Supporting Information

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SI Materials and Methods

Sampling. The data set includes a very high proportion (mean ± SD = 0.72 ± 0.13) of the males belonging to the 29 patrilineages except for the four patrilineages of village 2 (Fig. S5). Participation in village 2 was low (mean ± SD = 0.33 ± 0.15) for reasons of local politics that were unrelated to the study. The reference population for evaluating the proportion of each population sampled is defined as all males born in 1985 or earlier who were alive and living locally at the time of our census of the population in the year 2000. We did not conduct a random sample of the 29 patrilineages as that would not have generated a large enough number of nonpaternity cases, given that nonpaternity is a rare event. Our data set, although not a random sample, is representative of the total population, and the observations are independent of each other.

Inferred Haplotypes. We inferred the haplotypes for unsampled (sometimes deceased) individuals on the basis of the haplotypes for other individuals in the same pedigrees. In Fig. 1, the inferred individuals are marked with an asterisk. Among the 1,706 father–son pairs ($n = 3,412$ haplotypes), 1,106 sons were genotyped, 600 sons were inferred, 459 fathers were genotyped, and 1,247 fathers were inferred (Table S4). In pairs with genetic data for both fathers and sons, we found no instances where the same man was cuckolded twice, and we assumed that the same was true for fathers whose haplotypes were inferred. In calculating the mutation rate, we omitted pairs in which the father or the son (or both) had an inferred haplotype (SI), and we included only the pairs in which there was a mutation at one locus ($n = 23$ pairs) or at no loci ($n = 361$ pairs).

Genetic Variance. Table S2 shows the genetic variance within and between villages and patrilineages as calculated in Arlequin 3.0 (1, 2). In this analysis, we used only males who were genotyped, no inferred haplotypes, and the following 12 Y-STRs: DYS388, DYS389I, DYS389II-I, DYS390, DYS391, DYS392, DYS393, DYS394, DYS426, DYS438, DYS457, TAGA = DYS439 + four repeats.

Statistical Methods. This section provides further information on the statistical methods noted in the main text (*Results and Discussion*). Descriptive statistics (category frequencies) are presented in Table S4.

Statistical analyses were carried out in the programs SAS version 9.2 and PASW version 18. We used $\alpha = 0.05$ as the cutoff for statistical significance.

Menstrual huts. We analyzed the data on nonpaternity (yes, no) by menstrual hut use (yes, no) using Fisher's exact test, which is appropriate given that we have nominal data and a small sample size for nonpaternity events ($n = 31$). We hypothesized that nonpaternity events would be more frequent when mothers did not use the huts; therefore, we used a one-tailed test (*Results and Discussion*). For comparison, we also analyzed the data using exact logistic regression to obtain exact odds ratios, and the results were similar (exact odds ratio = 0.442, 95% confidence limits = 0.202–0.963, $P = 0.039$). Exact logistic regression is also an appropriate statistical method given the binary outcome variable and the small number of nonpaternity events. The father–son mismatches that occurred deep in the pedigrees were scored as nonpaternity but may actually have been caused by ancient immigration into the patrilineages. Deep in the pedigree everyone adhered to the Dogon religion, and women were re-

quired to use the menstrual huts; hence our hypothesis test is conservative.

Wealth. We used a standardized wealth variable based on informants' rankings of the relative wealth of each family in the total population (Fig. S4). Agreement among informants was excellent: mean Cronbach's $\alpha = 0.91$. We used the two-independent-samples t test to compare the mean wealth of the families of the males who were conceived through nonpaternity versus the mean wealth of the males who were a genetic match to their fathers. The Levene statistic supported our assumption that the variance in wealth in these two groups was equal (Levene statistic = 0.001, $P = 0.975$), and the assumption of normality was supported by the normal Q-Q plot of the expected versus the observed values that showed that the data were approximately on the diagonal line. See *Results and Discussion*.

Year of birth. Data on year of birth were obtained by B.I.S. during a census of the total population in the year 2000, and the mean male generation time in the data set was found to be 36 y. We calculated the year of birth for deceased ancestors by assuming that each generation in the pedigrees was 36 y (details available upon request). See *Results and Discussion* and Table S3.

