

A new use for an old tool: maternity waiting homes to improve equity in rural childbirth care. Results from a cross-sectional hospital and community survey in Tanzania

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Abstract

Limited quality of childbirth care in sub-Saharan Africa primarily affects the poor. Greater quality is available in facilities providing advanced management of childbirth complications. We aimed to determine whether Maternity Waiting Homes (MWHs) may be a tool to improve access of lower socio-economic women to such facilities. Secondary analysis of a cross-sectional hospital survey from Iringa District, Tanzania was carried out. Women who delivered between October 2011 and May 2012 in the only District facility providing comprehensive Emergency Obstetric Care were interviewed. Their socio-economic profile was obtained by comparison with District representative data. Multivariable logistic regression was used to compare women who had stayed in the MWH before delivery with those who had accessed the hospital directly. Out of 1072 study participants, 31.3% had accessed the MWH. In multivariable analysis, age, education, marital status and obstetric factors were not significantly associated with MWH stay. Adjusted odds ratios for MWH stay increased progressively with distance from the hospital (women living 6–25 km, OR 4.38; 26–50 km, OR 4.90; >50 km, OR 5.12). In adjusted analysis, poorer women were more likely to access the MWH before hospital delivery compared with the wealthiest quintile (OR 1.38). Policy makers should consider MWH as a tool to mitigate inequity in rural childbirth care.

Keywords: Maternal health, newborn health, maternity waiting homes, equity, obstetrics, Tanzania, universal health coverage, childbirth

Key Messages

- The rural poor in sub-Saharan Africa bear the burden of childbirth-related complications and deaths. Where facility delivery coverage is low, home delivery is common among women from lower socio-economic groups; available evidence indicates that as coverage increases they tend to access childbirth care in primary care or first-line facilities, able to provide lower quality. Solutions are needed to address the equity gap in outcomes.
- Through multivariate analysis of hospital survey data in a high facility delivery context, we found that the only district Maternity Waiting Home (MWH) was preferentially accessed by poorer women.
- Promoting MWHs near hospitals is a mitigation strategy that can reduce inequity, by improving poorer women's access to facilities able to provide advanced management of childbirth complications.

Introduction

Tackling maternal and perinatal mortality in sub-Saharan Africa (SSA) has proven challenging. In 2015 alone, 201 000 maternal deaths, 1 027 000 newborn deaths (UNICEF 2016) and 1 060 000 (Blencowe *et al.* 2016) stillbirths were estimated in the region. Wide socio-economic disparities exist within countries, with greater mortality among the poorest generally attributed to lower access to care (Lawn *et al.* 2009).

Care at delivery is crucial as complications and deaths are concentrated around this time. Efforts in rural SSA in the past have focused on demand promotion and higher facility densities to improve access to institutional delivery (Dettrick *et al.* 2013). Coverage itself is insufficient to reduce mortality, and the focus has recently been shifted to quality improvement. In SSA, childbirth assistance is provided both in primary care and in higher level facilities. The relevance of the primary health care system varies, with some countries assisting half of institutional deliveries at this level (Campbell *et al.* 2016; Kruk *et al.* 2016). Advanced management of complications is generally only available from the hospital level. Campbell and colleagues have recently provided a framework for improvement of this complex service, which the skilled birth attendance indicator was unable to describe fully (Campbell *et al.* 2016). Recent evidence indicates that greater quality is available in facilities with higher delivery volumes, offering more functions of obstetric care (Kruk *et al.* 2016).

