A model comparison approach shows stronger support for economic models of fertility decline

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The demographic transition is an ongoing global phenomenon in which high fertility and mortality rates are replaced by low fertility and mortality. Despite intense interest in the causes of the transition, especially with respect to decreasing fertility rates, the underlying mechanisms motivating it are still subject to much debate. The literature is crowded with competing theories, including causal models that emphasize (*i*) mortality and extrinsic risk, (*ii*) the economic costs and benefits of investing in self and children, and (*iii*) the cultural transmission of low-fertility social norms. Distinguishing between models, however, requires more comprehensive, better-controlled studies than have been published to date. We use detailed demographic data from recent fieldwork to determine which models produce the most robust explanation of the rapid, recent demographic transition in rural Bangladesh. To rigorously compare models, we use an evidence-based statistical approach using model selection techniques derived from likelihood theory. This approach allows us to quantify the relative evidence the data give to alternative models, even when model predictions are not mutually exclusive. Results indicate that fertility, measured as either total fertility or surviving children, is best explained by models emphasizing economic factors and related motivations for parental investment. Our results also suggest important synergies between models, implicating multiple causal pathways in the rapidity and degree of recent demographic transitions.

The demographic transition, in which high fertility and mortality rates decline to low levels, is a global phenomenon with significant ramifications for both global population and modern social organization (1). Beginning in late 18th century Europe, the demographic transition spread during the 19th and 20th centuries, until much of the world experienced major reductions in both mortality and fertility (2–4). Although most literature links the transition to the economic, social, and technological changes associated with development (2), the causal mechanisms underlying it remain the subject of intense debate (4–6).

The literature on the demographic transition, especially the remarkable decreases in fertility that characterize it, is crowded with competing theories, making comprehension difficult for academics and policymakers alike. Scholars working on this topic often call for more comprehensive, better-controlled studies that will allow us to tease apart different theoretical explanations (2, 5, 7). However, the data demands for systematic comparative analysis are heavy, and only limited work has been done (8–10). In this article we address this gap by explicitly comparing three prominent classes of models to determine which produces the most robust explanation of a rapid, recent demographic transition in rural Bangladesh.

To compare models rigorously, we use an evidence-based statistical approach using model selection techniques derived from likelihood theory (11, 12) and data collected explicitly for this type of comparative analysis. Although this approach is ideal for comparative analysis, it is not frequently used in the social sciences (12) and has not been applied in a comprehensive way to the demographic transition (10).

Demographic Transition Theory

Theoretical approaches to the demographic transition come from several disciplines, notably demography, economics, and evolutionary anthropology, but often share key predictions (Table 1) that can be organized into three classes.

Risk and Mortality Models. These models derive from Classic Demographic Transition Theory (13), which proposes that as infant mortality rates fall parents will change their reproductive behaviors to match the increased survival of their children. Rapid population growth will occur during an adjustment period, but once parents recognize that more children will survive childhood, fertility rates will rapidly decline. Recent approaches based on life history theory also stress the importance of decreasing risk as a primary factor in decreasing optimal fertility. Such research examines the relative risk of mortality or high levels of stress for either children (14) or adults (15, 16) as a primary factor in fertility decisions. More recently, Unified Growth Theory suggests that increases in adult life span and child survival rates allow greater payoffs to investments in self and individual children (17, 18).

Economic and Investment Models. These models examine the costs and benefits of investing in self and children. For example, Caldwell's Wealth Flows approach (19) suggests that in traditional agricultural societies, children provide their parents with significant wealth through labor, favoring high fertility, whereas in modern economies children consume wealth, resulting in low fertility. Other researchers have argued that children are always costly but that children's work can subsidize parental reproduction, leading to higher fertility (20, 21).

In contrast, Human Capital Theory (22) suggests that fertility declines with increasing payoffs to investment in human capital (primarily education) in modern labor markets. This approach has also been combined with life history theory (23) and the study of longevity (8). In modern economies, if child quality is a function of the investments made in children, then parents should raise fewer, high-quality children (23–25). This relates to a broader finding (24, 25) that when wealth is heritable, the costs of raising children increase, and fertility levels drop. Opportunity costs of raising children also increase in modern labor markets, especially for women (26–29), who may intentionally reduce fertility to take advantage of new labor market opportunities [including those offered by microcredit or other programs designed to increase women's market participation (30)] or delay reproduction so long that their fertility is reduced by biological limits (31).