SI Results

As described in the main text, we also conducted a further analysis restricted to men born from 1930 onward, effectively eliminating the period before the advent of religious change ($n = 1,317$ father–son pairs, including 24 nonpaternity events). In this analysis, the odds of nonpaternity in the Christians was five times higher than in the Dogon religion (exact odds ratio = 4.96, 95% confidence limits = 1.25–17.63, $P = 0.023$). When the Christians were split into Catholics and Protestants, the result for the Catholics was significant ($P = 0.021$) and for the Protestants was not ($P = 0.662$). However, the exact odds ratio for the Protestants was in the same direction as that for the Catholics (higher nonpaternity compared with the indigenous religion), which explains why the odds ratio for Christians as a whole was significant ($P = 0.023$). Among Muslims, the odds of nonpaternity were 2.2 times higher than in the Dogon religion, but this result was not significant (exact odds ratio = 2.218, 95% confidence limits = 0.806–6.403, $P = 0.135$). The lack of a significant difference between the Muslim and traditional fathers may be due to the requirement that Muslim women must inform their husbands when they are menstruating—as well as the greater entrenchment of sexual purity norms in Islam compared with Christianity at the study site (see below, *Religious Conversion in the Dogon*).

SI Discussion

Religious Texts. Additional patriarchal features shared by the world religions include the following: (*i*) the supreme deity or source of moral authority is male (3–6); (*ii*) women are subordinated to men (3–6); and (*iii*) female reproductive biology, especially menstrual blood, is seen as impure (7). Rules that protect males against paternity uncertainty are found in each of the five religions.

Christianity and Judaism. In these two Abrahamic religions, the blame for cuckoldry extends to children conceived outside of marriage: "Those born of an illicit union shall not be admitted to the assembly of the Lord. Even to the tenth generation, none of their descendants shall be admitted to the assembly of the Lord" (Deuteronomy 23:2 in ref. 4). The Cohanim, who are descendants of a Jewish priesthood (8, 9), have been shown to have high paternity certainty (10). Jewish *Halakha* law forbids physical

contact between spouses during the menses and for the following 7 d. The wife then purifies herself by taking a ritual bath at the public *mikveh*, after which it is the husband's duty to have sexual relations with her; thus copulation occurs during the fertile period and at a time of high sperm counts (10). An interesting but untested hypothesis proposes that this custom may be responsible for the high paternity certainty of the Cohanim (10, 11).

Hinduism. The Hindu text, *The Laws of Manu* advises that women are to be kept busy and carefully guarded (9:10–17 in ref. 5). Manu addresses the need to safeguard the husband's role as genitor of his wife's progeny: "The woman is traditionally said to be the field, and the man is traditionally said to be the seed; all creatures with bodies are born from the union of the field and the seed. ...A well-educated man who understands this and who has knowledge and understanding will never sow in another man's wife, if he wants to live a long life" (9:33–41 in ref. 5).

Islam. The Qur'an is explicit that females must be sexually chaste ("guarding the secret") and subordinate ("righteous women are therefore obedient") because males control the resources ("God has preferred [men] in bounty") and males provide paternal care ("have expended of their property") (Women 4:38 in ref. 6; 12). The Qur'an allows divorced women to remarry, but forbids the concealment of pregnancy: "Divorced women shall wait by themselves for three [menstrual] periods; and it is not lawful for them to hide what God has created in their wombs" (Cow 2:228 in ref. 6). This surah prevents the confusion of paternity and the potential for cuckoldry when there are two potential fathers (13).

Buddhism. In Buddhism, the *Dhammapada* (pp 309–310) advises that "The enjoyment of a scared man with a scared woman is short-lived, and the king also metes out severe punishment. Therefore, a man should not commit sexual misconduct with another man's wife" (3).

