The Prevalence and Associated Factors of Caesarean Section at Noakhali Sadar, Bangladesh

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Authors' contributions

This work was carried out in collaboration among all authors. Authors SSA, TR and SG designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors SSA, TR, TA and SA managed the analyses of the study. Authors DJR, MOF, RIM and SA managed the literature searches. All authors read and approved the final manuscript.

Original Research Article

ABSTRACT

Background: The present Caesarean section (C-Section) delivery rate is 33% in Bangladesh which is almost double what is recommended by the World Health Organization for each country. C-section delivery is related to surgical complications, thus increase the rate of hospitalization and reduce women's quality of life. However, data on C-section delivery rates in different areas in this country are limited. Keeping this in mind, the objective of this study was to investigate the prevalence and factors associated with C-section deliveries in Noakhali district, Bangladesh.
Methods: A cross-sectional study was carried out among 400 women of child-bearing age from Noakhali district, Bangladesh, who had either cesarean (215) or normal vaginal delivery (185) in the last two years using a structured questionnaire. Data were analyzed using SPSS version 26.0 and frequency tabulation, binary and multivariate logistic regression analyses were performed to achieve the study objective.

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Results: The prevalence of C-Section in the study area was 53.75%, which was higher than the current Bangladeshi C-section prevalence rate. The most important predictors of C-section delivery among the study area were the mother's nutritional status, education of the respondent and her husband, family income, normal representation of the fetus, prolong labor pain during delivery, delivery in a private facility, term delivery, and baby's birth weight. The adjusted odds of undergoing C-section was higher among respondents who were overweight (AOR=6.53; CI=3.007 to 14.18), had LBW baby (AOR= 4.641; CI=2.066 to 10.42), family income more than or equal 20,000 (AOR =3.038; CI=1.056 to 8.743),prolong labor pain during delivery (AOR = 6.027; CI=2.829 to 12.84), performed delivery in private facility (AOR= 27.88; CI=11.55 to 67.33) and mal-presentation of the fetus (AOR = 6.867; CI=2.519 to 18.72).
Conclusions: The health care system in Noakhali and other districts in Bangladesh urgently needs policy guidelines to monitor C-Section delivery indications to avoid high rates of unnecessary C-Section.

1. INTRODUCTION

Caesarean section (C-Section) is a life-saving clinical practice that is sometimes necessary and sometimes the only feasible option for high-risk pregnancies for those mothers having multiple pregnancy-related complications [1]. While medically it is indicated that C-Section has the potential to reduce neonatal morbidities & mortalities including complications of childbirth, there is a non-medical suggestion that C-Section has no additional benefits for women & newborns. Moreover, it carries both short and long-term health risks for both of them [2–4]. Caesarean section also increases the chance of having preterm or early term babies [5] and even newborn deaths [6]. The uterine rupture of C-Section delivery has seriously affected maternal and newborn health outcomes such as stillbirth, ruptured uterus, obstetric fistula, and many other obstetric conditions [7].

In recent decades, the practice of C-Section has increased dramatically worldwide, especially in middle and high-income countries [3]. In most nations, the C-section rate has increased the World Health Organization (WHO) recommended level of 10 to 15% [4]. Among high-income countries, C-Section is 22% in the United Kingdom, 30.3% in the USA, 19% in France, 26% in Canada, 28% in Germany, and 30% in Australia [8]. Several countries in South Asia have experienced dramatic increases in C-section rates over the last decade. In India, rates of C-section rose from 3% (1992) to 11% (2006); in Bangladesh, from 2% (2000) to 17% (2011); and in Nepal, from 1% (2000) to 5% (2011) [9].

The C-Section rate has increased more than eightfold in Bangladesh, from 2.7% in 2000 to 24% in 2014 [10] and to 33% in 2017 according to Bangladesh Demographic and Health Survey (BDHS). Several reports in South Asia and other low-in-the-middle countries suggested that the rising prevalence of national C-Section was largely due to the increasing use of C-Section by the richest population in the city [7,11]. Other reasons for performing C-Section are multiple births, maternal overweight or obesity [1], profit of private facilities [12], mothers' inadequate knowledge about childbirth complications [13], fear of vaginal delivery, relief from the pain of labor, and to obtain a tubal ligation [14].

