

Fertility After Cesarean Delivery Among Somali-Born Women Resident in the USA

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Abstract We evaluated the reproductive impact of cesarean versus vaginal delivery in Somali immigrants. Data were extracted for 106 Somali women delivering vaginally (64%) or by cesarean section (36%) between 1994 and 2006. Index delivery (vaginal versus cesarean) was compared to the cumulative incidence rate of subsequent deliveries. The incidence rate of a delivery after a vaginal delivery was 3.3% (CI:0–7.8%), 55.4% (CI:40.1–66.8%) and 74.4% (CI:59.0–84.0%) at 1, 2 and 3 years. Cesarean delivery lead to a second delivery incidence rate of 2.9%

(95%CI:0–8.2%), 25.9%(95%CI:9.8–39.2%) and 58.1%(95%CI:27.0–72.2%) at 1, 2 and 3 years. Somali women delivering vaginally were 1.56 times (95% CI:0.94–2.57; $P = 0.084$) more likely to have a subsequent delivery. The likelihood of Somali women having a second child after cesarean section is lower at 2 and 3 year follow-up.

Keywords Cesarean section · Somali · Infertility · Migrant

New contribution to the literature We are submitting this manuscript to bring attention to the fertility implications of the high cesarean section rates among Somali born refugee women. A paper written by Small et al. recently published in the BJOG demonstrates that Somali women are experiencing cesarean section rates higher than those in their receiving countries. Our findings indicate that the women who undergo cesarean sections are less likely to have children within 2 years after their delivery than the group who delivers vaginally. This decrease in fertility at 2 years is especially concerning given the importance and predominance of large families in the Somali culture. Women have on average 5.2 live births during their lifetime. We believe that the high cesarean rate in conjunction with the decrease fertility at 2 years presents a significant finding that should be considered and shared with Somali patients during their pregnancy. Consequently, building trust and cultural competency through well guided counselling that addresses the concerns of Somali women is of vital importance in easing their transition to a new health care system and a new country.

Background

War, political and economic instability have led to the diaspora of well over 150,000 Somalis leaving their home country since the 1990s. A large cohort of these Somalis moved to Minnesota, USA where they first utilized the American healthcare system in the setting of pregnancy. A few studies carried out in Europe and North America demonstrate significant disparities in the outcomes of Somali women in their new home when compared to the host population, especially with regards to the method of delivery[1–4]. The studies also shed light on the anxiety and fear among Somali women surrounding perinatal care, especially with regards to cesarean delivery. In general,

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Somali-born women would prefer minimal intervention in the birth process [5–10].

Meanwhile in the United States, the rate of cesarean births has reached a record high ranging from 25–30% [11, 12]. As this figure has continued to rise through the past three decades, much research has been directed at the future clinical implications surrounding cesarean delivery [13, 14]. At the forefront of these debates is the association between cesarean delivery and reduced subsequent fertility [15–17]. The medical literature offers a few theories for decreased fertility or fecundity following cesarean delivery. The most prominent ideas hinge around the notion that a mother's voluntary desire to have more children is reduced after cesarean delivery due to biological or psychosocial effects of a traumatic or emergent cesarean delivery or a previous pregnancy [18–23].

Studies investigating the relationship between cesarean delivery and reduced subsequent fertility have not been carried out on migrants. Different social and cultural beliefs alongside a sudden increase in access to cesarean delivery may be responsible for a unique response to the experience of pregnancy in a new country. For example, evidence indicates that Somali women are inclined to have large families with an average of 5.2 live births per mother [24]. Research from sub-Saharan Africa also suggests that the natural fertility rate after cesarean section was 17% lower than the fertility rate after vaginal delivery [17]. A reduced fertility among sub-Saharan African women may have complicated sociologic sequela such as lowered status among their community or social group. Some women fear that infertility or reduced fertility may validate a husband's right to a divorce. Furthermore, aging mothers are motivated to have large families as a source of economic protection [25].