How Did the Anti-Cuckoldry Tactics Get into the Religious Texts? Our theoretical perspective is that of human behavioral ecology, which sees culture, including religion, as the cumulative product of the reproductive striving of individuals (14–20). Doniger (21), a scholar of religion, states that the most important question about religious texts is "Says who?," which may be rephrased as "To whose advantage?" or "In whose interests?" We agree that these are the pertinent questions, and we argue that religious texts reflect the reproductive dilemmas and genetic interests of their authors—who were virtually always males. For example, the Torah or Old Testament was most plausibly written by male Levites, a priestly and literary caste of the ancient Hebrews (22). The Hindu text, *The Laws of Manu*, was written by male Brahmins, a priestly caste in ancient India (21). In most religions, males have traditionally held the important positions of power and authority (e.g., ref. 23). Among the laity, males have enjoyed greater religious freedom in guiding the religious choices of families and nations. Males have therefore disproportionately influenced sexual morality, embedding tactics that serve their reproductive interests—especially the promotion of paternity certainty—into religious systems (13, 24). Through a similar process, patriarchal laws were introduced into legal systems (see ref. 25).

Religious ideologies and practices that reduce the risk for cuckoldry appeal to current practitioners and prospective future male converts. Females are sometimes tempted to engage in EPCs, which threatens male paternity certainty. If females were never tempted to mate outside the pair bond, religious restraints on female sexuality would not be imposed in the first place. Once a society has a code of sexual purity, including anti-cuckoldry practices and ideologies, then a woman who does not conform to the code risks loss of marital opportunities and paternal investment. She may submit to the code and impose its standards on herself and other women, but the root cause of the sexual purity norms is male uncertainty of paternity (12, 13, 24). Individual males who protect themselves against cuckoldry avoid immediate

genetic costs; hence, invoking higher-order benefits at the level of the group as a whole is probably unnecessary. If internal cooperation among males is more harmonious in religions that successfully regulate paternity certainty, then an added benefit could accrue during intergroup competition between religions. We are skeptical, however, of the need to invoke cultural group selection (26), or "group beneficial norms" (27) to explain patriarchal ideologies. If a benefit could not be found for individual males, then it might make sense to search for a benefit at the level of the group as a whole.

Religious Conversion in the Dogon. *Islam.* Further insight can be gained from ethnographic observations of religious conversion in the Dogon. Cultural group selection models propose that religions that foster greater levels of cooperation out-compete less cooperative religions in a process of group selection (e.g., 26). In the Dogon, Islam is rapidly gaining converts (Fig. 3), but this process is driven by the conversion of individual males rather than the differential survival of religious groups as a whole. The latter is merely an epiphenomenon that reflects change from within. Similarly, Peterson (28) writes that, in southern Mali, Islam "was spread spatially through the diffusion of people migrating away from Muslim centers." Further, he comments: " 'Islamization' must be unpacked, and rethought, as a process of individual life histories, face-to-face social interactions and ...it cannot be assumed that 'Islam', itself, made inroads; rather, people made inroads, introducing subtle changes as agents."

To understand the attraction of Islam for young Dogon males, it is useful to recognize that Islam is the dominant religion in the Republic of Mali and neighboring countries such as the Côte d'Ivoire. When young Dogon men go to Bamako or Abidjan to earn wages, they usually convert to Islam and bring their new faith back home. The indigenous religion cannot be practiced in the city because it is tied to worship at nonportable religious shrines and altars in the home village, a factor that disfavors the Dogon religion among urban workers (13). More importantly, people tend to trust and cooperate with their coreligionists, and young men who seek friends and job opportunities in the city, yet admit to worshiping their ancestors, are viewed as country bumpkins and treated with skepticism (13). The indigenous Dogon religion carries low prestige in urban areas where most of the powerful people are Muslim. As noted in the *Results and Discussion*, a key difference between Dogon Christians and Muslims is that the Muslims have spent more time in the city (13).

