevent and effectively manage obstetric complications, thereby substantially reducing the risk of maternal death.

In low- and middle-income countries, where access to maternal health care remains limited and unequal (1), the situation is particularly alarming, with nearly 95% of global maternal deaths concentrated in this region in 2020 (3). This statistic reflects structural inequalities, such as limited access to prenatal and obstetric care, shortages of qualified health personnel, and inadequate infrastructure (4). Economic, geographic, and cultural barriers exacerbate disparities between rural and urban areas, hindering access to essential health services for pregnant women (1, 5). Many women continue to give birth at home without qualified medical assistance, thereby exposing their health to increased risks (6).

In Madagascar, maternal mortality remains a concern, with a rate of 478 deaths per 100,000 live births between 2006 and 2013, before decreasing to 426 deaths per 100,000 live births in 2018 (7). This rate remains well above the global average, reflecting both the persistent challenges in accessing prenatal and obstetric care and the structural inequalities within the country's health system (8, 9). Similar to many African countries, where health infrastructure is already inadequate and awareness of the benefits of qualified care remains limited—especially in the most remote regions (10)—the low utilization of institutional childbirth services amplifies this issue and is one of the main causes of maternal mortality.

According to the National Institute of Statistics (INSTAT), regional and socioeconomic inequalities are striking (8): women living in the poorest and most isolated areas are the most disadvantaged in terms of access to obstetric care. These disparities are exacerbated by poor integration of obstetric care services within the health system. As of 2024, Madagascar has only 19 functional emergency obstetric and neonatal care maternity units, providing coverage for only 16% of the population (11). Consequently, many women must travel up to two hours to access these essential services.

The objective of this study is to analyze the association between the likelihood of giving birth in a healthcare facility and various sociodemographic characteristics in Madagascar. The analysis will focus on variables such as maternal age, birth order or parity, frequency of prenatal visits, place of residence, education level, and socioeconomic status. The results will help identify key factors that limit or facilitate access to obstetric care and propose targeted interventions to improve the quality and accessibility of maternal health services in Madagascar, with the aim of reducing maternal mortality in the country.

Materials and methods

Study design: This study was conducted using data from the 2021 Madagascar Demographic and Health Survey (DHS), which provides comprehensive information on the sociodemographic and health characteristics of the Malagasy population. The DHS data is collected from a representative sample of households and is typically used to assess maternal and child health indicators, as well as socio-economic conditions and health-related behaviors.

Study population: The sample of the 2021 Madagascar DHS covers a wide range of households across various regions of the country, including women of reproductive age (15-49 years) and information on births that occurred in the last five years. Data on sociodemographic variables, such as age, birth order, education level, region of residence, economic status, and access to health services, were extracted for this analysis.

Variables of interest: The study focused on factors influencing access to healthcare for childbirth. The primary dependent variable is the place of delivery, coded as binary (1 if the delivery occurred in a healthcare facility, 0 otherwise). Independent variables include the sociodemographic characteristics of women, such as age, birth order, number of prenatal visits, residence (urban or rural), region, education level, and household economic status.

Analytical approach: Data analysis was conducted using R software (version 3.4.1), recognized for its robustness and flexibility in the field of statistics and data analysis. The analytical process was structured into several methodical steps to ensure the accuracy and reliability of the results.

First, the data were cleaned and prepared. Information from the 2021 Madagascar DHS was converted into a data frame to facilitate manipulation. Categorical variables were carefully recoded to ensure correct interpretation during subsequent statistical analyses.

The second step involved a thorough descriptive analysis. Descriptive statistics were calculated to summarize the characteristics of the sample, including proportions and confidence intervals for the variables of interest. This analysis provided an

overview of the characteristics of the studied population, offering essential context for the following analyses.

To assess the associations between sociodemographic variables and the place of delivery, a chi-square test was applied. This test served to determine whether there is a statistically significant association between the variable of interest and the sociodemographic characteristics. The significance level was set at 5% (p-value < 0.05), allowing for a rigorous interpretation of the potential associations between the studied variables.

Results

Table 1 summarizes the results of our study. The prevalence of institutional delivery services utilization was 37.4% (95% CI: 35.1-39.7). Univariate analysis highlighted variations in delivery assistance based on the sociodemographic characteristics of mothers. Among women under 20 years of age, 1,135 received qualified assistance during delivery, representing 36.7% (95% CI: 33.9-39.4). This figure slightly increased for those aged 20 to 34 years, where 3,032 women received assistance, corresponding to 39.8% (95% CI: 38.5-41.1). In contrast, mothers aged 35 to 49 years, with 583 receiving qualified assistance, represented a rate of 35.7% (95% CI: 32.9-38.5). Chi-square tests revealed a statistically significant association between maternal age and the likelihood of delivering in a health center, with a p-value of 0.0005.

