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Umbilical Cord Care Practices and Incidence of Febrile Illnesses in the First Month of Life among Newborns- A Population Based Study

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Authors' contributions

This work was carried out in collaboration between all authors. Author ODIC conceptualized the study, wrote the introduction, did the extraction, cleaning and statistical analysis of the data. Authors EU, OS and EB contributed in abstract, introduction and discussion writing. All Authors reviewed the final draft of the manuscript.

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ABSTRACT

Background: Infection accounts for 13% of the approximately three million newborns deaths that occur globally every year. Poor umbilical cord hygiene in the first week of life is a well documented risk factor that increases the likelihood of neonatal infections. To curb this trend in developing countries, the World health Organization in 2013 enlisted the use of antiseptic solution as an essential medicine for cord care.
Aim: This study aims to describe umbilical cord care practices among mothers in Nigeria and its association with development of fever in newborns in the first month of life.
Methods: This is a population based descriptive study using nationally representative data from the 2013 edition of the Nigeria Demographic and Health survey (NDHS). For this study, 12113

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women aged 15-49 years were randomly selected from households using a stratified two-stage cluster design. Logistic regression and chi-square was used in data analysis.

Results: Unhealthy umbilical cord care was practiced by 27.8% of the respondents. The World Health Organization and national policy recommendation of cord care was significantly practiced by older women (*P*=0.002), literate mothers (*P*=0.001), mothers with higher educational attainment (*P*=0.001), mothers in the higher wealth class (*P*=0.001), those with access to print and electronic media (*P*=0.001), mother who uses hospital based postnatal check-up (*P*=0.001) and mothers resident in urban areas (*P*=0.001). Compared to newborns whose mothers applied nothing to their umbilical stumps, the odds of developing fever in the first month of life was higher in newborns whose mothers applied Oil (OR 1.79 CI 0.39-8.87); Ash (OR 3.37 CI 0.09-29.51); Toothpaste (OR 4.10 CI 1.01-16.68); Animal dung (OR 11.01 CI 1.11-111); and Other concoction (OR 2.58 CI 0.30-22.22) to the umbilical stump and lower in newborns whose mothers applied Methylated spirit or Chlorhexidine solutions (OR 0.68 CI 0.10-5.6) to the umbilical stump.

Conclusion: The need for proper hygiene of the umbilical cord using the recommended antiseptic solution must be re-emphasized among health care providers particularly targeting traditional birth attendants in rural settings. Female education and empowerment which has long been designated as one of the child survival strategy and also highlighted in this study as a strong determinant of healthy cord care practices is needed to promote this low cost and highly effective practices amongst mothers.

Keywords: Newborn, umbilical cord, febrile illness, Nigeria.

1. INTRODUCTION

About a third (1.5 million) of all neonatal deaths worldwide that occur each year are due to infection and many of these infections begin as umbilical cord infection [1]. Umbilical cord infections can occur in all settings but are more likely to occur in low-income countries and in settings where the majority of births are not attended by a skilled attendant [1]. This is particularly worrying in Africa where infectious diseases accounts for 30-40% of all neonatal death [2] and majority of childbirths are attended by Traditional Birth Attendants (TBA i.e. unqualified and largely untrained pregnancy and child health providers). According to a survey by World Health Organization (WHO) in 2008, only approximately 39% of childbirths in Nigeria are attended by a Skilled Birth Attendant (SBA i.e. healthcare workers trained to provide basic and emergency health care services to women and their newborn during pregnancy, childbirth and the postpartum period). It was also noted that 70% of all childbirth in the country occurs in rural areas with just 27% of these births assisted by a SBA [3]. The WHO has long advocated for umbilical cord care without application of any substance. However in developing countries and in situations where hygienic conditions are poor, it has recommended the use of antiseptic agent to reduce bacterial colonization and infections [4,5]. Similarly, in Nigeria, the Ministry of health recommends the use of Methylated spirit and other chlorhexidine solution for cord care in newborns [6]. A metanalysis of different trials conducted in three South-Asian countries showed a 23% overall reduction in pooled risk of mortality in newborns whose cord care were done using antiseptics compared to control [7]. This reinforces the need of good umbilical care practice to help in reduction of neonatal infections and mortalities in Africa which accounts for more than 44% of the global burden of neonatal mortality [8]. Despite its benefits in developing countries, mothers across cultures are still believed to engage in harmful cord care practices in Nigeria. This study therefore tries to describe cord care practices and its association with newborns morbidity.