Research demonstrates that a higher proportion of Somali women undergo cesarean delivery in comparison to the population where they live post-migration despite an almost absolute aversion to cesarean deliveries in Somalia [3]. Their reluctance in Somalia is understandable as a majority of cesarean deliveries in sub-Saharan Africa are emergency operations in facilities of varying quality after prolonged labor/obstetrical complications which often result in fetal and/or maternal morbidity and mortality [26]. When also combined with relatively limited access to a qualified physician, it is understandable why Somali women may be so hesitant about a cesarean delivery. Post-migration there is a paradoxical effect which takes place in regards to the mode of delivery for pregnant women. For first births, Small et al. looked at data from six countries and found that there was a pooled odds ratio of 1.41 (95%CI:1.25–1.59) for cesarean delivery compared to the receiving country population [3]. In our experience at a Midwest tertiary care center, Somali-born women from

1993–2006 had an unadjusted cesarean rate of 26.8% compared to a cesarean rate of 22.5% in all other women (In our population, there was no statistical difference between the two groups) [27]. Therefore, the combination of an increased proportion of women undergoing cesarean delivery coupled with the social and cultural milieu of Somali women leads us to believe that the association between cesarean delivery and subsequent reduced fertility may be of particular relevance for Somalia-born women.

In the present study, we aim to explore the reproductive impact of cesarean delivery on Somali women who have delivered their first child in the United States. More precisely, this study will compare cumulative incidence rate of a second child as well as total fertility in relation to the type of index delivery.

Methods

Participants

All Somali women delivering between November 1994 and December 2006 at a single tertiary center were identified. In the entire Somali patient obstetric database from which we compiled our cohort there were 661 patients, 45 (6.8%) refused to participate in research. Medical records were reviewed for those women who had not denied access to their medical records for research purposes, in accordance with Minnesota statute 144.335. Only Somali women receiving obstetric care for their first known delivery which occurred at our institution were included in the study. All women with previous deliveries outside of the country or at other US facilities or under the age of 18 were excluded from review. This study was approved by the Mayo Foundation institutional review board #08-004210.

Data Collection

The following information about each woman's initial delivery was ascertained from the medical record: basic metrics of sub-fertility (maternal age, BMI, and tobacco use), date and type of delivery (cesarean or vaginal), emergency or elective cesarean section, gestational age, and birth weight. The date and type of each subsequent delivery was collected as well as the date of the woman's last medical visit through December 2007.

Measures and Statistical Analysis

The primary factor of interest in this study was the mode of delivery (cesarean vs. vaginal) of the initial child. The study aims were to compare the cumulative incidence of a

second delivery, and the number of deliveries between these two modes of delivery groups. Time to the second delivery was calculated as the time interval between the dates of the first and second deliveries; for women without a second delivery the follow-up time was recorded up until the date of their last medical visit. The Kaplan–Meier method was used to estimate the cumulative incidence of a second delivery, separately for each mode of delivery group. Cox proportional hazards models were fitted to evaluate the association between initial mode of delivery and time to the second delivery. Models were fitted with and without adjusting the model for potential confounders (maternal age, maternal BMI, gestational age, birth weight). Associations were summarized using the hazard ratios estimated from the Cox models and the corresponding 95% confidence intervals. The assumption of proportional hazards was assessed by graphical methods and by introducing a time-dependent covariate in the Cox models; the assumption was not violated in Figs. 1 and 2 [28]. A Poisson regression model was fitted to evaluate the association between the number of subsequent deliveries

and the initial mode of delivery. In this model, the number of subsequent deliveries per woman was offset by her duration of follow-up. All calculated *P*-values were two-sided and *P*-values less than 0.05 were considered statistically significant. Analyses were performed using the SAS software package, version 9.1 (SAS Institute, Cary, NC).

Results

Our sample consisted of 106 Somali women who delivered their first child at our institution. Of these 106 women, 68 (64%) had a vaginal delivery (Group 1) and 38 (36%) had a cesarean delivery (Group 2) as their first delivery. The median age at delivery for Group 1 versus Group 2 was 22.0 versus 24.5 years (Wilcoxon rank sum test, $P = 0.009$), respectively. Infants delivered vaginally had lower birth weights than the cesarean group (median, 3177.5 vs. 3442.5 g; $P = 0.044$). Table 1 summarizes maternal and fetal characteristics.

