The link between infant wantedness and child survival: Theory and data from Matlab, Bangladesh

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Abstract

Unwanted children may have lower survival. Testing for correlation between wantedness and child outcomes requires ex ante statements of fertility intentions to prevent post-hoc revision of birth intentions. It also requires control for unobservable confounding between successful fertility regulation and successful investments in children that are born. We develop a theory that highlights dueling statistical biases from biological removal of least fit households and socioeconomic removal of most fit households from contributing to the sample of births of unwanted children.

We test the effect of infant wantedness on survival and schooling using data on 7,946 women from Matlab, Bangladesh who were asked if they wanted more children while not pregnant in 1990.

Using an unadjusted bivariate model, we find that unwantedness increases child mortality (OR 1.21 $p<0.1$). The results of unwantedness on survival are insignificant in multivariate adjusted models. We show evidence of biological culling of unwanted pregnancies through miscarriage and stillbirth as well as socioeconomic culling with more unwanted pregnancies being aborted by women with higher schooling.

The link between family planning and a healthier birth cohort via changes in infant wantedness is not straightforward. Even with a large high-quality data set it is not possible to demonstrate that unwanted children are more likely to die as a result of their unwantedness.

I. INTRODUCTION

Family planning methods are typically used by people who do not want to be pregnant. By definition, having an "unwanted" pregnancy represents a setback in a person's ability to control their life circumstances. Although life is full of unwanted events that people cope with, offering people more control of unwanted circumstances is ipso facto worth doing. However, many argue that family planning services contribute to the health of both mothers and infants.

The policy question is whether unwanted pregnancies have worse health consequences than wanted pregnancies? If so, investing in helping people avoid unwanted births is not just a lifestyle issue, it is a public health investment relevant to MDG 4. The evidence to settle the question is still weak and the conceptual model linking declarations of wantedness to child death is undeveloped. This paper will start from the premise that declarations that another child is not wanted might signify an absolute inability to provide adequately for that child. We develop a theory to guide attempts to demonstrate an empirical connection between statements of wantedness and child survival and then test the hypothesis that unwantedness lowers child survival using data on wantedness collected prior to a birth.

II. BACKGROUND

Significant levels of unintended childbearing have been reported in virtually all developed and developing country settings for which data are available. United States data indicate that roughly one-half of all pregnancies were unintended at the time of conception, with mistimed more common than unwanted pregnancies (Marsiglio and Mott 1988; Forrest 1994; Gazmararian, Adams et al. 1995; Korenman, Kaestner et al. 2002; Pulley, Klerman et al. 2002; Finer and Henshaw 2006). Evidence on levels of unintended childbearing in developing countries comes almost exclusively from Demographic and Health Survey (DHS) data. Demographers classify unintended pregnancies into A) mistimed e.g. "this year would not be a good time but later would be OK" and B) unwanted e.g. "I/we do not want another baby". This paper will focus on "unwanted" pregnancies.

An extensive, but ultimately disappointing, literature exists on the health and social consequences of unintended childbearing. The evidence is characterized by considerable

variability in terms of sample representativeness, measurement, and methodological rigor (Brown and Eisenberg 1995; Gipson, Koenig et al. 2008). Only some studies control adequately for socioeconomic status (SES), and all studies are observational. For obvious reasons, there are no experimental data to link prenatal infant unwantedness to its consequences.

A major challenge confronting research, based exclusively on observational data, is disentangling the confounding of fertility intentions from unmeasured socioeconomic factors that affect families. The simple inclusion of measurable confounders associated with SES, however, does not solve the statistical problem. Unmeasured components of SES remain. Measured components of SES do not sufficiently control for families' ability to calibrate their investments in their children based on unobservable features of their lives that are simultaneously correlated with their ability to avoid an unwanted birth and the outcomes for that child. There have never been any studies of the effects of wantedness that have been conducted in the context of a randomized trial of an intervention that would alter the rate at which unwanted pregnancies would be conceived and unwanted children born. Innovation comes from our ability to identify causal effects stemming from higher wantedness because the Matlab quasi-experiment randomly allocated intervention area families to a treatment designed to alter their ability to avoid unwanted pregnancies.

Subject to the caveat that all of the existing literature on effects of wantedness could be subject to serious statistical limitations, the bulk of this literature suggests that there could be very positive benefits to children and mothers if unwanted births were avoided. Retrospective analysis of DHS data from five developing countries found that in three countries (Egypt, the Philippines, and Thailand), babies born to women who reported excess fertility at the time of the DHS survey had higher neonatal and post-neonatal mortality (Montgomery, Lloyd et al. 1997). A more sophisticated study used prospective maternal surveys from rural Bangladesh (1982-1998) and with a fixed effects model, detected large and significant estimates of excess mortality during infancy among unwanted infants (Chalasani, Casterline et al. 2007). Other studies from developing countries have found significant positive associations between child wantedness and women's use of prenatal care (Fawcus, Crowther et al. 1992; Magadi, Madise et al. 2000; Eggleston, Tsui et al. 2001; Marston and Cleland 2003), supervised delivery (Gage 1998; Marston and Cleland 2003) and full child vaccination coverage (Marston and Cleland 2003).