Considering the potential negative consequence of C-Section deliveries, this study aimed to identify the prevalence and associated factors of C-Section at Noakhali Sadar, Bangladesh. It will help us to analyze the current patterns and to take preventive measures by prioritizing the determining factors for reducing the unnecessary C-Section in Bangladesh.

2. MATERIALS AND METHODS

2.1 Study Setting and Design

A cross-sectional study was carried out among reproductive-aged (15 to 49 years) parous women having at least one child (age ≤ 1 year) were available for the study sample. It was conducted from November 13, 2019 to March 15, 2020 at Noakhali Sadar, Bangladesh. The interview was carried out based on a pretested and structured questionnaire to collect the data regarding the prevalence of C-section and the determinants that may impact on C-section.

Simple random sampling was used to include the respondents in the sample. The sample size was

calculated by this equation n = $(z)^2$ p(1 − p) / d^2, [15] where, Sample size (n), Statistic corresponding to the level of confidence (Z) which was assumed as 1.96, and prevalence (p) was 33% and Precision, (d) was 0.05. Finally, adding a 10% non-response rate, the sample size was determined to be 370 ≈ 400.

2.2 Selected Variables

In this study, the main outcome of interest was C-section delivery. To be used in the multiple binary logistic regression analysis, the responses to the question on the mode of delivery collected from the study area were coded '1' for C-section and '0' for normal vaginal delivery. This outcome variable was evaluated against all the independent variables. We selected the independent variables according to the objective of this study and from the literature review [16,17]. We have categorized the factors into three broad groups, e.g., healthcare institution related factors, demographic and pregnancy-related risk factors, and socio-economic factors Institutional factors include ownership of the facility where the delivery was conducted (public vs. private), antenatal care received in private facilities (yes or no).

Demographic and pregnancy risk factors include maternal age (less than 30 years and 30 years or more) maternal height (less than 60 inches, and 60 inches or more), birth order (two and more than two), maternal nutritional status (undernourished, normal, and obese), the weight of the baby (LBW, normal, overweight), experience of prolonged labor (yes or no), amniotic fluid disorder (yes or no), term delivery (yes or no), previous miscarriage (yes or no).

Among these variables, the baby's weight was measured from the maternal recall of the baby's weight at birth using a three-point Likert scale, and the responses were later recoded into 3 categories low birth weight (<2,500 g), normal birth weight (2,500–4,000 g) and High birth weight (≥4,000 g) [17,18]. Information on mothers who gave birth in five years preceding the survey had been used in this study. Diagnosis of prolonged labor was done according to the international classification for disease (ICD-10) (World Health Organization 1994) which defines prolonged labor; as the progress of slower than 1 cm per hour, irregular or poor uterine contractions, labor with regular uterine contractions for more than 12, cervical dilation of 10 cm for more than three hours [19].

To obtain information about term delivery the respondents were asked if they give delivery between 37-41 weeks [20]. To evaluate if mothers suffer from amniotic fluid disorder (Oligohydramnios) they were asked if their ultrasonography showed a deficiency in amniotic fluid less than 200 ml at term [21]. Maternal nutritional status is measured by body mass index (BMI), where mothers with a BMI of less than 18.5 were identified as malnourished, 18.5 to less than 25.0 as normal, and 25.0 or higher as overweight.

Socio-economic factors consisted of maternal education (primary, secondary, SSC and higher) and employment status (housewife, professional), husband's education (Primary, secondary, SSC and higher) occupation (farmer/laborer, professional, business, and none/others), family income (<10,000, 10000-20000,>20000).

2.3 Statistical Analysis

The general characteristics of the subjects were determined using descriptive statistics. To find out the statistical association, bivariate logistic regression analysis was done to identify the factors that affect the participant's caesarean section intention. Statistically significant factors from bivariate logistic regression analysis were included in the multivariate regression model to identify the independent predictors of participant's choice for the Caesarean section deliveries. Data analyses were performed in SPSS version 26.0 and a P-value of less than 0.05 and 95% CI was considered statistically significant for all tests.