A full treatment of religious conversion is beyond our present scope; we note, however, that the Dogon are typical of African societies in that, when a new religion is adopted, the old one is not entirely displaced (29). In the 1980s one could still observe a few Dogon Christians and Muslims using the menstrual huts although the huts are alien to their religions (13, 24). In the long term, the menstrual huts did not survive the loss of the religious enforcement mechanism. Menstrual pollution is believed to have the power to desecrate the sacred objects kept in the homes of families that practice the Dogon religion; if menstruating women were not segregated, then famine and illness would result. After the sacred objects have been given up and abandoned, then the supernatural mechanism that helps to impose the taboos on the women is no longer viable (13, 24). In addition, religious authorities, whether missionaries or Imams, have strongly opposed the menstrual taboos as they are part of a religion that they pejoratively view as "fetishist." Acting in combination, the above factors eventually led Dogon Christians and Muslims in all of the study villages to abandon the menstrual taboos despite the concern, articulated by informants, that this change might increase the risk for cuckoldry. Informants said people discuss this risk but cannot evaluate its validity.

Dogon female informants expressed strong dislike for the menstrual huts, viewing them as uncomfortable places where they

are forced to camp out at night, cut off from their children and possessions. Women explained that avoidance of these places is an important advantage to marrying a man who does not follow the Dogon religion (13, 24). First marriages for young men and women are arranged, and families choose spouses from within the same religion. After divorce, however, a woman may choose her own spouse (30). By opting out of the indigenous religion, a man may increase his attractiveness to women.

From a functional perspective, any religion has pros and cons for followers. Islam, the religion that is gaining the most ground and that will probably one day displace the other religions at the study site, has doctrines that mesh well with the conservative nature of Dogon society. Although Muslim Dogon women usually wear the traditional African head scarves rather than the Islamic head scarves, they are expected to obey the Qur'an's teachings on feminine modesty and chastity and to be subordinate to their husbands. Increasingly, Muslim girls at the study site are enrolled in Qur'anic schools (although even more are excluded from formal education or attend the government schools). Most importantly, Muslim Dogon women must notify their husbands when they are menstruating and they are not allowed to pray. We posit that the conservative features of Dogon Islam are aimed at the promotion of paternity certainty and form part of its appeal for Dogon men. When the father practiced Islam rather than the Dogon religion, the odds of nonpaternity were higher, but this difference was not statistically significant (Fig. 2B, main text). The loss of the menstrual taboos is a cost, but it is compensated by the gain of doctrines that serve a similar function.

Islam explicitly allows men to have up to four wives, a number similar to that of the Dogon cultural tradition, which sets a limit at three wives (30). Unlike the menstrual huts, polygyny in the Dogon is a cultural tradition that is not tied to any sacred objects and is therefore not influenced by the eradication of "fetishes." Dogon men strive to achieve large family sizes—a goal that is well served by Islam's endorsement of polygyny (30, 31). In summary, Islam is the fastest growing religion in the study area and is the most widely respected religion in Mali as a whole. It is highly compatible with Dogon cultural traditions and the desire to avoid cuckoldry.

Christianity. Tenets aimed at the avoidance of cuckoldry are found in each of the five religions that we considered; thus, the success of any given religion in preventing cuckoldry depends to a great extent on how stringently these anti-cuckoldry precepts are enforced. Our study has too few Protestants for meaningful statistical analysis, but the relatively high risk for nonpaternity in the Catholics probably reflects the relaxed way that this religion is practiced compared with official Church dogma in Rome. Compared with the traditional religion, Christianity is newly arrived at the study site

and its doctrines have not penetrated deeply (Fig. 3). Trans-Saharan traders introduced Islam to the Sahel by the 10th century (32). Islam did not win converts in the study villages until c. 1940, but the long history of Islam elsewhere in Mali helped it to spread quickly once Dogon men started to travel during the Colonial and post-Colonial period. Compared with Islam, Catholicism and Protestantism are marginal religions with small memberships in the study villages. The relative superficiality of Catholicism at the study site was captured by one woman who explained why she and her husband became Catholic: "The Catholic missionaries give out watering cans—what do the Protestant missionaries give you? Nothing." Informants also emphasized that Christians incur fewer expenses on funerals and holidays (13).