The United Republic of Tanzania, with a population of 53 470 000 (WHO 2016), in 2015 was among ten countries worldwide with the highest absolute numbers of neonatal, maternal deaths and stillbirths (Lawn *et al.* 2016), in spite of a well-developed primary health care network and delivery care available at all levels of the health system. High access to institutional deliveries has been documented in different areas of the country (Kruk *et al.* 2015, Straneo *et al.* 2016; TDHS-MIS 2016), making it an ideal context to study steps following coverage in low-income countries. Evidence from Tanzania highlighted an equity gap when institutional delivery coverage is achieved. Poorest women are more likely to access delivery care in the primary health care system where lower quality is available, and are under-represented where comprehensive emergency obstetric care (C-EmOC) is provided (Straneo *et al.* 2014). Though thresholds on optimal delivery volumes in primary care are a matter of debate (Kruk *et al.* 2016; Straneo *et al.* 2017), compelling evidence on the impact of limited quality in the peripheral component of the health system comes from a population survey in Tanzania, where direct maternal mortality reduced with proximity to a hospital, but not to any facility (Hanson *et al.* 2015). Quality of front-line delivery care in Tanzania has been found to be weak in different studies (Hanson *et al.* 2013; Kruk *et al.* 2016; Mkoka *et al.* 2014; Penfold *et al.* 2013). Users' perceptions on quality of front-line facilities are indicated by women's bypassing of facilities (Kantè *et al.* 2016). Coverage brings forward challenges, among which insufficient staffing and caseloads too low for skills retention, arduous to overcome without a complex health system reorganization (Fogliati *et al.* 2015).

How can access of the poorest women to facilities providing advanced management of childbirth complications be improved? Maternity Waiting Homes (MWHs) have been advocated for several decades to overcome distance barriers to obstetric care and reduce maternal and perinatal mortality (WHO 1996; Lee *et al.* 2009; van Lonkhuijzen *et al.* 2012). They have been extensively used in rural areas of limited resources countries, though there are knowledge gaps on their impact on outcomes, partly following difficulties comparing utilization in different contexts (van Lonkhuijzen *et al.*

2012). Very limited data exist on how mothers from different socio-economic groups utilize MWHs.

As part of an effort to address inequity in maternal and perinatal outcomes, we set out to answer the question of whether MWHs may be a strategy to improve poorer women's access to facilities providing advanced management of obstetric complications. The study was conducted in Iringa District, Tanzania, a high facility delivery coverage setting (87.7% in 2009) (Straneo *et al.* 2016). Specifically, MWH utilization among women who had delivered in the only District C-EmOC facility was assessed, to determine whether socio-economic status is a determinant.

Methods

Study setting

The study was carried out in Iringa District, a mostly rural district in the Tanzanian Southern Highlands, with an habitable surface of 9857 km². The estimated population of 254 023 was served by 73 health facilities in 2012, including one District-designated diocesan hospital, 6 health centres and 66 dispensaries. C-EmOC services were available only in the Hospital, equipped with a 45 bed Maternity Ward. In 2012, 7645 institutional deliveries were recorded in the District, with 2140 (28.0%) in the C-EmOC facility, and 5505 (72.0%) in primary care facilities. In 2011–12, the only MWH in the district was adjacent to the hospital. It offered basic accommodation with toilets and cooking facilities for pregnant women, and required payment of a small daily fee. Women admitted to the MWH were self-referred or referred by a health worker from a peripheral facility.

Maternity ward hospital survey

This study was based on secondary analysis of a cross-sectional survey of women who delivered in the only C-EmOC facility in Iringa District (Tosamaganga District-designated Hospital) between October 2011 and May 2012. Women were interviewed to collect data on access and quality of services ('hospital survey') (Straneo *et al.* 2014), as part of a development intervention aiming to strengthen maternal and newborn services. A baseline population socio-economic profile was obtained from a district-representative household survey ('community survey') described elsewhere (Straneo *et al.* 2016). Data collected included socio-demographic characteristics of women discharged and pregnancy outcomes. A pre-test validated, structured questionnaire was administered by ward staff at discharge. Where relevant (e.g. type of stillborn, birth weight, time of newborn death), data were extracted from the women's files. Neonatal and perinatal mortality definitions followed WHO guidelines (WHO 2006). Obstetric risk factor was defined according to national guidelines (Jahn *et al.* 1998; MoHSw 2008), and includes primigravidae, gravida >4, previous cesarean section and poor obstetric history.

Women were asked about village of residence. Euclidean distances to C-EmOC were remotely estimated by using a geographical information system and reference points at village level, like health facility or village centre. Intervals applied were ≤5, 6–25, 26–50, >50 km, in accordance with similar studies (Høj *et al.* 2002; Wild *et al.* 2012).

Characteristics of the population of women who had stayed in the MWH and of those who had accessed the maternity ward directly were examined. Variables examined were age, tribe, parity, education, marital status, sex of household head, distance of residence from the hospital, obstetric risk, socio-economic strata (SES).