3. RESULTS

Descriptive analysis was performed to have an overall view of all the attributes of the study participants. Table 1 showed the sociodemographic status of study participants. Out of 400 mothers, 53.8% were reported to have C-section delivery, and the remaining were reported to go through normal vaginal delivery. The majority of our respondents were younger, approximately 83.8% were less than 30 years old, and 16.3% were more than 30 years. The C-section- birth rate was 69.2% in older women, aged ≥30 years, and 50.7% in women, aged ≤30 years. Around 53.5% of mothers had more than 60 inches of height and about half of them (48.0%) were overweight. More than half of the respondents had completed secondary level of

schooling, whereas, 42.3% of their husbands completed secondary level of schooling. The proportion of family income having less than 10,000 BDT per month was 34.3%. About 61.0% of the respondent's baby had normal weight during delivery. The study showed that 73.3% of the respondent's babies had low birth weight during delivery. The analysis also revealed that an increase in birth order had a corresponding increase in C-section rate. The C-section rate was 63.8% among the mothers who had more than 2 children. Around 85.5% of the study respondents had visited private health care facility for their antenatal care, 79.0% of the mothers had a normal representation of the fetus, 39.3% of the mothers had prolonged labor pain during delivery and 64.0% of the respondents went private facility for delivery. Moreover, 62.7% delivery were not termed delivery and only 23% of respondents had a history of previous miscarriage.

4. FACTORS ASSOCIATED WITH C-SECTION DELIVERIES

Statistically significant factors from bivariate logistic regression analysis were included in the multivariate regression model to identify the independent predictors of participant's choice for the Caesarean section deliveries. Chances of C-section increased with the age of the mother. e.g., mother having age more than 30 years [AOR=2.844; CI=1.116-7.248]. Mothers who were overweight [AOR=6.53; CI=3.007-14.18] had higher odds of C-Section delivery. The chance of C-section decreased with a higher education level of the husbands. e.g., secondary level of education [AOR=0.103; CI=0.045-0.237] and SSC and higher level of education [AOR=0.016; CI=.005-.058]. Mothers who are housewives had higher odds of C-Section delivery [AOR =2.533; CI=0.99-6.475]. Chance of C-Section increases with family income more than or equal 20,000 [AOR =3.038; CI=1.056-8.743].Chances of c-section delivery increases with LBW [AOR= 4.641; CI=2.066-10.42] as well as overweight [AOR=2.657; CI=0.974-7.25]. The mother who had mal-presentation of the fetus has higher odds of C-Section delivery [AOR = 6.867; CI=2.519-18.72]. Mother who had Prolong labor pain during delivery [AOR = 6.027; CI=2.829-12.84] and had amniotic fluid disorder [AOR= 2.199; CI=1.034-4.677] had higher odds of C-section delivery. Mothers who had a delivery in private facilities had a higher chance of C-Section delivery [AOR= 27.88; CI=11.55-67.33].

5. DISCUSSION

The present study was performed to identify the prevalence and determinants of C-Section delivery in Noakhali Sadar Upazila, Bangladesh. C-Section is now one of the most common surgical procedures all over the world and especially in developing countries like us, it has become uncontrolled as the hospitals make more profit for C-section delivery and so they convince their patients who are less educated by showing them possible risks of going through normal vaginal delivery, which is a practical situation is not true if taken proper care on time. Despite the importance and worldwide concern about uncontrolled C-Section delivery, this is the first study at the Noakhali Sadar that identified the rate and explored factors associated with C-section delivery in this district. Findings of the present study revealed that mother's nutritional status, husband's education, birth weight, birth order, normal representation of the fetus, prolong labor pain during delivery, amniotic fluid disorder, delivery in the private facility were significantly associated with C-section deliveries in this area.

The average C-section rate worldwide is 18.6%, ranging from 6.0% to 27.2% in the least developed and more developed regions, respectively. Western Africa has the lowest C-Section levels (3%) and South America has the highest average C-Section rates in the world (42.9%). Countries with the highest prevalence of C-Section are Brazil (55.6%), Dominican Republic (56.4%) in Latin America [3]. The research found that the average rate of cesarean section in Asia was 27.3%, with China having the highest overall rate followed by Vietnam, Thailand, and Sri Lanka [22,23]. According to BDHS the present prevalence of C-Section delivery in Bangladesh is 33% (15). Whereas, in the present study it was found that the prevalence of C-Section deliveries among participants was 53.75% which was quite higher than that of the national data and this finding reminds us of the necessity for the formation of legislation to lower this uncontrolled c-section delivery in this area.