To determine the cumulative incidence of having another delivery after their index delivery, the 106 Somali women were followed from their index delivery through December 2007. During this time period, 68 women delivered a second infant with a median time interval between delivery dates of 1.7 years [Mean (SD) = 2.1 (1.3) years, range = 0.9–8.2 years]. The 38 women with no documented subsequent delivery were followed until their last known medical visit. The median time interval between the index delivery and their last date of medical follow-up was 2.0 years [Mean (SD) = 3.1 (2.9) years].

Following their first delivery, the women in Group 1 had a cumulative incidence of a second delivery of 3.3, 55.4 and 74.4% after 1, 2 and 3 years, respectively. In contrast to this group, the women in Group 2 had a cumulative incidence of a second delivery of 2.9, 25.9 and 58.1% after 1, 2 and 3 years, respectively (Table 2 and Fig. 1). Based on fitting a Cox proportional hazards model, Somali women who had an initial vaginal delivery were 1.56 times (95%CI, 0.94–2.57; $P = 0.084$) more likely to have a subsequent delivery compared to women who had an initial cesarean section. The strength of this association was unchanged after adjusting for maternal age, maternal BMI, gestational age, or birth weight (HR for vaginal vs. c-section = 1.56, 1.67, 1.55, and 1.56, respectively). After adjusting for maternal age, gestational age, and birth weight in a multivariable Cox model, the HR for vaginal vs. c-section was 1.55 (95%CI, 0.92–2.61; $P = 0.10$), similar to our univariate model.

The cumulative incidence of having a third delivery was also estimated, according to the mode of delivery for the first two deliveries (15 women had CS/CS, 9 had CS/Vag, 8 had Vag/CS and 36 had Vag/Vag). Among the 68 women,

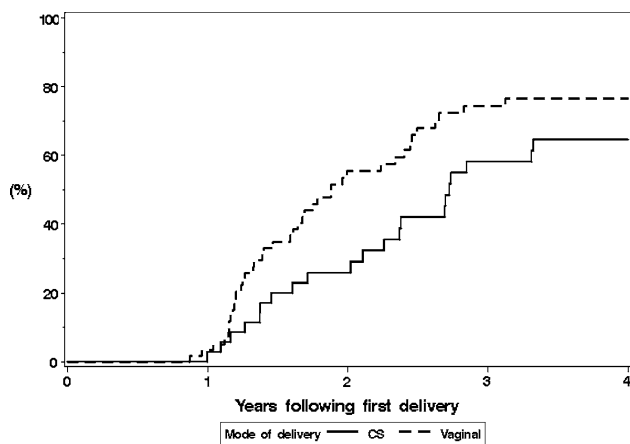


Fig. 1 Cumulative incidence of subsequent delivery following cesarean section versus vaginal delivery

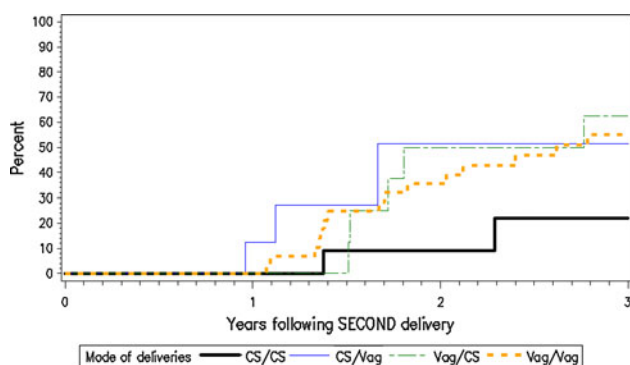


Fig. 2 Cumulative incidence of a third delivery indexed by mode of first two deliveries