Sample size for the primary study was calculated to detect a 30% difference among the socio-economic groups accessing the C-EmOC facility compared with the baseline community SES groups, with a significance level of 5 and 90% power.

Socio-economic stratification

Socio-economic stratification of the district population was obtained from a District-representative cross-sectional survey conducted in 2009. It was based on durable household goods or housing characteristics (thatched roof, non-mud floor, radio, mobile phone, bicycle). Five SES were obtained using principal component analysis, labelled 1–5 from lowest to highest. The socio-economic profile of women with a hospital delivery was obtained by applying the cut-offs of socio-economic quintiles from the District population (Straneo *et al.* 2014). SES quintiles were collapsed into two categories (1–4 and 5) in multivariable analysis, to assess differential access of poorer women compared with the wealthiest.

Data analysis

Data entry and cleaning was done using Epidata version 3.1. Data were analysed using STATA version 9.

Characteristics of women who stayed at MWH and of those who directly accessed the hospital were summarized using proportions and 95% CI. Factors associated with staying at MWH were assessed by multivariable logistic regression. Crude and adjusted odds ratios with 95% CI were estimated and *P*-values calculated with the Wald test. Pregnancy outcomes were examined for MWH users and non-users in bivariate analysis. Proportions and 95% CI were calculated for each group and chi-squared test was applied to estimate *P*-values. Multivariable analysis on fetal/neonatal outcomes could not be performed due to small counts in some sub-groups. All *P* < 0.05 values (two-sided) were considered statistically significant.

Results

In the study period, 1405 women were discharged after delivery from the Maternity Ward, including six who died during admission. From comparison with the ward register, 99% of women discharged were interviewed.

Characteristics of women utilizing MWH

After excluding women living outside the District (*n* = 333), records from 1072 women were analysed. Information on MWH stay was available for 1046 women (97.6%). We found 335 women (31.3%) had stayed at the MWH. Baseline characteristics of women with MWH stay and of those with direct hospital access are summarized in Table 1. There were no relevant differences between the two groups regarding age, tribe (data not shown), parity, marital status, sex of household head, obstetric risk factors and type of delivery.

In bivariate analysis, years of education, distance to hospital and SES were significantly associated with MWH stay. Women who had stayed in the MWH were more likely to be less educated (crude OR 0.53, 95% CI 0.34–0.82 for women with ≥8 years' education compared with baseline 7 years), more likely to live distant from the hospital with crude OR of MWH stay increasing with distance (women living 6–25 km, OR 4.74, 95% CI 3.01–7.46; living 26–50 km, OR 5.20, 95% CI, 3.10–8.74; living >50 km, OR 5.58, 95% CI, 2.89–10.78), and more likely to belong to the lowest four socio-economic

groups (quintiles 1–4 compared with the wealthiest quintile, crude OR 1.52, 95% CI 1.16–1.99).

The final model for multivariable logistic analysis included age, distance to hospital, education, marital status, household head sex, SES and presence of obstetric risk factors. The variable parity could not be fitted into the regression model because of collinearity with variable age, and type of delivery was excluded as posterior to MWH stay. Adjusted OR, with 95% CI and *P*-values are depicted in Table 2. After adjusting, factors significantly associated to MWH stay were distance from hospital (women living 6–25 km, OR 4.38, 95% CI 2.75–7.00; living 26–50 km, OR 4.90, 95% CI, 2.87–8.37; living >50 km, OR 5.12, 95% CI, 2.61–10.02) and socio-economic status, with poorer women (quintiles 1–4) more likely to access the MWH than those from the highest quintile (adjusted OR 1.38, 95% CI 1.02–1.88).

Outcomes

Data on delivery outcome were available for all 1046 deliveries. In total, 1077 babies were delivered, with 1015 singletons and 62 twins. Approximately one third (348, 32.3%) were from mothers in the MWH group, and 67.7% (729) from women with no MWH stay. Median hospital stay was 1 day. Characteristics of the two groups are shown in Table 3.

There were non-significant differences in proportions of twins among the two groups. There were no differences in the proportion of babies born alive in the two groups, though there were significant differences in birthweight distribution, with more babies weighing ≤2500 g in the group with direct hospital access (5.6 vs 1.4%).