2. METHODOLOGY

2.1 Study Area

Nigeria is in West African sub-region, lying between Niger in the North, Chad to the North-East, Cameroun in the East and Benin to the West. The 2006 population and housing census puts Nigeria's population at 140,431,790 making it the most populous nation in Africa and 14th in the world [9]. Presently Nigeria is made up of 36 states and a Federal Capital Territory (FCT) grouped into six geopolitical regions: North-central, North-east, North-west, South-east, South-west and South-south. There are 774 constitutionally recognized local governments and more than 374 identifiable ethnic groups nested within this states and regions [10].

2.2 Sample Design

The sample for the 2013 Nigeria Demographic and Health Survey (NDHS) is a nationally representative and covers the entire population residing in non institutional dwelling units throughout the country. The survey used as a sampling frame the list of enumeration areas (EAs) prepared for the 2006 population census of the Federal Republic of Nigeria, provided by the National Population Commission (NPC). The sample for the 2013 NDHS was designed to provide population and health indicator estimates at the national, zonal, and state levels.

Administratively, Nigeria is divided into 6 regions and 37 states. Each state is subdivided into local government areas (LGAs), and each LGA is divided into localities. In addition, during the 2006 Population Census, each locality was subdivided into convenient areas called census enumeration areas (EAs). The primary sampling unit (PSU), referred to as a cluster for the 2013 NDHS, is defined on the basis of EAs from the 2006 EA census frame. The 2013 NDHS sample was selected using a stratified two-stage cluster design consisting of 904 clusters, with 372 in urban areas and 532 in rural areas. A representative sample of 40,680 households was selected for the 2013 NDHS survey, with a minimum target of 943 completed interviews per state. In each state, the number of households was distributed proportionately among its urban and rural areas [11].

A complete listing of households and a mapping exercise were carried out for each cluster from December 2012 to January 2013, with the resulting lists of households serving as the sampling frame for the selection of households in the second stage. All regular households were listed. In the second stage of the selection process, an average of 45 households was selected from each cluster by equal probability systematic sampling. A total of 40,320 households were selected from 896 sample points, of which 38,904 were found to be occupied at the time of the fieldwork. Of the occupied households, 38,522 were successfully interviewed, yielding a household response rate of 99 percent.

All women age 15-49 who were either permanent residents of the households in the 2013 NDHS sample or visitors present in the households on the night before the survey were eligible to be interviewed. In addition, a subsample of one eligible woman in each household was randomly selected to be asked additional questions. For this survey, a total of 12113 eligible women were successfully interviewed for their cord care practices [11].

2.3 Data Collection

The field survey for the 2013 NDHS started with the training of 316 data collectors from 6th January to 4th February 2013. The training was conducted following the standard DHS training procedures, including class presentations, daily reviews, mock interviews, class exercises, and a written test at the end of every module. Unlike the previous rounds of DHS surveys, the fieldwork for the 2013 NDHS was launched in the six zones instead of in the 37 states, thus keeping the teams of each zone together and assigning the first clusters in the vicinity. This enabled close supervision of the teams because three to four trainers were available in each zone. Interviewers had ample opportunities to resolve their doubts and build up confidence before they were finally dispatched to their respective states. Data collection for the 2013 NDHS was carried out by 37 interviewing teams, one for each of the 36 states of the country and Federal capital territory (FCT). Each team consisted of a supervisor, one field editor, four female interviewers, two male interviewers, and two drivers. Data quality was ensured by the technical team/trainers that also functioned as quality controllers. Data quality was also monitored through field check tables generated concurrently with data processing. Because of security reasons, the data collection could not be completed in eight clusters: four in Borno, two in Yobe, one in Nasawara, and one in Plateau all in the North-east and North-central region [11].

3. MEASURES

Respondents with children under-5 years of age were asked about umbilical cord care practices based on recall. Instruments used for cutting the umbilical cord after childbirth and substances applied on the umbilical cord until falling off of the umbilical stump on their index child was obtained. Enquiries on history of fever in the previous 2 weeks in children 1 months or less that was serious enough to require treatment or hospital visit was also sought.