Differences did exist between the Catholic and Protestant missionaries. The Jesuits of the Catholic mission were French and emphasized small development projects in the general region (but outside the study villages); the Protestant missionaries were Americans who focused on translating the Bible and training the local pastors who now carry on their work (the last American evangelical departed in 1987). Both traditions are Christian, but they differ in their degree of puritanism. The French tended to be laissez faire in regard to cultural traditions such as polygyny and alcohol consumption, whereas the Americans viewed these practices as sinful. Both types of Dogon Christians frequently disregard the doctrine of monogamy (*Results and Discussion*) just as Christians in high-income countries often disregard Jesus' prohibition of divorce and remarriage. The presence of a bar at the Protestant mission calls into question the success of attempts by the Protestant missionaries to regulate the drinking of alcohol. The small number of Protestant fathers living in the study villages makes it difficult to ascertain whether any meaningful differences exist between Protestants ($n = 34$) and Catholics ($n = 64$) in regard to risk for cuckoldry. In a study of religion and self-reported extramarital affairs in the United States, members of liberal churches reported more affairs than members of conservative churches, and differences also emerged between Protestants and Catholics (33).

No theoretical reason exists why the Dogon Protestants and Catholics should have identical rates of nonpaternity. However, when the members of these two separate congregations are combined for the sake of analysis, the exact odds of nonpaternity were 4.0 times higher under Christianity than under the Dogon religion ($P = 0.03$) (*Results and Discussion*). Thus, the significant result for Catholics is not erased by including Protestants in the analysis. Neither form of Christianity provides as seamless a fit as Islam to the cultural milieu, nor would it be surprising if both disappear from the study site over time.

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Fig. S1. The number of patrilineages that shared a given haplotype based on 14 Y STR loci.

Villages (column groupings): L01–L04: Vill 1; L05–L08: Vill 2; L09–L10: Vill 3; L11–L12: Vill 4; L13–L15: Vill 5; L16–L19: Vill 6; L20–L21: Vill 7; L22–L23: Vill 8; L24–L26: Vill 9; L27–L29: Vill 10.

hap	N	L01	L02	L03	L04	L05	L06	L07	L08	L09	L10	L11	L12	L13	L14	L15	L16	L17	L18	L19	L20	L21	L22	L23	L24	L25	L26	L27	L28	L29
h001	7	0.02									0.01		0.01				0.12				0.74							0.06	0.19	
h002	23	0.80	0.77	0.83	0.29	0.61		0.18	0.06	0.69	0.07	0.02	0.92	0.56	0.80	0.49	0.11		0.17		0.03		0.03	0.72		0.03	0.04	0.07	0.18	
h003	3	0.02								0.14			0.01																	
h004	3	0.02																					0.05					0.17		
h005	3	0.02			0.32					0.03																				
h006	1	0.14																												
h007	2		0.08													0.02														
h008	4		0.15										0.03												0.02	0.30				
h009	1			0.17																										
h010	2				0.36									0.04																
h011	1			0.03																										
h012	2					0.11		0.06																						
h013	1					0.06																								
h014	1					0.11																								
h015	1					0.11																								
h016	1						1.00																							
h017	1							0.18																						
h018	1							0.18																						
h019	1							0.35																						
h020	1							0.06																						
h021	1								0.06																					
h022	4								0.56		0.57														0.16		0.01			
h023	1								0.06																					
h024	1								0.19																					
h025	6								0.06			0.02		0.01		0.55									0.08	0.05				
h026	4								0.03								0.01	0.07		1.00										
h027	1									0.07																				
h028	1									0.03																				
h029	1									0.12																				
h030	2									0.01	0.03																			
h031	1									0.08																				
h032	1									0.05																				
h033	3									0.03					0.38				0.13											
h034	1									0.02																				
h035	3									0.49					0.02		0.04													
h036	1									0.01																				
h037	1									0.01																				
h038	1									0.01																				
h039	1									0.05																				
h040	1									0.03																				
h041	1											0.08																		
h042	1											0.08																		
h043	1											0.02																		
h044	1											0.02																		
h045	6											0.10				0.04		0.03	0.75									0.40	0.46	
h046	1											0.02																		
h047	1											0.07																		
h048	1												0.01																	
h049	1												0.01																	
h050	1													0.04																
h051	2													0.16								0.17								
h052	1														0.07															
h053	1														0.37															
h054	2													0.02											0.44					
h055	1																0.04													
h056	1																0.01													
h057	6																0.38	0.67					0.03	0.04			0.23			0.59
h058	2																0.13	0.11												
h059	1																0.06													
h060	3																0.05								0.08	0.08				
h061	1																0.01													
h062	1																0.01													
h063	1																0.01													
h064	1																0.01													
h065	1																		0.04											
h066	1																		0.04											
h067	1																		0.04											
h068	1																			0.02										
h069	1																			0.02										
h070	1																			0.17										
h071	1																			0.02										
h072	1																			0.02										
h073	4																			0.02			0.02		0.18	0.08				
h074	1																				0.03									
h075	1																				0.03									