There were 25 neonatal deaths among 1044 babies born alive. Facility early neonatal mortality for the population was 24/1044, corresponding to 23.0/1000 live births. At bivariate level, we found significant differences in neonatal survival, with greater survival in the MWH group, compared with the group that had accessed the hospital directly. Very early and early neonatal mortality were lower in the MWH group, while perinatal mortality was not different between the two groups (Table 3).

Six maternal deaths were recorded during the study period, with data on MWH stay missing for one. One of the women who died had stayed in the MWH (intra-hospital mortality 1/334; 0.3%, 95% CI 0.0–1.7), and four had accessed the hospital directly (intra-hospital mortality 4/710; 0.6%, 95% CI 0.2–1.4): *P*-value was non-significant (*P* = 0.566).

Discussion

Three main findings arise from this study. First, among women with a hospital delivery, analysis of determinants indicates poorer women are more likely to access the MWH prior to delivery compared with those from the wealthiest quintile. Second, distance from a hospital makes MWH utilization more likely, with highest OR for women living >50 km from the facility. The third regards outcomes: neonatal survival and very early neonatal survival were greater among MWH women compared with those with direct hospital access.

The first finding is the most important, and strives to answer the research question. There is very limited published data on how women from socio-economic groups access MWH. One study found greater maize production in bivariate analysis among MWH utilizers in Zambia compared with non-utilizers (Van Lonkhuijzen *et al.* 2003). More recently, a study from Malawi (Singh *et al.* 2017) found in bivariate analysis that poorest women were more likely to have accessed MWHs. In the present study, after adjusting for

Table 1. Baseline characteristics of women who delivered at District hospital and stayed at MWH compared with women who did not stay at MWH. Iringa Rural District, Tanzania (2011–2012) (*n* = 1072)

Variable	Stayed at MWH (<i>n</i> = 335)			Not stayed at MWH (<i>n</i> = 711)		
	<i>n</i>	%	(95% CI)	<i>n</i>	%	(95% CI)
Age (years)						
≤19	63	18.9	(14.6–23.1)	110	15.5	(12.8–18.2)
20–39	263	78.7	(74.3–83.2)	583	82.1	(79.3–84.9)
≥40	8	2.4	(0.7–4.0)	17	2.4	(1.3–3.5)
Parity						
1	129	38.5	(33.3–43.7)	294	41.4	(37.8–45.0)
2–4	139	41.5	(36.2–46.8)	290	40.9	(37.2–44.5)
≥5	67	20.0	(15.7–24.3)	126	17.8	(14.9–20.6)
Education (years)						
0–6	33	9.9	(6.7–13.1)	61	8.6	(6.6–10.7)
7	273	81.7	(77.6–85.9)	540	76.5	(73.4–79.6)
≥8	28	8.4	(5.4–11.4)	105	14.9	(12.2–17.5)
Marital status						
Married/living together	283	85.0	(81.1–88.8)	575	81.3	(78.5–84.2)
Single	50	15.0	(11.2–18.9)	132	18.7	(15.8–21.5)
Sex of household head						
Male	307	93.9	(91.3–96.5)	645	91.9	(89.9–93.9)
Female	20	6.1	(3.5–8.7)	57	8.1	(6.1–10.1)
Distance from hospital (km)						
0–5 km	25	8.3	(5.2–11.5)	201	30.9	(27.3–34.4)
6–25 km	184	61.3	(55.8–66.9)	312	47.9	(44.1–51.8)
26–50 km	66	22.0	(17.3–26.7)	102	15.7	(12.9–18.5)
>50	25	8.3	(5.2–11.5)	36	5.5	(3.8–7.3)
Obstetric risk factors^a						
Present	217	64.8	(59.6–69.9)	447	63.0	(59.4–66.5)
Absent	118	35.2	(30.1–40.6)	263	37.0	(33.5–40.7)
Type of delivery						
Vaginal	231	69.0	(64.0–73.9)	489	68.8	(65.4–72.2)
Cesarean section	104	31.0	(26.1–36.0)	222	31.2	(27.8–34.6)
SES						
Very low	28	8.5	(5.4–11.5)	36	5.1	(3.5–6.8)
Low	43	13.0	(9.4–16.6)	76	10.8	(8.5–13.1)
Medium	59	17.8	(13.7–22.0)	115	16.4	(13.7–19.2)
High	87	26.3	(21.5–31.1)	163	23.3	(20.1–26.4)
Very high	114	34.4	(29.3–39.6)	311	44.4	(40.7–48.1)