Regarding birth order, the results indicated that 1,761 women delivering their first child received assistance, corresponding to 49.9% (95% CI: 48.5-51.3). This percentage decreased to 40.2% (95% CI: 38.9-41.5) for those with 2 to 3 children, with 1,871 assisted deliveries, and dropped to 30.2% (95% CI: 28.5-32.0) for women having 4 to 5 children, with 439 assisted deliveries. For those with 6 or more children, the rate reached 23.2% (95% CI: 21.3-25.1). Chi-square tests also revealed a statistically significant association between birth order and the probability of delivering in a health center, with a p-value of 0.0001, highlighting the strong statistical association between these two variables.

Prenatal visits also had a significant impact on delivery assistance. Among women who did not receive prenatal visits, only 39 or 4.1% (95% CI: 2.6-5.6) received assistance. In contrast, 795 women who had between 1 and 3 visits received assistance, representing 29.4% (95% CI: 28.0-30.8). Women who had 4 or more visits benefited from assistance in 2,941 cases, or 53.2% (95% CI: 52.0-54.4). The number of prenatal visits was a determining factor for delivering in a health facility, with a p-value of 0.0000 confirming the importance of visit frequency in seeking care at a health center.

The mothers' residence also played a crucial role in access to delivery assistance. Indeed, 1,130, or 58.9% (95% CI: 56.6-61.2), of women living in urban areas received qualified assistance, while only 3,628, or 34.8% (95% CI: 33.7-35.9), of women residing in rural areas had this opportunity. Chi-square tests showed a notable influence of residence on delivery at health centers, with a p-value of 0.0001, underscoring the disparities in access to care based on living conditions.

Regional disparities revealed significant differences as well. For instance, in Antananarivo, 320 or 68.7% (95% CI: 63.8-73.6) of deliveries occurred in a health center, while in the Betsiboka region, only 50 or 26.5% (95% CI: 20.1-32.9) of women chose this option. Other regions, such as Analamanga and Vakinankaratra, reported high rates of assisted deliveries, at 1,011 or 68.7% (95% CI: 66.2-71.2) and 400 or 42.8% (95% CI: 39.0-46.6), respectively. In contrast, the regions of Ihorombe and Atsimo Atsinanana displayed significantly lower rates, with 34 or 14.7% (95% CI: 10.0-19.4) and 104 or 20.5% (95% CI: 16.4-24.6), respectively (Figure 1). The p-value of 0.0001 highlighted the significance of these regional disparities.

The mother's education level also influenced delivery assistance. Among women without education, only 521 or 18.5% (95% CI: 16.5-20.5) received qualified assistance, while this figure increased to 1,795 or 32.9% (95% CI: 31.5-34.3) for those with a primary education level. Women with secondary education displayed an assistance rate of 676 or 53.4% (95% CI: 51.8-55.0), which reached 258 or 85.7% (95% CI: 80.9-90.5) for those with higher education. The p-value of 0.0001 indicated a strong association between education level and the use of health centers for delivery.

Finally, the analysis of economic well-being quintiles revealed notable inequalities in delivery assistance. Only 557 or 17.5% (95% CI: 15.6-19.4) of women in the lowest quintile delivered with qualified assistance, while this figure increased to 774 or 29.3% (95% CI: 27.5-31.1) for those in the second quintile, reaching 1,318 or 72.5% (95% CI: 70.3-74.7) for those in the highest quintile.

Table 1: Association between sociodemographic characteristics and assisted childbirth by qualified personnel in Madagascar in 2024, n =12345