Fig. S2. The Y DNA structure of the villages and patrilineages (haplotypes 1–75). h001–h075: haplotypes based on 14 Y STR loci. Vill 1–Vill 10: villages. L01–L29: patrilineages. n = number of lineages that shared a given haplotype (pink, unique haplotypes; blue, haplotypes shared by two to four patrilineages; yellow, haplotypes shared by more than four patrilineages). The data for this figure are based on 1,218 males who were genotyped and do not include the inferred haplotypes.

hap	N	L01	L02	L03	L04	L05	L06	L07	L08	L09	L10	L11	L12	L13	L14	L15	L16	L17	L18	L19	L20	L21	L22	L23	L24	L25	L26	L27	L28	L29
		Vill 1				Vill 2				Vill 3		Vill 4		Vill 5			Vill 6				Vill 7		Vill 8		Vill 9			Vill 10		
h076	3																					0.21			0.12		0.01			
h077	1																					0.04								
h078	2																						0.83	0.03						
h079	1																						0.02							
h080	1																						0.02							
h081	1																						0.02							
h082	3																						0.03			0.18	0.32			
h083	1																							0.02						
h084	1																								0.04					
h085	1																								0.04					
h086	1																								0.04					
h087	3																								0.04	0.01	0.05			
h088	1																									0.06				
h089	1																									0.01				
h090	1																									0.01				
h091	1																									0.01				
h092	1																									0.01				
h093	2																									0.01	0.01			
h094	1																										0.02			
h095	1																										0.01			
h096	1																										0.01			
h097	1																										0.01			
h098	1																										0.04			
h099	1																										0.01			
h100	1																										0.04			
h101	1																										0.01			
h102	1																										0.01			
h103	1																										0.01			
h104	1																										0.1			
h105	2																											0.1		0.1
h106	1																											0.1		
h107	1																												0.1	
h108	1																												0.2	
h109	1																												0.1	
h110	1																													0.1
h111	1																													0.2

Fig. S3. The Y DNA structure of the villages and patrilineages (haplotypes 76–111). h076–h111: haplotypes based on 14 Y STR loci. Vill 1–Vill 10: villages. L01–L29: patrilineages. n = number of lineages that shared a given haplotype (pink, unique haplotypes; blue, haplotypes shared by two to four lineages). The data for this figure are based on 1,218 males who were genotyped and do not include the inferred haplotypes.

Fig. S4. Wealth distribution measured in SDs [$n = 1,238$; mean ($\pm$ SD) $= 0.58 \pm 0.844$]. The standardization was performed on the entire population from which the men in this study were drawn. Thus, in our study the mean is not 0 and the SD is not 1.0. The men in our study are slightly wealthier than the population average because our study excludes families comprised of elderly widows and families with no sons, which tend to be less wealthy.
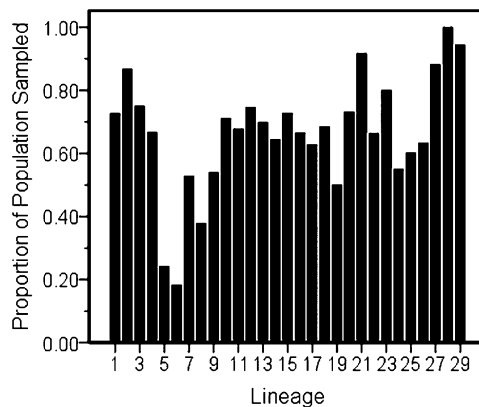
Fig. S5. The proportion of the population sampled by patrilineage.