Cultural Transmission Models. Cultural transmission theories of the demographic transition were proposed in demography by Cleland and Wilson (32) and have since been used extensively (33, 34). Fertility reductions are thought to result from changes

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Table 1. Key citations and related predictions for three classes of models of fertility decline

Risk/mortality models*†	Economic/investment models*†	Cultural transmission models*†
1. Classic Demographic Transition Theory (13): Fertility declines with reductions in infant mortality, increases in development 2. Childhood Environment (15): Fertility declines with decreases in local mortality rates or chronic stress 3. Extrinsic Risk (14): Fertility declines with decreases in extrinsic mortality, especially in infancy and childhood 4. Variance Compensation (16): Fertility declines with decreasing mortality rates, variance in mortality 5. Unified Growth Theory (17, 18): Fertility declines with increasing adult lifespan, increasing child survival rates	1. Wealth Flows (19, 21): Fertility declines with the reduction in child productivity, following a shift away from agriculture 2. Human Capital (22)/Embodied Capital (23)/Unified Growth Theory (18): Fertility declines with increasing payoffs to investment in human capital in modern labor markets 2a. Women's Opportunity Costs (27–29): Increasing investment in women's education and careers produce a tradeoff with children and/or delays in childbearing 2b. Investment in Child Quality (22, 23): Increasing payoffs to investments in children motivate parents to have fewer children and increase tradeoffs between children 2c. Rising Costs of Children (22, 25): Fertility declines with increasing costs of raising children, especially when wealth is heritable	1. Diffusion (32, 34): Fertility declines with critical mass of low fertility innovators or mass media technology 2. Social Network Effects (35, 36): Fertility declines with changes in social network structure that foster transmission of new information or adoption of new fertility behaviors 3. Cultural Evolution (37, 38): Fertility declines with an increasing number of high prestige adopters of low fertility 4. Kin Influence (39): Fertility declines with decreasing interactions with kin, increasing interactions with nonkin

*Given space constraints, we focus here on some of the best-known models from several disciplines.
†The models discussed often have numerous predictions. We focus on those amenable to modeling with our sample.

in the perception of the value of children, ideal family size, or the acceptance of modern family planning methods. Change begins with adoption of low fertility norms or behaviors (e.g., using contraception or delaying childbearing) by elites and then spreads through society via media or social contact with relatives, neighbors, friends, or partners in social programs (30, 31, 33). A related approach (35, 36) applies social network analysis to fertility decline, focusing on both the transmission of new information as well as the influence of social network members on each other's behavior. Heterogeneous and sparse networks seem to facilitate the flow of information, whereas homogeneous and dense networks strengthen the effects of social influence. Another set of models comes from cultural evolution theory and proposes that humans seek to increase prestige and have evolved learning biases that lead them to adopt behaviors that aid in this aim (37, 38). If low fertility is characteristic of high prestige members of a society, the rest of the society may emulate low fertility as a means of achieving higher prestige. Related models (39) suggest that kin may help maintain a cultural preference for high fertility, whereas nonkin may introduce low-fertility behaviors or ideals. As societies become more mobile and gain new communication technologies, interactions with kin may decrease and nonkin increase, reducing pronatal social pressures.

Cultural transmission models can be seen as either mechanisms of how fertility decline spreads, or as causal models that posit why individuals adopt low fertility. In this article we address only their interpretation as causal models, seeking to test their efficacy as predictors of the adoption of low fertility behavior alongside other potential motivators of change.

Comparative Approaches. Many authors have called for comparative research on the demographic transition (5–7, 40), but such work has been limited (8–10). Comparative analyses are challenging for several reasons. Different models often emphasize similar variables or do not produce unique predictions, making them difficult to distinguish using conventional hypothesis-testing methods. Datasets often lack the many variables needed to adequately compare multiple models at once. Finally, the ubiquity of standard regression methods means that comparative testing often consists simply of assessing models according to how well one or two key predictors perform (41). Although this method can be useful, model selection methods, which are becoming the standard in fields such as ecology, are more appropriate for direct comparisons (12).