^aObstetric risk factors: primipara, grand multipara, previous cesarean section, poor obstetric history.

potential confounders, poorer women were more represented in the MWH. It is likely that even in rural SSA the wealthiest women have the economic means for emergency transport to hospital once labour starts. For poorer women, the MWH may be a means to access higher level obstetric care without incurring in costs for private transport during labour. There is at present insufficient evidence on optimal organization of MWHs (van Lonkhuijzen *et al.* 2012, Lori *et al.* 2016), and no clear demonstration of impact on neonatal (Buser and Lori 2016), maternal outcomes, and stillbirths, which ongoing randomized trials may contribute to address (National Institutes of Health Undated). Notwithstanding the uncertainties, the double burden of poor outcomes among the poor and limited quality of services they access, calls for urgent policy measures. Promoting MWHs near hospitals is a mitigation strategy that can address inequity. As obstetric services with advanced management of complications are rolled out in rural areas, such as non-hospital C-EmOC units (Nyamtema *et al.* 2016), establishment of MWHs in their proximity should be considered to facilitate poorer women's access.

In addition, it is worth noting that, though relatively there is preferential MWH uptake by lower SES groups, in absolute terms

the poorest are under-represented in the hospital population compared with that of origin (only 8.5% of women from the lowest socio-economic quintile) (Straneo *et al.* 2014).

Distance has been shown in several studies to be a determinant for MWH uptake, thus their availability has been advocated to overcome geographical barriers to facility delivery (WHO 1996; van Lonkhuijzen *et al.* 2012). This study adds that distance remains a significant factor even in settings with high coverage (Straneo *et al.* 2016; TDHS 2015–16).

The third finding relates to outcomes. In this analysis, overall neonatal deaths, very early and early neonatal deaths were lower in MWH women, compared with the direct hospital access group. The finding must be interpreted with caution. Mothers with premature labour are likely to access the hospital directly. Prematurity is likely to explain at least part of the greater mortality among the group with direct hospital access. We did not find an association of obstetric risk factors' presence and MWH uptake. This contrasts with findings from other studies (van Lonkhuijzen *et al.* 2003, 2012) carried out in low coverage contexts. Overall, over 60% of women reported an obstetric risk factor both in MWH and non-MWH women. Risk factors in addition to those reported could have been

Table 2. Factors associated with staying at MWH

Variable	OR crude	(95% CI)	P-value*	OR adjusted**	(95% CI)	P-value*
Age (years)						
≤19	1.27	(0.90–1.79)	0.172	1.36	(0.89–2.09)	0.152
20–39	1			1		
≥0	1.04	(0.44–2.45)	0.923	1.24	(0.49–3.16)	0.655
Education (years)						
0–6	1.07	(0.68–1.67)	0.767	0.90	(0.54–1.51)	0.694
7	1			1		
≥8	0.53	(0.34–0.82)	0.005	0.72	(0.43–1.21)	0.214
Sex of household head						
Female	1			1		
Male	1.36	(0.80–2.30)	0.257	0.89	(0.43–1.82)	0.743
Marital status						
Married/living together	1.30	(0.91–1.85)	0.149	1.64	(0.95–2.83)	0.077
Single	1			1		
Distance from hospital (km)						
0–5 km	1			1		
6–25 km	4.74	(3.01–7.46)	<0.001	4.38	(2.75–7.00)	<0.001
26–50 km	5.20	(3.10–8.74)	<0.001	4.90	(2.87–8.37)	<0.001
>50	5.58	(2.89–10.78)	<0.001	5.12	(2.61–10.02)	<0.001
Obstetric risk factors						
Present	1.08	(0.83–1.42)	0.569	1.13	(0.82–1.57)	0.450
Absent	1			1		
SES						
Poorer (lower 4 quintiles)	1.52	(1.16–1.99)	0.003	1.38	(1.02–1.88)	0.037
Wealthiest (quintile 5)	1			1		

*Wald test.