Table S1. Independence of nonpaternity events

Lineage	N	Observed no. of nonpaternity events	Expected no. of nonpaternity events	Mean relatedness (r) between nonpaternity cases in same lineage
1	98	0	1.82	NA*
2	22	0	0.41	NA
3	72	0	1.34	NA
4	41	0	0.76	NA
5	15	1	0.28	NA
7[†]	22	0	0.41	NA
8	15	0	0.28	NA
9	59	1	1.10	NA
10	154	5	2.87	0.09
11	73	3	1.36	0.00
12	129	1	2.40	NA
13	53	1	0.99	NA
14	32	0	0.60	NA
15	68	2	1.27	0.02
16	108	2	2.01	0.00
17	29	0	0.54	NA
18	68	2	1.27	0.00
19	3	0	0.06	NA
20	37	1	0.69	NA
21	31	1	0.58	NA
22	102	1	1.90	NA
23	76	1	1.41	NA
24	35	2	0.65	0.00
25	90	3	1.67	0.00
26	199	4	3.70	0.00
27	19	0	0.35	NA
28	7	0	0.13	NA
29	9	0	0.17	NA

Monte Carlo estimate for Fisher's exact test: $P = 0.57$ (99% confidence limits: 0.55–0.58).
*NA, not applicable. These lineages had fewer than two nonpaternity events (so the question of clustering or relatedness between events in these lineages was moot).
[†]Lineage no. 6 was omitted because a low proportion (<20%) of the men in this lineage were sampled (this was due to political conflict between two villages: see *SI Materials and Methods*). Lineage 6 had no instances of nonpaternity.

Table S2. AMOVA results showing the percentage of genetic variation between and within villages (F_{ST} = 0.21) and patrilineages (F_{ST} = 0.41) (computed in Arlequin 3.0) (1, 2)

Source of variation	Degrees of freedom	Sum of squares	Variance components	% of variation
Between villages	9	558.88	0.51	21.44
Within villages	1,205	2,252.06	1.87	78.56
Total	1,216	2,810.94	2.38	
Between patrilineages	28	1,156.50	0.97	41.06
Within patrilineages	1,189	1,659.08	1.40	58.94
Total	1,217	2,815.58	2.37	

The 12 Y STR loci used are the following: (DYS388, DYS389I, DYS389II-I, DYS390, DYS391, DYS392, DYS393, DYS394, DYS426, DYS438, DYS457, TAGA = DYS439 + 4 repeats). $P < 0.0001$ based on 1,023 permutations.

1. Excoffier L, Laval G, Schneider S (2005) Arlequin (version 3.0): An integrated software package for population genetics data analysis. *Evol Bioinform Online* 1:47–50.
2. Excoffier L, Smouse PE, Quattro JM (1992) Analysis of molecular variance inferred from metric distances among DNA haplotypes: Application to human mitochondrial DNA restriction data. *Genetics* 131:479–491.