The relationship between age and cesarean section rate has been extensively studied in the literature, with considerably mixed findings. A study conducted in Egypt showed that younger (less than 30 years) women were more likely to have a C-section delivery [24], meanwhile, another author found a higher likelihood of C-section delivery among older women [12]. The

latter finding is consistent with our study finding. The result can be explained by natural physiological and anatomical changes accompanying aging which expose older mothers to an elevated risk of pregnancy and delivery-related complication [25–27]. The current finding showed that women who were overweight have 6.53 times greater odds of C-Section delivery. There are some other studies that exhibited that obese mothers had 3.16 times higher odds of exposing to C-Section delivery [1]. This is due to the unwillingness of practitioners to conduct normal vaginal delivery for overweight women because of the increased risk of complications during delivery; such as the increased risk of newborns from shoulder displacement [28].

Previous studies conducted in Nigeria and Bangladesh found that when the level of education of the husband was higher, the risk of C-Section delivery was higher [1,23]. In this study it was found that with the increasing education level of the respondents' husband, the risk of C-Section delivery has been decreasing, a possible indication that higher education made people more aware of the possible risks of C-section deliveries, therefore the family tends to avoid C-section delivery and prefers to go for normal vaginal delivery.

Low birth weight (LBW) is another significant indication for C-section. This study found that respondents having LBW baby had 4.641 times higher odds of C-Section deliveries than those had normal weight baby. LBW cases require early delivery because of intrauterine complications or fetal distress. Because of the coexistence of gestational complications, low body weight, and restricted intrauterine development, infants with LBW typically showed poor overall tolerance, which may lead to higher C-section deliveries. This result in this study is consistent with previous studies [29,30]. However, this high birth rate of LBW infants could be a possible indication of early childbirth using surgical procedures that we still do not know.

Mal-presentation of the fetus is a very common indication of caesarean delivery. This study found that the chance of C-Section delivery was higher among mothers who had mal-presentation of the fetus. The result is consistent with some other studies [4,31,32]. The participants having prolonged labor pain during delivery were found to have 6.027 times more odds of having a C-

section. This result is consistent with some other studies [33,34]. Mothers received the information that C-Section is convenient, less painful, and relatively smooth which also creates the desire for choosing the cesarean section [35,36].

Disorder of amniotic fluid was found to be one of the leading causes of C-Section delivery [12]. However, one study in Pakistan revealed that isolated oligohydramnios is not related to an adverse perinatal outcome such as a high rate of birth asphyxia or admission to an intensive care unit compare to mothers having normal amniotic fluid. Thus elective C-section for potential perinatal morbidity due to oligohydramnios is not approved for any instance [37]. This study found that respondents who had amniotic fluid disorder have 2.199 folds higher odds of C-section delivery. The amniotic fluid disorder causes intrauterine growth restriction, increases the risk for compression of the umbilical cord [38], and thus leads to complexity in normal delivery.

Preference of the C-section depends on the place of delivery. In this study, it was found that the women who went for delivery in private facilities had 27.88 times more chances to give birth via C-section. Our findings supported the results of earlier studies of the high prevalence of C-section delivery in private facilities in other South Asian nations [9]. During the last two decades, the private health sectors are on a dramatic rise in Bangladesh [39] and maternal healthcare services occupy a significant part of it [40]. A higher rate of C-section births in private sector health facilities clearly indicates the involvement and motivation of health care professionals for performing C-section delivery, which might be due to their individual financial gain. Sometimes, women themselves could also opt for C-section delivery due to fear of pain or sometimes they believe C-section deliveries are safer for their child [33]. Again, cultural factors, previous experience may also responsible for the high prevalence of C-section deliveries [41].

As the study was not nationally representative, it restricts the generalizability of our results to geographical settings outside of Noakhali Sadar. The research was cross-sectional, and it could only indicate correlations rather than causal relationships. However, the results of this study provided significant details on the prevalence and associated factors of C-section deliveries in Noakhali Sadar.