3.1 Socio-Demographic Characteristics

i) Age of respondent: in years was assessed and grouped as 15–24, 25–34, 35+; *ii) Educational*

attainment: was assessed using the following variables: highest level of education and grouped into no education, primary and secondary or higher education: *iii) Literacy level:* considered as a factor influencing access to information, was assessed as the ability to read (being "able to read whole sentences) formed one group of the dichotomy, while "able to read part of a sentence" and "unable to read" were considered as representing illiteracy, and formed the other group of the dichotomy; *iv) wealth index:* an indicator of the economic status of households that is consistent with expenditure and income measures was constructed to represent the household's economic level using principal component analysis since the DHS does not generally collect information on household income or wealth. These weighted values of wealth index from DHS data were categorized into poorest, poorer, middle, richer and richest. These were then summed and each household assigned to either the poor (poorest and poorer), middle, or rich (richer and richest) tertials; *v) Contributes to family decision:* was assessed by asking if the women had final say regarding significant household activities. Possible response options "respondent alone", "respondent and husband/partner", "respondent and other person in the household", formed one group of the dichotomy, while the options "husband/partner alone", and "someone else" formed the other group of the dichotomy. The various answers within each sub-variable were all summed up and categorized as 'no' for women with no decision autonomy and 'yes' for those who had autonomy in family decisions; *vi) Access to electronic or print media:* was assessed using question on frequency of listening to radio, reading newspapers/magazines, and watching television. Possible responses were not all, less than once a week, at least once a week and almost every day. The responses were dichotomized and summed up into ''No'' for those with no access (not at all and less than once a week), and ''Yes'' for women who had access (at least once a week and almost every day) to print and electronic media. *vii) Postnatal check-up visit:* was classified as ''institutional'' for respondents who used the health facilities for postnatal check-up for their newborn babies and ''non institutional'' for those whose postnatal check-up was not in a health facility.*viii) Household location*: defined as the geographic location of the household was categorized as urban, and rural; *ix) Respondent religion:* was categorized into Christianity; Islam; and traditional religion.

3.2 Ethical Considerations

The survey procedure and instruments for DHS for Nigeria was ethically approved by the Ethics Committee of the Opinion Research Corporation (ORC) Macro International Inc, Calverton, USA, and by the National Ethics Committee of the Federal Ministry of Health of Nigeria. Informed consent was obtained from all participants prior to participation in the survey, and collection of information was confidential. This study is based on analysis of secondary data with all participant identifiers removed. Ethical permission for use of the data in the present study was obtained from ORC Macro Inc [11].

3.3 Analysis

The Predictive Analytics Software (PASW) statistical package version 20.0 was used for data analysis. Chi-square analysis was used to determine maternal factors that were associated with use of antiseptic agents in umbilical cord care of newborns. Logistic regression was used to establish the relationship between substances used in cord care and incidence of febrile illness in the first month of life in the newborns. Results were presented in percentages, odds ratios and 95% confidence intervals where appropriate. Statistical significance was set at p-value <0.05.

4. RESULT

4.1 Characteristics of Respondents

A total of 12113 mothers were successfully interviewed for this survey with 9654 (81.6%) and 2182 (18.4%) resident in rural and urban areas respectively. Most, 5493 (46.4%) of the surveyed women were 35 years and above with a large proportion not literate 9669 (82.5%). About two-third, 7746 (65%) of the respondents have no form of education and 3995 (33.8%) and 95 (0.8%) with primary and secondary and higher education as their highest educational attainment. Mothers from the poor, middle and rich wealth class represented 63.6%, 19.6% and 16.8% of respondents respectively and 8127 (70.4%) of them have no access to electronic or print media. Majority of respondents (94.6%) contributed to family decision and for those that had postnatal check up after delivery of their index child, about 1 in 10 of this check-up (11.8%) were done in traditional health institutions. Islam is the dominant religion practiced by most 8594 (73.0%) of the

respondents. A total of 10809 under-5 years old children were unevenly distributed among the 12113 respondents. Five hundred and three 506 (4.7%) of these children were neonates aged ≤1 month while the remaining 95.3% (10303) were 2-59 months old with an overall mean age of 28.0±17.3 months.