Table S3. Results of best subset selection with logistic regression

No. of variables in model	χ^2 score	Variables (odds ratio, P value)				
1	7.4618	**Catholic (3.98, 0.01)**				
1	5.3154	**Menstrual hut use (0.44, 0.02)**				
1	3.0942	Year of birth (1.01, 0.08)				
1	0.9722	Muslim (1.45, 0.32)				
1	0.2403	Protestant (1.66, 0.62)				
2	10.2681	Catholic (2.78, 0.08)	Menstrual hut use (0.52, 0.08)			
2	9.4527	Muslim (0.41, 0.10)	**Menstrual hut use (0.22, 0.004)**			
2	9.2288	**Catholic (3.12, 0.046)**	Year of birth (1.00, 0.165)			
2	9.2235	**Catholic (4.81, 0.006)**	Muslim (1.728, 0.167)			
2	7.7834	**Catholic (4.05,0.01)**	Protestant (1.84, 0.55)			
3	10.7080	Catholic (1.85, 0.53)	Muslim (0.63, 0.61)	Menstrual hut use (0.34, 0.23)		
3	10.6165	Protestant (0.44, 0.47)	Muslim (0.33, 0.06)	**Menstrual hut use (0.18, 0.003)**		
3	10.5703	Catholic (2.71, 0.09)	Year of birth (1.00, 0.51)	Menstrual hut use (0.62, 0.31)		
3	10.3300	Catholic (2.82, 0.08)	Protestant (1.27, 0.82)	Menstrual hut use (0.52, 0.10)		
3	9.8367	**Catholic (3.70, 0.04)**	Muslim (1.36, 0.50)	Year of birth (1.01, 0.37)		
4	11.0345	Protestant (0.44, 0.47)	Muslim (0.34, 0.07)	Year of birth (1.00, 0.49)	**Menstrual hut use (0.22, 0.02)**	
4	11.0301	Catholic (1.81, 0.54)	Muslim (0.63,0.60)	Year of birth (1.00, 0.51)	Menstrual hut use (0.41, 0.33)	
4	10.8868	Catholic (0.733, 0.90)	Protestant (0.33, 0.67)	Muslim (0.24, 0.56)	Menstrual hut use (0.13, 0.40)	
4	10.6245	Catholic (2.75, 0.09)	Protestant (1.23, 0.84)	Year of birth (1.00, 0.52)	Menstrual hut use (0.63,0.33)	
4	10.1411	**Catholic (3.92, 0.03)**	Protestant (1.79, 0.59)	Muslim (1.44, 0.45)	Year of birth (1.00, 0.44)	
5	11.2505	Catholic (0.68, 0.87)	Protestant (0.31, 0.64)	Muslim (0.23, 0.53)	Year of birth (1.00, 0.49)	Menstrual hut use (0.15, 0.43)

Logistic regression multivariable models generated by the method of best subset selection (1), which identifies the top models for a given number of variables. Significant covariates (at $\alpha = 0.05$) are in boldface type. The rule of thumb is that there should be at least 10 events per covariate; as we have only 31 nonpaternity events, models with more than three variables are likely to be over-fitted. In single-variable models, the χ^2 was higher for Catholic ($\chi^2 = 7.46$, $P = 0.01$) and menstrual hut use ($\chi^2 = 5.32$, $P = 0.02$) than for other variables such as year of birth ($\chi^2 = 3.09$, $P = 0.08$). The best two-variable model ($\chi^2 = 10.27$) included the variables Catholic (odds ratio = 2.78, $P = 0.08$) and menstrual hut use (odds ratio = 0.52, $P = 0.08$), both of which lost statistical significance due to collinearity. *Of all 16 models presented above, there was never more than one significant term in any model, and adding variables beyond two did not substantially improve the χ^2.* In particular, the inclusion of year of birth did not improve the fit in any of the multivariable models nor did it eliminate the significance of Catholic or substantially affect its odds ratio. These results explain our choice of bivariate over multivariable models in the main text. More importantly, they support our conclusion that nonpaternity was highest in Catholics and in sons whose mothers did not use the menstrual hut (main text). We also performed best subset selection with seven variables, the above five plus polygyny and wealth, neither of which were significant in any model. Due to missing data, these models had only 18 nonpaternity events in 834 father–son pairs. We therefore elected to include no more than two predictors in models with polygyny or wealth (main text).

1. Hosmer DW, Jovanovic B, Lemeshow S (1989) Best subsets regression. *Biometrics* 45:1265–1270.

Table S4. Frequencies of categorical variables for father–son pairs

Variable	Frequency	%	Total
Father–son pairs			
Matched	1,675	98.2	
Mismatched	31	1.8	1,706
Males' Y STR haplotype			
Genotyped	1,106	64.8	
Inferred	600	35.2	1,706
Fathers' Y STR haplotype			
Genotyped	459	26.9	
Inferred	1,247	73.1	1,706
Menstrual hut use			
Yes	1,152	67.5	
No	550	32.2	1,702
Missing data	4	0.2	
Father's religion			
Indigenous Dogon	1,136	66.6	
Protestant	34	2.0	
Catholic	64	3.8	
Muslim	470	27.5	1,704
Missing data	2	0.1	
Father's wives			
One wife	381	22.3	
Two wives	413	24.2	
Three wives	99	5.8	
Four wives	18	1.1	911
Missing data	795	46.6	