Existing comparative literature supports economic and/or investment models (10, 42), infant mortality reductions (9, 43), and cultural transmission as the primary causes of demographic transitions (44–46). These studies have limitations, however: they only compare a small number of models or variables, and/or their methods are not well-suited to model comparison. Furthermore, the inconsistent methods and variables used by different researchers means we do not know the relative strengths of different predictors or which motivation(s) are more likely to serve as an impetus for large-scale demographic change. In this article we seek to overcome these limitations by using data collected and methods designed explicitly for comparative analysis.

To do this, we use an evidence-based statistical approach using model selection techniques derived from likelihood theory (11, 12) and data collected explicitly for comparative analysis. Traditional statistical analyses are poorly suited to model comparison because only the null hypothesis is in a position to be rejected; moreover, P values are poor indicators of the weight of evidence in the data for a particular hypothesis (47). In contrast, an evidence-based approach uses measures such as Akaike Information Criterion (AIC) based on likelihoods to quantify the relative evidence for multiple alternative models (11). Using these methods, we are better able to interpret the support the data give for alternative models, even when models are not nested or have overlapping predictions.

Study Setting

Data were collected in rural Matlab, Bangladesh, an area known for demographic and public health research conducted by the International Center for Diarrheal Disease Research, Bangladesh (ICDDR,B). The primary economy of the Matlab area is farming of rice and other crops, followed by fishing (48, 49). Villagers may participate in agriculture even if they own no land themselves. Extended patrilocal families live together in a *bari* or neighborhood containing several small houses. Women practice a limited form of purdah or seclusion and usually spend most of their time in the bari engaged in agricultural processing work, cooking, and childcare. Income is generated from agriculture, fishing, day labor, handicraft production, small businesses, and remittances from family members working in cities or abroad (49). Average annual income was an estimated $1,584 in 2010 purchasing power parity dollars (50). Education levels vary considerably, but 30% of the population has no schooling (49). Since the 1990s education has become more widely available, and a small but growing number of men have obtained education-based employment. Education has also become more acceptable for women, a fraction of whom have entered the labor market (51). Labor migration, primarily by men, and remittances have become increasingly important in the Matlab economy (44, 51). These shifts are thought to be linked to decreasing land ownership due to rising population (52) and increasing access to national and international markets for labor and goods (44, 53).

The demographic transition in Bangladesh has been studied since the early 1980s (*SI Text*). Between 1966 and 2010, total fertility rates have fallen from 6.7 to 2.6 children per woman. Conversely, life expectancy at birth has risen from 53 to 69.3 y for men and from 51 to 73.2 y for women, owing mainly to decreases in infant and child mortality (54).

Results

We analyzed data for two outcome variables: (*i*) total fertility—the total number of children born to a woman, and (*ii*) surviving children—the number of a woman's children currently surviving or having lived past age 10 y. Demographers most commonly use total fertility, whereas evolutionary anthropologists and biologists often use surviving children because it is a better proxy for reproductive success. These different variables may yield different insights into the demographic transition, because total fertility has declined sharply with the demographic transition, whereas surviving children has shown a more modest decline (6).

Table 2 shows the best (most parsimonious) model for each model class and outcome variable based on model selection among all potential predictor variables. *SI Text* provides descriptions of all variables analyzed; *Methods* describes the process of variable selection. We use AIC to compare alternative models (11). For a given model, $\mathrm{AIC} = -2\log(L) + 2K$, where L is the likelihood of the model given the data, and K is the number of parameters in the model. With $n = 799$, we do not need to use AICc to correct for small samples. Among a specific set of alternative models, the relative likelihoods can be normalized, such that the values sum to 1. These are termed Akaike weights (w_i) and are interpreted as the relative likelihood that model i is the best model among those being compared (11). For a single model with a given number of variables, one can also calculate Akaike weights for submodels with all permutations of those variables. The sum of the Akaike weights for each model that a given variable appears in is defined as the relative importance of that variable compared with the others in the model (11).