4.2 Cord Care Practices

Delivery packs during childbirth were used in about half of the respondents 5803 (47.5%) while such pack was not used during childbirth in 6397 (52.5%). Of the latter group, new or blade sterilized by boiling was used in cutting the umbilical cord after childbirth in 5566 (87.0%) and 'used' unsterilized blade was used in 256 (4.3%) of deliveries. Other object like knifes, scissors, sickles etc were used in umbilical cord cutting in 551 (8.6%) of deliveries.

Approximately sixty percent, 7065(58.3%) of the 12113 respondents did not apply anything to the umbilical stump of the cord while the remaining 5048 (41.7%) applied one substance or the other to the stump during cord care. The commonest substances applied on stump were methylated spirit in 1521 (12.6%) and oil in 1461 (12.1%) of the respondents. Toothpaste 691 (5.7%), ash 339 (2.8%), powder 304 (2.5%) and other concoctions 504 (4.2%) were also used as cleaning and drying agent among respondents. Other substances included dettol, turmeric and animal dung in 151 (1.3%), 15 (0.1%) and 62 (0.5%) of the respondents respectively (Fig. 1).

Table 1 shows the maternal socio-demographics associated with use of recommended agents such as methylated spirit and dettol in umbilical cord care. Older (14.5%) and literate women (37.4%) were seen to use antiseptics agents more in cord care compared to younger [(14.0% for 25-34) and (11.9% for 15-24 years old); P=0.002] and illiterate women (8.7%, P=0.001). Similarly, higher education attainment (no education 4.9% vs. primary education 29.7% vs. higher education 51.6%, P=0.001) and higher wealth class (poor 3.9% vs. middle 21.0% vs. rich 42.1%, P=0.001) were significantly associated with use of recommended antiseptic agent in cord care. Furthermore, mothers with access to print and/or electronic media (22.7%) compared to those without access to media (9.4%) and those who use health facilities for postnatal check-up (82.3%) compared to those who do not (17.7%) were seen to have used the recommended antiseptic agents more in the cord care of their newborns (P=0.001). Lastly, more women residing in urban area (31.3% vs. 9.6% rural) and those practicing Christianity (30.6%, Islam 6.6% and traditionalist 7.8%) significantly used the recommended agents more in cord care of their newborns (P=0.001).

4.3 Cord care Practices and Incidence of Febrile Illnesses in the First Month of Life

History of fever in the preceding 2 weeks that was serious enough to warrant hospital visit and/or treatment was sought from the 506 mothers with babies that were ≤ 1 month of age. Sixteen (3.2%) of the 506 neonates had developed fever that were serious enough to warrant hospital visit within the last two weeks preceding interview of the respondents (Table 2). Respondents who used animal dung (20.0%), toothpaste (8.6%), ash (7.2%) and other concoction (5.5%) accounted for a higher proportion of newborns with febrile illnesses compared to those who used oil (3.9%), methylated spirit or dettol (1.5%) and 2.2% for those who applied nothing to the umbilical stump of their newborns. Regression analysis showed that newborn whose mothers applied non antiseptic agents to the umbilical stump during cord care were more likely to develop fever compared to newborns whose mothers applied nothing (Table 2).

It was shown that applying oil (OR 1.79 CI 0.39-8.87), ash (OR 3.37 CI 0.90-29.51), toothpaste (OR 4.10 CI 1.01-16.68), animal dung (OR 11.0 CI 1.11-111) and other concoction (OR 2.58 CI 0.30-22.22) increased the odds of febrile illness while application of methylated spirit or dettol (OR 0.68 CI 0.10-5.60) decreased the odd of developing fever in the newborns.

5. DISCUSSION

The finding that the cord care practices of majority of the respondents were in line with the recommendation of the World Health Organization and the Federal Ministry of Health is very encouraging. However, with almost a third of respondents still engaged in unhealthy and potentially dangerous cord care practices is disturbing and implies there is need for more action. This is particularly crucial considering that the socio-demographics of mothers still engaged in this harmful practice is considerably more in rural areas, younger age, poorer households and mothers with limited or no access to media.