Table 1 Summary of maternal and fetal characteristics

	Total (N = 106)
Maternal age at birth (years)	
Mean (SD)	24.0 (4.2)
Median	23.0
IQR	21.0, 27.0
Range	(18.0–34.0)
Delivery type	
Cesarean section	38 (35.8%)
Vaginal	68 (64.2%)
Emergency cesarean section (% of 38)	
No	26 (68.4%)
Yes	7 (18.4%)
Unknown	5 (13.2%)
Prenatal tobacco use (% of 105)	
No	103 (98.1%)
Yes	2 (1.9%)
Substance exposure (% of 96)	
No	78 (81.3%)
Yes	18 (18.8%)
Maternal BMI (N = 93)	
Mean (SD)	23.7 (4.7)
Median	22.9
IQR	20.3, 25.9
Range	(16.3–38.7)
Gestational age (weeks)	
Mean (SD)	39.0 (2.4)
Median	40.0
IQR	38.0, 41.0
Range	(28.0–42.0)
Birth weight (grams)	
Mean (SD)	3132.8 (603.7)
Median	3207.5
IQR	2890.0, 3505.0
Range	(950.0–4200.0)
Fetal outcome	
Fetal demise	1 (0.9%)
Level II	1 (0.9%)
Premature live birth	12 (11.3%)
Term live birth	92 (86.8%)

34 had a third delivery by the end of the follow-up period. While the precision of the cumulative incidence estimates is limited due to small sample size in three of the four groups, it appears that women having a repeat cesarean may be less likely to undergo a third delivery (Fig. 2).

The second outcome measure of interest was the total number of children a woman delivered. Following the initial delivery, the 106 women were followed for a total of 505.3 person-years [median = 4.6, mean (SD) = 4.8 (2.8) years]. Over the course of follow-up, 38 women had 1 delivery, 35 had 2 deliveries, 15 had 3 deliveries, 16 had 4 deliveries, and 2 had 5 deliveries.

Among the 68 women in Group 1 there were an additional 85 deliveries over a total of 321.5 person-years of follow-up, for a rate 26.4 deliveries per 100 women per year. Among the 38 women in Group 2, they had an additional 36 deliveries over a total of 183.8 person-years of follow-up, for a rate of 19.6 deliveries per 100 women per year. Based on fitting a Poisson regression model that was offset by the duration of follow-up, we did not identify a statistically significant association between the number of subsequent deliveries and the initial mode of delivery (rate ratio for vaginal vs. c-section = 1.35; 95%CI, 0.92–2.01; P = 0.09) when followed longitudinally over extended periods of time.

Discussion

For Somali-born women delivering infants at our institution, we observed that the likelihood of having a second child after cesarean delivery at 2 and 3 years is lower than the likelihood of having a child at 2 and 3 years following a vaginal delivery. These results support other studies that have assessed the association between cesarean delivery and subsequent fertility, but this is the first study to our knowledge that has looked at a migrant population from sub-Saharan Africa [16, 29]. Our study also suggests that the cultural and social milieu of Somali women was unable to overcome the biological or psychosocial distress associated with cesarean delivery. The results do suggest that there is a difference that may be significant if the

Table 2 Summary of Kaplan–Meier estimates for the cumulative probability of a subsequent delivery following the index delivery

Time point following index delivery	Cesarean section group estimate (95% CI)	Vaginal group estimate (95% CI)
	Group 1	Group 2
1 year	2.9% (0–8.2)	3.3% (0–7.8)
2 years	25.9% (9.8–39.2)	55.4% (40.1–66.8)
3 years	58.1% (27.0–72.2)	74.4% (59.0–84.0)

participants were followed up longer in the total number of children delivered between the two groups ($P = 0.09$). Our study, however, did not detect a statistically significant difference between the two groups. Our research demonstrates that following cesarean deliveries, Somali-born women display fertility trends that are similar to previous studies where decreased fertility seems to be maintained over time [16].