**Adjusted for all variables.

Table 3. Outcomes babies (1072 women enrolled, available data on MWH stay 1046)

Variable	Mother stayed at MWH (n = 335)			Mother did not stay at MWH (n = 711)			P-value*
	n	%	(95% CI)	n	%	(95% CI)	
Total babies delivered (alive and dead)	348	32.3	(29.5–35.2)	729	67.7	(64.8–70.5)	
Singleton ^a	322	92.5	(89.2–95.1)	693	95.1	(93.2–96.5)	0.095
Twins ^a	26	7.5	(4.9–10.8)	36	4.9	(3.5–6.8)	0.095
Birth weight							
<2.5 kg	5	1.4	(0.5–3.3)	41	5.6	(4.1–7.6)	0.001
≥2.5 kg	343	98.6	(96.7–99.5)	688	94.4	(92.4–95.9)	0.001
Born dead^a	12	3.4	(1.8–5.9)	21	2.9	(1.8–4.4)	0.613
MSB	9	2.6	(1.2–4.9)	9	1.2	(0.6–2.3)	0.106
FSB	3	0.9	(0.2–2.5)	12	1.6	(0.9–2.9)	0.305
Born alive^a	336	96.6	(94.1–98.2)	708	97.1	(95.6–98.2)	0.613
Neonatal deaths^b	3	0.9	(0.2–2.6)	22	3.1	(2.0–4.7)	0.029
very early (≤24 h)	2	0.6	(0.1–2.1)	11	1.6	(0.8–2.8)	0.192
early (0–6 days)	3	0.9	(0.2–2.6)	21	3.0	(1.8–4.5)	0.037
late (7–27 days)	0			1	0.1	(0.0–0.8)	0.491
Perinatal deaths^c	14	4.0	(2.2–6.7)	41	5.6	(4.1–7.6)	0.266
Alive at discharge ^a	333	95.7	(93.0–97.6)	686	94.1	(92.1–95.7)	0.280

^aDenominator total babies delivered.^bdenominator babies born alive.^cPerinatal death: early neonatal deaths and still births > 1000 g; denominator born deaths weight > 1000 g and live births.

*Chi-squared test.

present leading to misclassification, thus the finding needs to be evaluated further.

This study has several strengths. One is its very high response rate (>95%), thus it offers a complete picture, with the few missing data unlikely to affect results. Second, it derives the hospital population's socio-economic profile from comparison with that of the district population. It allows to compare the women with the

population of origin, rather than with more general regional or national data. Third, multivariable analysis was used to adjust for confounding where applicable.

Limitations of the study should also be considered. Regarding the study question on factors associated with MWH, one limitation is it was a secondary analysis of survey data. Sample size and power were calculated for the primary study indicators (Straneo *et al.* 2016). In spite

of this, a significant difference in socio-economic groups' use of the MWH was detected. Second, the two populations were not time-matched, with hospital data collected 24–31 months after the community survey. Third, this was a facility study, thus the population examined was not representative of the general population. In relation to outcomes, the study was not designed to assess differences in outcomes between MWH users and non-users. Short median follow-up did not allow to identify all neonatal deaths, therefore it is likely only data on stillbirths and very early neonatal deaths are accurate, while early neonatal deaths are likely to be underestimated. Further studies are needed to assess MWH effect on outcomes.

In published literature, this is the first study that has explored a relation between MWH utilization and socio-economic status controlling for confounders, in high institutional delivery coverage. This is particularly important in limited resources contexts with expanding rural health systems, where contrasts between coverage and quality of care become evident (Hanson *et al.* 2015; Straneo *et al.* 2017). Further studies are required to validate this result, and to address questions that arise from it. Solutions to improve poorest MWH access should be sought, as, in absolute terms; they were still under-represented. Development of communities' shared models of MWH, adapted to local contexts, may favour women's uptake (Sialubanje *et al.* 2015; Lori *et al.* 2016).

Conclusion

In a rural high facility delivery context, poorer women, compared with the wealthiest, were more likely to access a MWH before hospital delivery.

Promoting MWHs near hospitals can contribute to mitigate inequity in childbirth-related outcomes in SSA, by improving poorest women's access to facilities able to provide advanced management of delivery complications.

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Ethical clearance

The National Institute for Medical Research, United Republic of Tanzania, provided ethical clearance for the hospital and the community household surveys. All participants in both surveys provided informed, signed consent. Data were entered anonymously for confidentiality.

Conflict of interest statement. None declared.

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