Risk/Mortality Variables. We analyzed 22 indicators of risk or mortality levels, including measures of food insecurity, length and severity of illness, life expectancy, mortality in local neighborhoods, population mortality rates, residence in an area receiving healthcare interventions, and perception of several types of risk and mortality. Consistent with predictions, more child deaths and higher infant mortality rates were associated with higher fertility, whereas living in a health intervention area was associated with lower fertility. Counter to some expectations (18), higher life expectancy was also associated with higher fertility, although only after adjusting for measures of mortality.

Economic/Investment Variables. We analyzed 18 indicators of economic or investment motivations for fertility reduction, including measures of income, occupation, level of education, costs of education, time spent with children, marriage costs, and microcredit use. Consistent with predictions, land ownership and engagement in agriculture were both associated with higher fertility, whereas higher education and nonagricultural occupations were associated with lower fertility. Although it had a negative bivariate correlation with fertility, consistent with other findings (23, 40) income was associated with higher fertility in the presence of other variables.

Cultural Transmission. We analyzed 25 indicators of cultural transmission of low fertility norms among women and their close kin, such as education, travel, labor migration, media exposure, and access to and attitudes about contraception. Consistent with predictions, the general fertility rate has a positive effect on a woman's fertility, whereas higher levels of education, residence in an intervention area where free contraceptives and promotion of family planning were introduced in 1978, and the husband's labor migration to cities or abroad have negative effects on fertility. Exposure to modern media has a negative bivariate relationship with fertility, but contrary to predictions the relationship becomes positive with other variables in the model.

Model Comparison. Table 3 shows the results of a comparison across model classes. For total fertility, the economic/investment model performs best, having the lowest AIC value and taking 0.738 of the weight; the risk/mortality model has the next lowest AIC value and garners 0.234 of the weight (the Δ of 2.3 suggests that the risk/mortality has moderate support in comparison with the economic/investment model, which has substantial support); the cultural transmission model is better than a base model but receives very little of the weight (0.029). Likewise, for surviving children the economic/investment model performs best, with by far the lowest AIC value and the highest weight (0.996). In

Table 2. Most parsimonious model for each model class

Risk/mortality model			Economic/investment model			Cultural transmission model		
Variable*†	Sign	Importance	Variable*†	Sign	Importance	Variable*†	Sign	Importance
Total fertility			Total fertility			Total fertility		
Child deaths in bari	+	1.00	Woman's level of education	–	0.95	Woman's level of education	–	0.98
Woman in intervention area	–	0.86	Whether family owns land	+	0.91	Husband's location	–	0.85
Infant mortality rate‡	+	0.83	Husband's primary occupation	–	0.87	Woman in intervention area	–	0.78
Life expectancy at birth‡	+	0.74	Family engaged in agriculture	+	0.73	General fertility rate‡	+	0.69
			Household income	+	0.66			
Surviving children			Surviving children			Surviving children		
Child deaths in bari	+	0.95	Family engaged in agriculture	+	0.99	Woman in intervention area	–	0.78
Infant mortality rate‡	+	0.81	Whether family owns land	+	0.98	Woman's level of education	–	0.70
Woman in intervention area	–	0.69	Woman's level of education	–	0.67	Husband's location	–	0.67
			Household income	+	0.64	General fertility rate‡	+	0.67
						Exposure to modern media	+	0.61

*Variables are listed in order of importance.
†Woman's age and age at marriage are included as control variables in all models.
‡Figure given for the year of the woman's marriage, when childbearing is likely to begin.

contrast, essentially no weight goes to either the risk/mortality or cultural transmission models.

Finally, Table 4 shows the best inclusive models that result when all independent variables from Table 2 are modeled simultaneously. The inclusive models, which are allowed to draw independent variables from across model classes, are superior to the best model within any single model class. The inclusive models also have the lowest AIC values (for total fertility AIC = 2936.4, for surviving children AIC = 2793.8) and receive all of the weight (1.000) in a model comparison with the other model classes. For the inclusive model of total fertility, $R^2_{\mathrm{DEV,adj,1}} = 0.49$ and $R^2_{\mathrm{adj}} = 0.47$, whereas for the inclusive model of surviving children, $R^2_{\mathrm{DEV,adj,1}} = 0.49$ and $R^2_{\mathrm{adj}} = 0.46$. These measures suggest that the models discussed have relatively high explanatory value. A table showing the importance values for all variables modeled in Table 2 is included in *Supporting Information*.