In a review paper of eight cohort studies by Hemminki et al. [16] they suggested that cesarean delivery was a risk factor for lowered fertility. Porter et al. [29] found statistically significant results that indicate that cesarean delivery is a risk factor for lowered fertility, but state the underlying mechanism or psychosocial etiology is not well understood. Murphy et al. [30] conducted a study on over 14,000 women and found cesarean section versus vaginal delivery was associated with a statistically significant risk of taking more than year to achieve a planned pregnancy 1.53 [95% confidence interval (CI) 1.09, 2.14]. Compared to previous research from sub-Saharan Africa, our study is consistent with the association between cesarean section and subsequent subfertility. Collin et al. [17] conducted a study of over 35,000 women living in sub-Saharan Africa which demonstrated a decreased odds ratio of becoming pregnant within 5 years of delivering by cesarean section when compared to vaginal delivery (OR = 0.75, 95%CI 0.62–0.89).

There are, however, some limitations to our research protocol that should be noted and revised in future studies. The majority of Somali women delivering their first child in the United States are still in their reproductive years. Another study should be extended to record data on these women until they reach menopause to capture the effect of a women's first delivery on her entire reproductive history. We were only able to look at women delivering their first child at our institute in the United States which may have introduced a selection bias into the study sample. It is possible that these women are not representative of Somali women delivering infants outside our institution. It is important to understand that Somali-born residents in Rochester, MN are likely affected by the same problems, regardless of the medical institution they attend. The Minnesota Health Worker Alliance states, "Low socioeconomic status, lack of health insurance, lack of culturally sensitive health professionals, immigration or refugee status, lack of transportation, and unequal treatment in the health care system are all barriers to some individuals and families accessing quality health care in Minnesota [31]".

We also recognize that we may have lost some participants to follow up as they may have gone to another institution for their obstetric care. In our area, there are only two hospitals equipped with a labor and delivery unit with our institution representing the majority of deliveries.

Clinical qualitative evidence supports the assumption that women delivering at our institution expressed a desire for continuity with future deliveries at the same institution. We are also the only institute to offer vaginal delivery after cesarean section, making it the institution of choice among Somali women who had a previous cesarean section. We were not able to collect data on women delivering their first child at our institution with subsequent deliveries elsewhere, but this figure is believed to be very low according to the reasons mentioned. Finally, we were limited by the number of women meeting inclusion criteria. A larger sample size would have been favorable to increase the statistical power of the study especially in detecting fertility between the second and third deliveries. It should also be noted that while there was a statistically significant difference of 2.5 years in age between the two groups, the biological significance of a difference in subsequent fertility between these two age groups is likely to be negligible. The patterns that seem to affect Somali-born women after a cesarean delivery call for us to conduct further quantitative and qualitative research to identify and understand the underlying reasons for these trends. Such research will better enable us to counsel and treat this cohort of patients in a culturally competent manner.

Several papers have attributed the decreased fertility after cesarean delivery to be a voluntary decision by women [23, 32]. In a study including more than half a million women, Tollanes et al. found that women delivering by cesarean had a significantly reduced probability of a subsequent birth if the child survived past one year (relative risk [RR] 0.82, 95% confidence interval [CI] 0.81–0.83) [32]. Bhattacharya et al. also found that the mode of delivery was one of several factors that influenced women to avoid a subsequent pregnancy [23]. While we cannot be certain since we did not formally interview all the participants, this effect is likely present in Somali-born women. We speculate that the desire or cultural predisposition to have more children within this population did not outweigh the subsequent sequela after a cesarean delivery.

The cultural context of having large families within the Somali-born population must be acknowledged and addressed while counseling pregnant Somali women. The preference to have large families may shift as Somali women adapt to their host culture in response to the availability of birth control and other family planning options. In the meantime, the observations from this study can be cautiously used to inform Somali women about birth rates after cesarean section within their own cohort. It must be remembered that a Somali woman's total fertility has an important social and economic impact in a traditional setting. Counseling Somali women about the potential delay in a second live birth after a cesarean delivery should also be considered a priority as this will likely be an issue of

concern. A frank dialogue between physicians and Somali mothers is a pivotal step in enabling this migrant population to trust and access the American health care system. Building trust and cultural competency through well guided counseling that addresses the concerns of Somali women is of vital importance in easing their transition to a new health care system and a new country.

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Details of Ethics Approval The study protocol was reviewed and then approved by the Mayo Clinic Institutional Review Board. This study received institutional approval #08-004210 for review of patient data in July 2008.

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