Sociodemographic characteristics		Deliveries assisted by qualified personnel							p-value
		Yes			No		Total		
		n	(%)	CI 95%	n	(%)	n	(%)	
Mother's age at birth	<20	1135	36.7	33.9 - 39.4	1959	63.3	3094	100.0	0.0005
	20-34	3032	39.8	38.5 - 41.1	4586	60.2	7618	100.0	
	35-49	583	35.7	32.9 - 38.5	1050	64.3	1633	100.0	
Birth order	1	1761	49.9	48.5 - 51.3	1768	50.1	3529	100.0	0.0000
	2–3	1871	40.2	38.9 - 41.5	2783	59.8	4654	100.0	
	4–5	686	30.2	28.5 - 32.0	1584	69.8	2270	100.0	
	6+	439	23.2	21.3 - 25.1	1454	76.8	1893	100.0	
Prenatal visits	None	39	4.1	2.6 - 5.6	916	95.9	955	100.0	0.0000
	1–3	795	29.4	28.0 - 30.8	1909	70.6	2704	100.0	
	4+	2941	53.2	52.0 - 54.4	2588	46.8	5529	100.0	
	Unknown/missing	24	54.5	34.1 - 74.9	20	45.5	44	100.0	
Residence	Urban	1130	58.9	56.6 - 61.2	789	41.1	1919	100.0	0.0000
	Rural	3628	34.8	33.7 - 35.9	6798	65.2	10426	100.0	
Region	Antananarivo	320	68.7	63.8 - 73.6	146	31.3	466	100.0	0.0000
	Analamanga excl. Antananarivo	691	68.8	65.3 - 72.3	313	31.2	1004	100.0	
	Analamanga	1011	68.7	65.0 - 72.4	460	31.3	1471	100.0	
	Vakinankaratra	400	42.8	39.8 - 45.8	535	57.2	935	100.0	
	Itasy	200	51.7	47.7 - 55.7	187	48.3	387	100.0	
	Bongolava	128	35.9	31.7 - 40.1	229	64.1	357	100.0	
	Haute Matsiatra	204	32.8	28.6 - 37.0	418	67.2	622	100.0	
	Amoron'i Mania	147	39.1	34.6 - 43.6	229	60.9	376	100.0	
	Vatovavy Fitovinany	225	37.8	33.5 - 42.1	371	62.2	596	100.0	
	Ihorombe	34	14.7	10.0 - 19.4	197	85.3	231	100.0	
	Atsimo Atsinanana	104	20.5	16.4 - 24.6	403	79.5	507	100.0	
	Atsinanana	229	36.5	32.8 - 40.2	398	63.5	627	100.0	
	Analanjirofo	216	37.6	33.8 - 41.4	359	62.4	575	100.0	
	Alaotra Mangoro	195	39.9	35.4 - 44.4	293	60.1	488	100.0	
	Boeny	149	38	33.5 - 42.5	243	62	392	100.0	
	Sofia	253	32.8	29.0 - 36.6	518	67.2	771	100.0	
	Betsiboka	50	26.5	20.3 - 32.7	139	73.5	189	100.0	
	Melaky	29	21.6	15.3 - 27.9	105	78.4	134	100.0	
	Atsimo Andrefana	321	26	23.0 - 29.0	912	74	1233	100.0	
	Androy	161	24.3	20.7 - 27.9	502	75.7	663	100.0	
	Anosy	184	36.9	32.4 - 41.4	315	63.1	499	100.0	
	Menabe	78	21.7	16.4 - 27.0	282	78.3	360	100.0	
	Diana	194	56.7	51.4 - 62.0	148	43.3	342	100.0	
	Sava	244	41.2	37.0 - 45.4	348	58.8	592	100.0	
Mother's education level	None	521	18.5	16.5 - 20.5	2293	81.5	2814	100.0	0.0000
	Primary	1795	32.9	31.5 - 34.3	3662	67.1	5457	100.0	
	Secondary 1	1501	53.4	51.8 - 55.0	1310	46.6	2811	100.0	
	Secondary 2	676	70.3	67.5 - 73.1	286	29.7	962	100.0	
	Higher	258	85.7	80.9 - 90.5	43	14.3	301	100.0	
Economic wellbeing quintiles	Lowest	557	17.5	15.6 - 19.4	2625	82.5	3182	100.0	0.0000
	Second	774	29.3	27.5 - 31.1	1867	70.7	2641	100.0	
	Middle	933	37.5	35.5 - 39.5	1554	62.5	2487	100.0	
	Fourth	1171	52.8	50.8 - 54.8	1046	47.2	2217	100.0	
	Highest	1318	72.5	70.3 - 74.7	500	27.5	1818	100.0	