Table 1. Association between mode of birth and socioeconomic and demographic factors of the study participants

Predictor	Categories	Frequency, N (%)	Normal delivery, N (%)	Caesarean Delivery, N (%)	P value
Maternal age (year)	<30	335 (83.8)	165(49.3)	170(50.7)	0.007
	≥ 30	65 (16.3)	20(30.8)	45(69.2)	
Mother's height (inch)	<60	186 (46.5)	111(59.7)	75(40.3)	0.001
	≥ 60	214 (53.5)	74(34.6)	140(65.4)	
Mother's nutritional status	Undernourished	49 (12.2)	32(65.3)	17(34.7)	0.001
	Normal	159 (39.8)	97(61.0)	62(39.0)	
	Overweight	192 (48.0)	56(29.2)	136(70.8)	
Mother's Education	Primary	85 (21.3)	43(50.6)	42(49.4)	0.504
	Secondary	206 (51.5)	96(46.6)	110(53.4)	
	SSC and higher	109 (27.3)	46(42.2)	63 (57.8)	
Husband's education	Primary	110 (27.5)	24 (21.8)	86 (78.2)	0.001
	Secondary	169 (42.3)	101 (59.8)	68 (40.2)	
	SSC and higher	121 (30.3)	60 (49.6)	61 (50.4)	
Mother's occupation	Housewife	326 (81.5)	138 (42.3)	188 (57.7)	0.001
	Professional	74 (18.5)	47 (63.5)	27 (36.5)	
Husband's occupation	Farmer/ Laborer	82 (20.5)	40 (48.8)	42 (51.2)	0.88
	Business	129 (32.3)	58 (45.0)	71 (55.0)	
	Professional	170 (42.5)	77 (45.3)	93 (54.7)	
	None/Others	19 (4.8)	10 (52.6)	9 (47.4)	
Family income	<10,000	137 (34.3)	78 (56.9)	59 (43.1)	0.001
	10,000-20,000	129 (32.3)	61 (47.3)	68 (52.7)	
	>20,000	134 (33.5)	46 (34.3)	88 (65.7)	
Birth weight	Normal	244 (61.0)	137 (56.1)	107 (43.9)	0.001
	LBW	105 (26.3)	28 (26.7)	77 (73.3)	
	Overweight	51 (12.8)	20 (39.2)	31 (60.8)	
Birth order	One to two	320 (80.0)	156 (48.8)	164 (51.2)	0.05
	More than two	80 (20.0)	29 (36.2)	51 (63.8)	

Predictor	Categories	Frequency, N (%)	Normal delivery, N (%)	Caesarean Delivery, N (%)	P value
Antenatal care visit received from private sector	No	58 (14.5)	35 (60.3)	23 (39.7)	0.02
	Yes	342 (85.5)	150 (43.9)	192 (56.1)	
Normal presentation of the fetus	No	84 (21.0)	11 (13.1)	73 (86.9)	0.001
	Yes	316 (79.0)	174 (55.1)	142 (44.9)	
Prolong labor pain during delivery	No	243 (60.8)	123 (50.6)	120 (49.4)	0.03
	Yes	157 (39.3)	62 (39.5)	95 (60.5)	
Amniotic fluid disorder	No	244 (61.0)	124 (50.8)	120 (49.2)	0.02
	Yes	156 (39.0)	61 (39.1)	95 (60.9)	
Delivery in private facility	No	256 (64.0)	167 (65.2)	89 (34.8)	0.001
	Yes	144 (36.0)	18 (12.5)	126 (87.5)	
Term delivery	No	251 (62.7)	111 (44.2)	140 (55.8)	0.3
	Yes	149 (37.3)	74 (49.7)	75 (50.3)	
Previous miscarriage	No	308 (77.0)	139 (45.1)	169 (54.9)	0.475
	Yes	92 (23.0)	46 (50)	46 (50)	
Total	-	400 (100)	185 (46.2)	215 (53.8)	-

Data were collected from 400 women in Noakhali Bangladesh who underwent C-section delivery P value<0.05, P value<0.01 were considered significant and highly significant

Table 2. Logistic regression analysis of factors associated with cesarean section delivery at Noakhali Sadar