Others have reported a significant inverse association between wantedness and the risk of low birth weight (Eggleston, Tsui et al. 2001) and adequate nutritional status (Montgomery, Lloyd et al. 1997).

In terms of more long-term consequences, several European studies have found lower levels of educational attainment among children who were either unwanted or born due to denied abortion (Forssman and Thuwe 1981; Kubicka, Matejcek et al. 1995; Myhrman, Olsen et al. 1995; Pop-Eleches 2006). The effects on children of being unwanted or unintended may extend well into childhood and even adulthood, with studies reporting significant inverse associations between pregnancy intention and child development (Matejcek, Dytrych et al. 1978; Baydar 1995; Kubicka, Matejcek et al. 1995).

For developing countries, Montgomery et al. (1997) examined data on "retrospective wantedness" from five DHS country surveys and found significantly lower levels of school attainment among unwanted children in three of the five countries studied, with the likelihood of the completion of any secondary school between 3.7 to 8.5 percentage points lower for unwanted births. Chalasani et al (2007) found that in Bangladesh, unwanted children achieved 7 to 9 percent fewer years of schooling than wanted children; this held for both within-sibset and between-sibset comparisons. None of the DHS studies could control for confounding by unobservable components of SES. There is significant post-hoc revision of birth intentions that occurs after a woman learns she is pregnant, which could bias an analysis of outcomes related to birth intentions {Joyce, 2002 #4776}. For example, a woman having a complicated pregnancy might be more likely to revise her intentions to say "unwanted" and that would spuriously create a correlation between unwanted fertility and poor outcomes. None of the DHS-based studies of wantedness and child health could measure prenatal wantedness, and all must be interpreted with caution

III. A THEORY OF THE LINK BETWEEN UNWANTEDNESS AND CHILD HEALTH

When a woman is asked "Do you want an additional child?" multiple factors will affect the reply. Some of her considerations could have a negligible correlation with the survival prospects of that potential child, but if she foresees impediments to the child's survival she is more likely

to say "No". If we parse out the considerations into a component of non-health and health considerations, we might model her response to "Do you want another child?" as

[1] Say "Don't Want" if Pr(No| H, $\tilde{H}$, X)=f(H, $\tilde{H}$, X)>K else say "Yes" or don't answer.

Where Pr(A|B) is the conditional probability operator, assumed to reflect a latent cognitive process. H is a vector of observable determinants that are positively associated with future child survival. $\tilde{H}$ is a vector of survival determinants unobserved by the analyst, but perceived by the woman. Presumably the woman knows things about prior birth outcomes for herself and her family and knows things about her immediate economic horizon and family situation that cannot be captured in a survey interview. X is a vector of factors that affect fertility preferences, but which have no bearing on child survival. K is a constant threshold value above which the latent process registers a dichotomous value of "No".

Let us assume that partial derivatives f'(H)<0 and f'($\tilde{H}$)<0, implying that increases in predicted child survival lower the probability of saying "No" and conversely that worse predictions of child health increase the probability of saying "No".

The assumption that a woman's declaration of whether she wants another child is informed by her inside information about the survival of the child would lead one to hypothesize that

[Null Hypothesis 1] E(H| Say "Want")- E(H| Say "Don't Want")=0

One would then be tempted to compare observable health H in a sample of children whose mothers' pre-conception wantedness declarations are on file. This would be a mistake. The problem is one of selective conception and birth that could bias simple tests of [Hypothesis 1].

The sample of observable children includes only those who were both conceived and not aborted. Presumably mothers who say "Don't Want" will be selectively practicing contraception and abortion. As shown in Figure 1, there are two opposing selective pressures on the population of potential children whose mothers said "Don't Want". Positive selection creates biological non-conception and biologically spontaneous abortions with higher intensity among children whose fitness endowment is smaller. Positive selection would presumably cull more intensely

among unwanted pregnancies whose fitness is already presumed to be smaller. This would lessen the difference in fitness between observed infants who are wanted vs. unwanted. Without controlling for positive selection, tests of [Hypothesis 1] might falsely favor the null.