These demographic characteristics which have been implicated in harmful cord care practices in other studies within and outside Nigeria [12,13,14] have long been recognized by UNICEF as poor prognostic factors in child survival [15].

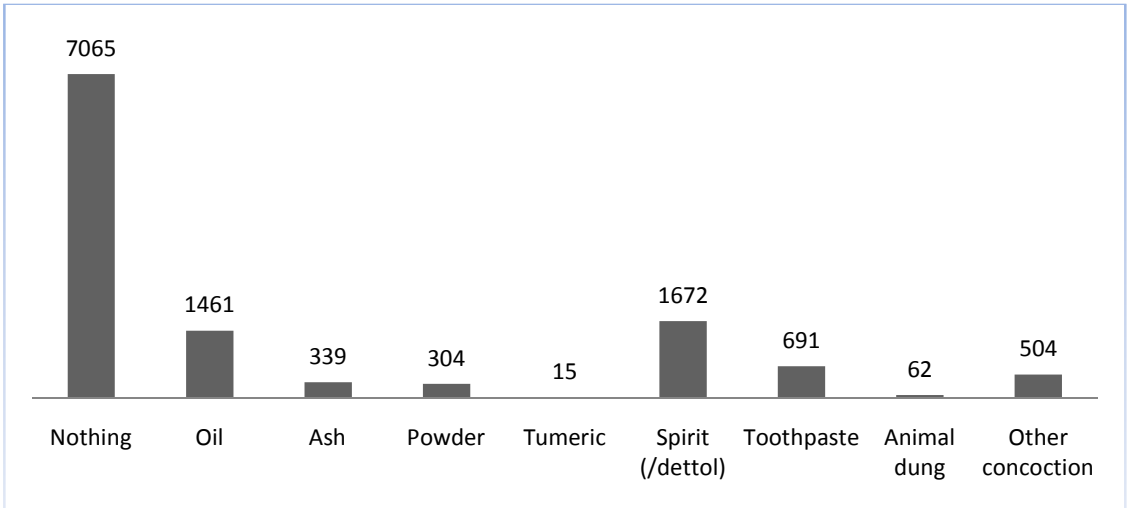

Fig. 1. Substances applied to umbilical stump during cord care

Table 1. Cord care practices among surveyed mothers

Socio-demographic factors	N (%)	Antiseptic agent used for cord care †		P-value
		No (n%)	Yes (n%)	
Mothers' age (years)	**N= 11836**			
15-24	3295 (27.8)	2904 (88.1)	391 (11.9)	0.002
25-34	3048 (25.8)	2621 (86.1)	427 (14.0)	
35+	5493 (46.4)	4697 (85.5)	796 (14.5)	
Mothers' literate	**N= 11714**			
No	9669 (82.5)	8831 (91.3)	538 (8.7)	0.001
Yes	2045 (17.5)	1280 (62.6)	764 (37.4)	
Educational attainment of mother	**N= 11836**			
None	7746 (65.4)	7368 (95.1)	378 (4.9)	0.001
Primary	3995 (33.8)	2808 (70.3)	1187 (29.7)	
Secondary or Higher	95 (0.8)	46 (48.4)	49 (51.6)	
Wealth index of household	**N= 11836**			
Poor	7532 (63.6)	7241 (96.1)	291 (3.9)	0.001
Middle	2316 (19.6)	1830 (79.0)	486 (21.0)	
Rich	1988 (16.8)	1151 (57.9)	837 (42.1)	
Contributes to family decisions	**N= 6599**			
No	356 (5.4)	294 (82.6)	62 (17.4)	0.764
Yes	6243 (94.6)	5264 (84.6)	979 (15.7)	
Access to electronic or print media	**N= 11536**			
No	8127 (70.4)	7364 (90.6)	763 (9.4)	0.001
Yes	3409 (29.6)	2634 (77.3)	775 (22.7)	
Postnatal check-up visit	**N= 1880**			
Non institutional	221 (11.8)	163 (10.5)	58 (17.7)	0.001
Institutional	1659 (88.2)	1389 (89.5)	270 (82.3)	
Place of residence	**N= 11836**			
Urban	2182 (18.4)	1499 (68.7)	683 (31.3)	0.001
Rural	9654 (81.6)	8723 (90.4)	931 (9.6)	
Religion	**N= 11776**			
Christianity	3029 (25.7)	1999 (66.0)	1030 (34.0)	0.001
Islam	8594 (73.0)	8026 (93.4)	568 (6.6)	
Traditional	153 (1.3)	141 (92.2)	12 (7.8)	