Discussion

The demographic transition is a global phenomenon with significant ramifications for worldwide population levels and resource availability in the 21st century and beyond (1). High birth rates are a key deterrent to economic development in less developed nations, whereas population aging combined with below-replacement fertility undermines social safety nets and contributes to social tensions in more developed nations. This article sheds light on both theoretical and methodological concerns in the study of fertility decline, with implications for understanding demographic transitions ongoing in rural Bangladesh and globally.

Although studies of fertility decline abound, comparative research has been limited. Our study shows the utility of model selection methods in weighing relative evidence for alternative models. Distinguishing between different classes of models has several important implications. First, it leads to a more nuanced empirical understanding of the demographic transition, answering previous calls in the literature for research of this type (4, 5, 7). Second, it raises the important theoretical questions of why economic changes that affect motivations for investment in self and children should have stronger effects than changes in other social domains, and whether this phenomenon is universal or varies regionally. Third, identifying the strongest drivers of fertility decline greatly improves our ability to design the policies and interventions most likely to have an impact on fertility decisions. Given the very large expenditures on family planning programs globally, this is far from a trivial concern.

Methodological Implications. Model selection approaches avoid the limitations that can arise when focusing tests on individual models or extrapolating from a limited number of variables. Our work is unique in using a dataset with enough detail (number and types of variables) to provide a strong test of the comparative strength of different models of fertility decline, and our findings demonstrate the value of model comparison with the study of the demographic transition and thus potentially to other complex, multicausal social phenomenon. Our findings corroborate those of previous studies, especially the work of Kabeer (52), who emphasizes land saturation due to rising population as a key predictor of fertility decline, as well as previous findings on the efficacy of Matlab fertility and health interventions (55, 56). However, we are also able to determine the relative importance of each of these sets of predictors, both in relation to each other and to other variables and models, yielding results that suggest (*i*) the importance of economic/investment models compared with other models, and (*ii*) that analyses focused on limited sets of variables may miss significant relationships, such as that between risk and total fertility, which have not been emphasized in the Bangladeshi context.

Theoretical Implications. There are three key theoretical implications of these findings: (*i*) the primacy of economic models over other types of models in predicting fertility decline, (*ii*) a possible threshold for mortality risk, and (*iii*) the multicausal nature of fertility decline. What the best models and predictors therein have in common is that they reflect meaningful changes in the ecological conditions (i.e., the tangible costs and benefits) faced by individuals. Economic circumstances almost always shape individual costs and benefits—as exemplified by the importance of variables such as whether the family owns land or is involved in agriculture, the woman's level of education, and her husband's occupation. Risk variables can also affect individual costs and benefits, especially when risks are high, as reflected in variables such as the infant mortality rate, the number of child deaths in the marital bari, and the effect of residing in a health intervention area. In contrast, cultural transmission models as a group may be comparatively weak because many transmission variables do not alter the individual cost and benefit calculus appreciably. Our results thus call into question the importance of models of cultural transmission that focus on variables such as media exposure or contact with foreigners or modern ideas (32, 57), and suggest that the importance of more generalized, anonymous forms of transmission such as media exposure is very limited in comparison with intensive, individualized forms of transmission, such as contraceptive interventions or the location of the husband, which have more tangible effects on costs and benefits.

Model comparison results also suggest a stronger role for economic/investment models over other models, although this

Table 3. Model comparison

Model	K	AIC	Δ_i	w_i
Total fertility				
Economic/investment model	7	2950.1	0	0.738
Risk/mortality model	7	2952.4	2.3	0.234
Cultural transmission model	7	2956.6	6.5	0.029
Base model	2	2978.5	28.4	0.000
Surviving children				
Economic/investment model	6	2800.4	0	0.996
Risk/mortality model	6	2811.8	11.4	0.004
Cultural transmission model	8	2815.2	14.8	0.001
Base model	2	2825.4	25.0	0.000

K refers to the number of fitted parameters for each model; Δ_i refers to the change in AIC between the lowest value and the variable of interest; w_i refers to the Akaike weight.