Variables	OR	(95% CI)		P- Value	AOR	(95% CI)		P- Value
		Lower	Upper			Lower	Upper	
Age (year)								
<30	1				1			
≥ 30	2.184	1.237	3.856	0.007	2.844	1.116	7.248	0.028
Mother's height (inch)								
<60	1							
≥ 60	2.8	1.865	4.204	0.001	-	-	-	-
Mother's nutritional status					-	-	-	-
Normal	1				1			
Undernourished	0.831	0.426	1.623	0.588	1.066	0.309	3.681	0.92
Overweight	3.8	2.434	5.932	0.001	6.53	3.007	14.18	0.001
Mother's Education								
Primary	1				1			
Secondary	1.173	0.707	1.945	0.365	1.832	0.697	4.814	0.219
SSC and higher	1.402	0.793	2.48	0.034	4.329	1.173	15.97	0.028
Husband's education								
Primary	1				1			
Secondary	0.188	0.109	0.325	0.001	0.103	0.045	0.237	0.001
SSC and higher	0.284	0.159	0.505	0.001	0.016	0.005	0.058	0.001
Mother's occupation								
Professional	1				1			
Housewife	2.371	1.407	3.996	0.001	2.533	0.99	6.476	0.052
Husband's occupation								
Farmer/ Laborer	1							
Business	1.166	0.669	2.03	0.588	-	-	-	-
Professional	1.15	0.678	1.95	0.603	-	-	-	-
None/Others	0.857	0.316	2.328	0.762	-	-	-	-
Family income								
<10,000	1				1			
10,000-20,000	1.474	0.909	2.39	0.116	1.484	0.623	3.533	0.373

Variables	OR	(95% CI)		P- Value	AOR	(95% CI)		P- Value
		Lower	Upper			Lower	Upper	
>20,000	2.529	1.547	4.134	0.001	3.038	1.056	8.743	0.001
Baby's birth weight								
Normal	1				1			
LBW	3.521	2.133	5.811	0.001	4.641	2.066	10.42	0.001
Overweight	1.985	1.071	3.676	0.029	2.657	0.974	7.25	0.050
Birth order								
One to two	1							
More than two	1.673	1.009	2.774	0.046	-	-	-	-
Antenatal care visit received from private sector								
No	1							
Yes	0.513	0.291	0.906	0.021	-	-	-	-
Normal presentation of the fetus								
Yes	1				1			
No	8.132	4.155	15.916	0.001	6.867	2.519	18.72	0.001
Prolong labor pain during delivery								
No	1				1			
Yes	1.571	1.045	2.359	0.030	6.027	2.829	12.84	0.001
Amniotic fluid disorder								
No	1				1			
Yes	1.609	1.07	2.42	0.022	2.199	1.034	4.677	0.041
Delivery in private facility								
No	1				1			
Yes	13.13	7.527	22.922	0.001	27.88	11.55	67.33	0.001
Term delivery								
Yes	1				1			
No	1.244	0.829	1.868	0.029	3.119	1.465	6.641	0.003
Previous miscarriage								
No	1							
Yes	0.822	0.516	1.311	0.411	-	-	-	-

Data were collected from 400 women in Noakhali Bangladesh who underwent C-section delivery. P value<0.05, P value<0.01 were considered significant and highly significant

6. CONCLUSIONS

In Noakhali, the prevalence of C-section delivery among married women of reproductive age is too high, compared to the recommendation rate given by the WHO. Respondents who were overweight, whose husbands only attend the primary level of schooling and those who had more than two children experienced more C-section deliveries. Also, mal-presentation of the fetus, prolongs labor pain during delivery, amniotic fluid disorder and delivery in the private facility were important predictors for C-section delivery. However, this high rate of C-section delivery is not acceptable in a small district in Bangladesh, where most of the health-care facilities are poorly structured and do not have adequate treatment and care compared to other big cities in this country. Hence, it is important to develop legislation, guidelines, and intervention strategies to keep the emphasis on the predictors of C-section delivery to enhance awareness about its negative health outcomes. Adequate training, timely and frequent monitoring and supervision by health authorities is very important to increase awareness of the negative outcomes of C-section delivery where it is possible to avoid it and thus it will be possible to effectively control the rapid rise of C-Section in this area.

CONSENT AND ETHICAL APPROVAL

This study was approved by Ethical Review Board of Noakhali Science and Technology University (NSTU), Noakhali, Bangladesh. The researchers clarified the purpose of this research and obtained informed consent from the respondents.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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