† Antiseptic agent refers to methylated spirit and dettol (chlorhexidine containing agents)

Table 2. Cord care practices and incidence of fever in the first month of life

Cord care practices	N (%)	Had fever in the last 2 weeks n (%)		AOR (95% CI)
		No	Yes	
Substance applied	**N = 506**	**N = 490**	**N = 16**	
Nothing	314 (62.1)	307 (97.8)	7 (2.2)	1
Oil	51 (10.1)	49 (96.1)	2 (3.9)	1.79 (0.39-8.87)
Ash	14 (2.8)	13 (92.8)	1 (7.2)	3.37 (0.90-29.51)
Powder	2 (0.4)	2 (100.0)	0 (0.0)	-
Tumeric (ginger derived spice)	1 (0.2)	1 (100.0)	0 (0.0)	-
Methylated spirit (and/or Dettol)	66 (13.0)	65 (98.5)	1 (1.5)	0.68 (0.10-5.60)
Toothpaste	35 (6.9)	32 (91.4)	3 (8.6)	4.10 (1.01-16.68)
Animal dung	5 (1.0)	4 (80.0)	1 (20.0)	11.01 (1.11-111)
Other concoction	18 (3.6)	17 (94.4)	1 (5.5)	2.58 (0.30-22.22)

The socio-demographic characteristics of the mothers (higher educational, older age, attainment, higher wealth class, access to media, urban dwelling) who practiced the WHO and nationally approved care of umbilical cord in this study are expected as they are more likely to have their antenatal cares in an approved health facility where they will be taught the standard care practice. Similar findings were documented in Benin City Nigeria where the practices of healthy cord care were seen to increase with increasing maternal education [16].

Application of other harmful substances like animal dung in cord care and its association with neonatal tetanus has been documented in other studies [17,18,19]. Likewise, the risk of febrile illness in the first month of life was seen to be higher in the newborns whose mother applied topical agents like toothpaste, oil, ash, or animal dung have also been documented in other studies [20,21,22]. These are unsterile agents capable of contaminating the cord with infective organisms. Conditions such as omphalitis, neonatal sepsis and neonatal tetanus are more likely to arise with these agents.

This study further showed that majority of delivery was not conducted with sterile delivery packs. This is corroborated by a study in the Niger Delta region of Nigeria which documented that a significant number of the study population uses unsterilized instrument in cutting the cord at birth and this practice was associated with neonatal tetanus in the study population [23]. This finding is very disturbing as these unsterile instruments are more prone to be contaminated with common infectious agents in the environment leading to more chances of infection and possibly death in these newborns.

There is still need for intensive nationwide campaigns and public enlightenment program involving community heads and community health workers in close collaboration with religious leaders particularly targeting women in rural area (and secondary relatives like mother-in-laws grandmothers, household heads etc), traditional birth attendants and even workers in health facilities within these areas. The health ministry must ensure that antiseptic solutions listed as an essential medicine by WHO [5] is supplied to all health facilities including traditional birth homes engaged in child delivery services. This is believed will significantly reduce the incidences of neonatal infections [24,25] and mortality [7,14] in these settings which account for a substantial proportion of under-5 deaths in Nigeria.

6. LIMITATION

Given the cross-sectional design of the demographic and Health survey (DHS) survey, the information from mothers on history of fever in their newborns that was serious enough to warrant hospital visit was obtained by recall from the mothers. Therefore, recall bias could have led to collection of wrong information and/or misclassification of data. Similarly, even though the umbilical cord is the commonest route of infection in newborn, we cannot with certainty say the cause of febrile illnesses in this surveyed newborns was due umbilical cord infection. Caution is therefore advised in result interpretation.

7. CONCLUSION

Unhealthy umbilical cord care practices using harmful substances that predisposes newborns to febrile illness is still significantly practiced by

younger, uneducated, poorer and mothers resident in rural area in Nigeria. Targeted maternal education on healthy cord care practices needs to be sustained to get rid of these harmful practices.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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