95% IC=95% confidence interval,

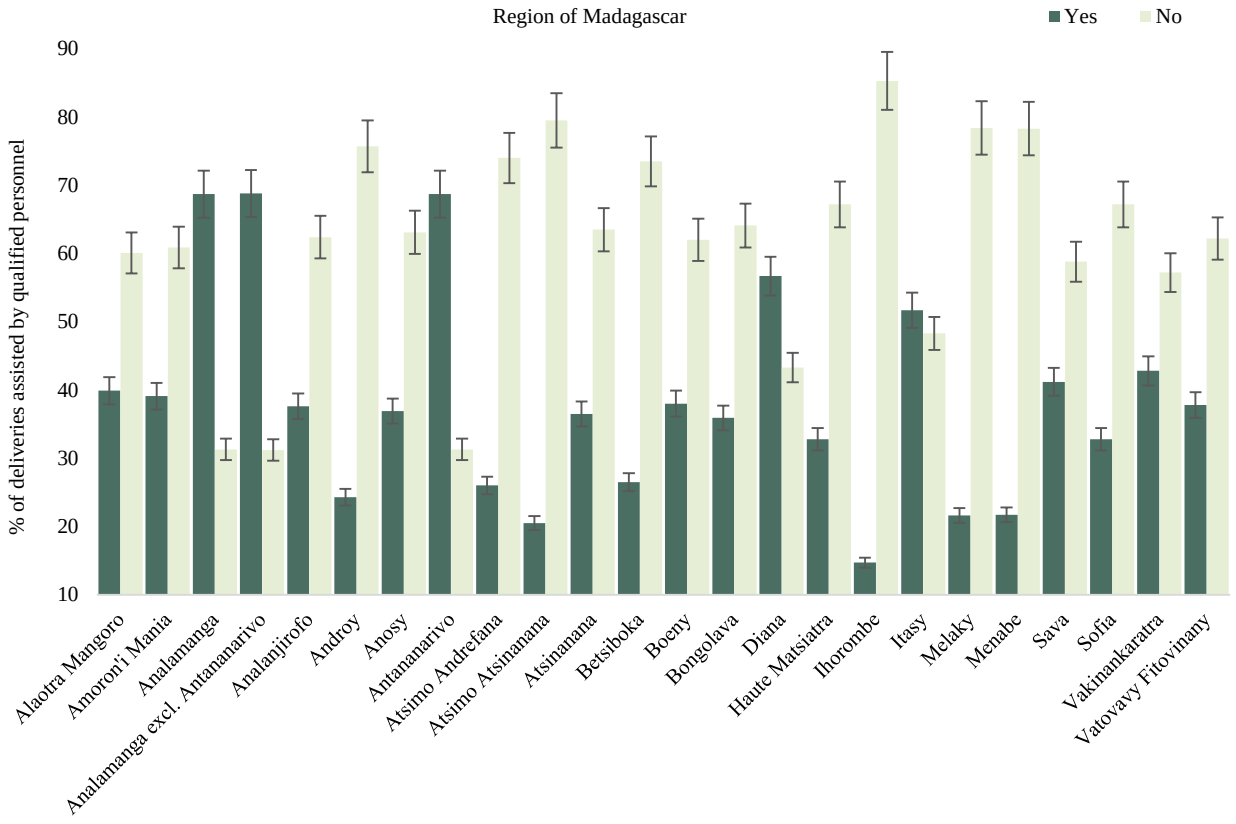

Figure 1: Assisted delivery by qualified personnel in relation to the regions of Madagascar in 2024

The associated p-value of 0.0001 confirmed the existence of economic inequalities in access to appropriate healthcare services during delivery.

Discussion

During our study, we observed a prevalence of 37.4% (95% CI: 35.1-39.7) for the utilization of institutional delivery services, compared to a prevalence ranging from 12.1% to 80.1% in Ethiopia (12). The analysis results highlight a significant association between sociodemographic factors and assisted delivery by qualified personnel. These findings broadly corroborate recent trends observed in contemporary maternal health studies, underscoring the importance of a socially and demographically driven approach to improving access to obstetric care.

Maternal age remains a crucial factor. In our study, mothers under 20 years old and those over 35 years were less likely to deliver in a health facility. These results align with the work of Chakraborty et al. (13), Ababulgu et al. (14), and Chernet et al. (15), which reveal that older women often prefer home deliveries, believing that their prior childbirth experiences reduce the need for professional care. Conversely, Tekelab et al. (16) show that older women, generally having more experience and greater decision-making power, are more likely to opt for institutional delivery.

Birth order also stands out as a determining factor in the utilization of health center delivery services. The results show that primiparous mothers are more likely to deliver in a facility, while women with a higher number of children (birth order 4-5 and 6+) are significantly less inclined to do so. This aligns with studies by Babalola and Fatusi (17), Kebede et al. (18), Yebyo et al. (19), and Ababulgu et al. (14), which demonstrate that mothers with higher birth orders perceive less risk associated with delivery and rely more on home births. However, Nigusie et al. (12) show that the number of children a woman has delivered is not significantly associated with the use of institutional delivery services.