Table 4. Most parsimonious inclusive models

Variable*†	Sign	Importance
Total fertility		
Child deaths in bari (R)	+	0.99
Husband's primary occupation (E)	−	0.93
Whether family owns land (E)	+	0.93
Woman in intervention area (R, C)	−	0.81
Woman's level of education (E, C)	−	0.75
Infant mortality rate‡ (R)	+	0.67
Life expectancy at birth‡ (R)	+	0.62
Surviving children		
Whether family owns land (E)	+	0.98
Family engaged in agriculture (E)	+	0.98
Child deaths in bari (R)	+	0.87
Woman in intervention area (R, C)	−	0.85
Household income (E)	−	0.58
Woman's level of education (E, C)	−	0.53

R refers to a risk/mortality variable, E refers to an economic/investment variable, and C refers to a cultural transmission variable.

*Variables are listed in order of importance.

†Woman's age and age at marriage are included as control variables in all models.

‡Figure given for the year of the woman's marriage, when childbearing is likely to begin.

result is more moderate in conditions of higher risk, suggesting a possible threshold effect for mortality risks on fertility decisions. This is especially clear when comparing the results for total fertility with those for surviving children. Economic/investment models are by far the best predictors of fertility for surviving children; they are also the best predictors of total fertility, although here risk/mortality models also retain some weight. Risk/mortality models gain ground with the total fertility outcome variable because of the 25% of women in the sample who have lost children; women who have lost multiple children strengthen this effect. Older women faced exceptionally high levels of mortality and risk during their reproductive years, experiencing first Bangladesh's 1971 Liberation War, followed by devastating floods and famines in 1974–1975. When we remove these women and limit our analyses to the 725 women younger than 60 y we find that the risk/mortality model of total fertility becomes much less competitive against the economic/investment model. In particular, infant mortality rate is no longer a salient variable. This suggests that once mortality rates become low enough in a population, they may cease to exert a strong influence on fertility decisions.

This balance between economics and risk matches the predictions of models that focus on the interaction of economics and mortality constraints, predicting that mortality will be a key determinant of fertility as long as mortality remains high, but that economic or parental investment factors will become primary once mortality rates or variance in mortality fall (8, 16, 23). Once mortality rates become low enough, it may pay for parents to make larger expenditures on schooling, or a high-status modern occupation. To benefit from larger investments, however, parents must limit the number of children they have to begin with or restrict inheritance to a particular child or children (6, 58). High economic growth is also known to reduce fertility to very low levels (18, 22, 23), however, which mortality reduction itself has not been shown to do.

Our findings echo those of previous studies comparing theoretical models from historical (18), cross-national (9), and evolutionary perspectives (10) that human capital investments deriving from the demand for well-trained workforces have driven demographic transitions in many parts of the world. In the Bangladeshi case, economic/investment models may be particularly powerful owing to the interaction of land saturation (decreasing per capita land ownership due to population growth) with the increasing integration of villagers into a wage-labor economy (52). This situation creates a feedback loop in which children become relatively more expensive because they no longer subsidize themselves through agricultural labor and, at the same time, payoffs to alternate forms of investment such as education are increasing, prompting parents to reduce fertility in favor of more intensive educational or skills investment.

Finally, our findings make it clear that fertility decline in Matlab is multicausal. The best inclusive models contain variables from each class of causal model, suggesting that a full explanation of the demographic transition is likely to include changes in economic conditions, risk profiles, and more individualized forms of cultural transmission either acting separately or in feedback with each other. Moreover, several of the strongest predictors are variables that tap into more than one causal pathway. Variables such as a woman's education, residence in the intervention area, and the location of the respondent's husband may exhibit a combination of economic and cultural transmission effects. Other variables, including residence in the intervention area, suggest a potential interaction between risk and cultural transmission factors. *SI Text* provides further discussion of this point. Such variables may be especially important drivers of fertility decline.

In summary, although we find that when compared head to head, models emphasizing economic and investment variables are by far the best predictors of fertility, our results also corroborate previous research regarding important predictors and indicate that multiple causal pathways are needed to explain the rapid, recent fertility declines in modern Bangladesh and much of the developing world.

Methods

Data. The Matlab study area includes ~250,000 people on whom detailed demographic data have been collected since 1966 as part of the ICDDR,B Health and Demographic Surveillance System (HDSS). The region is divided into an ICDDR,B Area, where many health and family planning interventions have been made, and a Government Service Area, functioning as a control area where basic health services are available from the Bangladeshi government. The majority of demographic research on Matlab uses the HDSS sample. Because the intensive data demands of our analysis required more detailed individual information than was available, we drew a random subsample of women from the HDSS for a tailored survey. Our sample included even numbers of women from (*i*) the ICDDR,B Area and the Government Service Area, and (*ii*) each of three 15-y age categories (20–34, 35–49, and 50–64), allowing for better representation of older women and 45 y of time depth regarding fertility and its correlates. Our final survey sample size was 944 women.

Our survey was based on a broad review of the demographic transition literature and designed to address predictions from causal models such as those in Table 1. Survey data contain sufficient information to allow the simultaneous comparison of multiple models and have enough power to provide robust tests. A few variables not taken from the survey come from published data on the Matlab population and linked to survey respondents on the basis of their age or age at marriage. Because not all women in the sample had completed fertility, woman's age and woman's age at marriage were used as control variables in all models (*SI Text*).

A key advantage of our dataset is that we have numerous measures for each class of model, and sometimes multiple proxies for key variables. To identify appropriate independent variables from the pool of candidate variables, we used the following criteria. First, the variable had to have been suggested in the literature as an indicator of a particular class of model. Second, the meaning of the variable in the local Bangladeshi context had to match the meaning suggested by theory so that the interpretation of the variable would be consistent with model predictions. Finally, each variable was screened for data entry problems and completeness.

Some theoretical models of fertility assume that the system is at equilibrium, a condition that is rarely met in human samples (59). Fertility in Matlab is clearly not at equilibrium because the phenomenon of interest is the result of change. Our analysis, however, addresses this concern in several ways (*SI Text*). Such concerns are also equally true for risk, economic, and cultural transmission variables, and thus should not affect the interpretation of one set of variables compared with the others.

Analysis. We focused our analyses on all women in our survey married for at least 5 y with or without children ($n = 810$) and for whom data were available on all variables used to test all models ($n = 799$) (*SI Text*). We constructed models separately for the outcome variables total fertility (total number of births) and surviving children (number of children surviving past the age of 10 y). Because these outcome variables are count data with a limited range (0–11 children) and no evidence of overdispersion, we estimated generalized linear models with a Poisson error distribution and log link function. Our primary analytical goal was to evaluate the relative evidence for alternative models within and across model classes; analyses were completed using R functions (60), including the glmulti package (61).

Our modeling approach was structured as follows. First, we conducted model selection analyses within each of the three major classes of models (Table 2). For each model class, we wanted a set of independent variables that, when put together, produced a strong contender for that class. The initial set of variables was first reduced by removing (*i*) variables that had no apparent relationship with the outcome variable, and (*ii*) variables that were conflated with others in the model. We then used glmulti to systematically draw combinations of variables from the narrower list and find the model with the lowest AIC value. For the best model within each class, we report the direction of the relationship between the independent variables and the outcome variables, and also each independent variable's importance value (Table 2).

Second, for each outcome variable, we did a formal comparison of the models that resulted from step 1 by determining AIC values for each model, finding the difference between each model's AIC value and the lowest AIC value among the models compared, and using the AIC differences to calculate Akaike weights (Table 3). Finally, for each outcome variable, all independent variables resulting from step 1 were analyzed together using glmulti to find an inclusive model that retained the independent variables of highest importance (Table 4). A variety of pseudo-R^2 measures have been developed for comparing nonlinear models, although they are not measures of explained variance in an ordinary least-squares sense. Mittlebock and Waldhor (62) propose several such measures for Poisson distributions, including $R^2_{\mathrm{DEV,adj,1}}$. We also calculated R^2_{adj} for our inclusive models based on ordinary least squares regression (i.e., as if our count data were continuous). All variables analyzed are listed in *SI Text*, as are details of variables included in final models.

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