The frequency of prenatal visits appears to be a key factor in accessing obstetric care. In this study, women who had four or more prenatal visits were much more likely to deliver in a health center. A

similar trend is observed by several authors, including Yeji et al. (20), Kidanu et al. (21), Kifle et al. (22), Assefa et al. (10), Ahmed et al. (23), and Nigusie et al. (12), who indicate that each additional prenatal visit significantly increases the chances of delivering in a health facility, as these consultations raise awareness of obstetric risks and the importance of professional care. Furthermore, Simkhada et al. (5), Tsegay et al. (24), and Mekie et al. (25) reveal that the complete absence of prenatal visits is strongly associated with home deliveries due to insufficient awareness and lack of medical follow-up.

Geographic location, particularly the place of residence, is a factor extensively studied in recent research. Women living in urban areas are, according to our results, more likely to deliver in a health facility than those living in rural areas. This finding is supported by the study of Gabrysch and Campbell (6), which demonstrates that physical accessibility and proximity to health infrastructure in urban areas promote the use of maternal health services. Similarly, Weldemariam et al. (26) and Nigusie et al. (12) show that the place of residence is a determining factor influencing the use of health center delivery services, noting that women in urban areas are more likely to deliver in a health facility than those in rural areas, who often face limited access to care.

The regional disparities observed in this study are also striking. Women residing in regions such as Analamanga and Antananarivo are more likely to deliver in a health center compared to women in more disadvantaged regions like Androy and Atsimo Atsinanana. Recent studies by Afulani (27) and Gage and Calixte (28) highlight the impact of regional inequalities on access to healthcare. They show that the unequal distribution of health resources, the availability of qualified personnel, and the quality of infrastructure explain these regional gaps, thereby exacerbating maternal health disparities.

Maternal education level is another important determinant in accessing delivery services. Our results show that women with higher levels of education are more likely to deliver in a facility than those with only primary education. Studies by Say and Raine (4), Kidanu et al. (21), and Nigusie et al. (12) reinforce this observation, emphasizing that education increases women's awareness of health services, as well as their ability to understand and navigate health systems. Moreover, education often enables women to negotiate health-related decisions more effectively within their households, as demonstrated by Edward's study (29).

Finally, the results show a strong correlation between economic well-being quintiles and the utilization of delivery services. Women in the wealthiest quintile are more likely to deliver in a health facility than those in the poorest quintile. These findings are consistent with studies by Yebyo et al. (19), Chernet et al. (15), and Weldegiorgis et al. (30), which demonstrate that women from higher socioeconomic statuses are more likely to deliver in a hospital than those from lower economic statuses. This can be explained by the costs of care, as highlighted by the study of Gage and Calixte (28), which underscores that the financial burdens associated with institutional delivery, including transportation and care costs, represent significant barriers for women from poor households. Thus, the impact of poverty on access to maternal care poses a real challenge in public health improvement, highlighting that subsidy and exemption policies for healthcare costs may play a crucial role in reducing these economic disparities.

Conclusion

The results of this study, supported by recent research, confirm the importance of factors such as age, birth order, frequency of prenatal visits, geographic location, education level, and socioeconomic status in accessing institutional delivery services. These observations highlight the need for a multisectoral approach to improve equity in maternal healthcare access, especially by targeting vulnerable populations living in rural areas, those with lower educational levels, and those from the lower economic quintiles. Specific interventions, such as improving geographic and economic accessibility to healthcare services and conducting awareness campaigns targeting young mothers and marginalized regions, are essential to bridge these gaps.

Moreover, several avenues for further research should be considered. First, longitudinal studies are needed to evaluate the impact of specific interventions on access to delivery services. These studies should account for contextual variations, including socioeconomic and cultural factors, which influence the effectiveness of interventions.

In addition, exploring the role of community actors in raising awareness and educating populations about the importance of skilled obstetric care is a promising research direction. This approach would offer insights into how these actors can help reduce

disparities in access to care.

Furthermore, analyzing health service financing models and their impact on healthcare accessibility would be beneficial. Such research could provide crucial data for the formulation of tailored health policies aimed at optimizing resources allocated to maternal health.

Finally, conducting qualitative studies to better understand women's perceptions and expectations regarding maternal healthcare would be worthwhile. These studies could help guide interventions toward solutions that adequately meet the specific needs of women, taking into account their realities and expectations.

These research directions will not only strengthen existing knowledge on the determinants of access to maternal care but also inform policies and programs designed to improve the equity and quality of maternal healthcare services. Such efforts could play a decisive role in reducing maternal mortality, both in Madagascar and in similar contexts.

Conflict of Interests

Authors declare no conflict of interests.

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