On the other side adverse selection would occur if access to contraception and medical abortion is correlated with socioeconomic advantages that are themselves correlated with better child health. If birth prevention is more successful among more fortunate mothers who don't want pregnancies then the observed sample of infants will be less fortunate. (By assumption, all women who say they want additional births are making no attempt to avoid them.) Culling of the healthiest of the unwanted potential children will create an opposite bias in which tests of [Hypothesis 1] might falsely reject the null.

Both types of birth selection are plausible, and a priori it is impossible to say which process will dominate. Finding that the unadjusted health and survival of unwanted children is worse than wanted children might mean that equation [1] is true, or it might mean that adverse selection has occurred. To make a causal inference, one would need to somehow neutralize the correlation between a woman's socioeconomic status and her successful control of fertility. A quasi-experiment would help.

IV. EMPIRICAL METHODS

In 1975 in Matlab, Bangladesh there began an extraordinary quasi-experiment in which 70 villages (Pop. 89,350) were designated as a treatment area and 79 villages (Pop. 85,596) were designated as a comparison area. Individuals in the treatment area received door-to-door biweekly visitation by community health workers promoting family planning and health services. The comparison area continued standard government services. The results were stunning. General fertility rate fell from 185 to 164 in the treatment area between 1974 and 1979, but GFR in the control area had risen from 187 to 218 over the same period.

A. Sample

The KAP survey was conducted in 1990 among 7,946 reproductive age women in both the Matlab intervention and comparison areas. Multi-stage sampling procedures were employed to yield a sampling frame of approximately 8,500 currently married women of reproductive age.

This resulted in the random selection of 31 and 36 villages in the intervention and comparison areas, respectively. Ongoing surveillance information was used to enumerate all eligible women in selected villages, with every alternative woman chosen for interview. Interview completion rates were high in both areas, exceeding 90 percent, and in total, 7,946 eligible women were successfully interviewed. The survey covered a range of topics related to contraceptive and health behavior, household socio-demographic characteristics, as well as respondents' perceived access and quality of care. Also included were detailed questions concerning women's preferences for additional childbearing, which are key to the objectives of this pilot proposal.

B. Measures and Analysis

Women in the KAP survey were asked whether they wanted additional sons or daughters. They could reply Yes or No and if Yes the number of additional sons or daughters desired was recorded. We code a child as unwanted if they were born between 9 months to 7 years after the date of the survey the mother replied "No" to both the additional sons and the additional daughters questions. Data on childhood mortality is classified by the timing of the death for survival analysis and dichotomously for logistic regression analysis.

Data on worker's responsiveness to questions as rarely (4.88%), sometimes (10.89%), usually(25.77%), and always (58.46%) coded numerically from 1 to 4. These responses were averaged over each of the 66 villages. The village average was 3.26 with a minimum of 2 and a maximum of 3.97. The ICDDR, B treatment area villages had an average family planning worker quality of 3.68 (min=3.125, max 3.97). The comparison villages had an average family planning worker quality of 2.89 (min=2, max=3.5). We make the assumption that the quality of the family planning worker assigned to a village is an exogenous factor that affects the ability of women who don't want to get pregnant to realize this goal independently of their socio-economic status or biological health endowment. We predict that when family planning worker quality is lowest that women's own agency the quality of the family planning worker who visited them were collected from each woman during the KAP survey whether this family planning worker was the government worker or the ICDDR, B worker. The key indicator for this analysis was the rating of the family planning plays a larger factor in removing unwanted children from the birth cohort and the effect of right truncation on making unwanted children look unhealthy will be

strongest. We predict that when family planning worker quality is higher the removal of unwanted children will be less correlated with higher social and biological fitness. We examine the gradient in the adjusted probability of survival of children as a function of family planning worker quality and will interpret a positive relationship as evidence that there is socioeconomic adverse selection bias.

V. RESULTS

Table 1 compares the characteristics of non-pregnant women who say they do not want more children to those who say they do. The populations are very different. Somewhat paradoxically we find that 33 percent of women who say they want more children are currently using family planning. Of these 1043 women, 962 (93 percent) say they want their next child to be born more than two years from now and 73 say they want their next child one year from now, so these can be presumed to be practicing birth spacing. Women who want more children currently have fewer sons and fewer daughters. Gender preference did not appear to be a major concern. A separate analysis (not shown) indicated that 66 percent of women who had a daughter but no son wanted more children and symmetrically 65 percent of women who had a son but no daughter wanted more children ($p=0.46$). Woman who did not want more children were older and more educated.

Among the 3866 women who said they did not want more children there were 1470 subsequent pregnancies (38 percent) and 1121 live births (29 percent). The ratio of stillbirths to unwanted pregnancies (3.9 percent) was significantly higher than that for wanted pregnancies (2.7 percent) $p=0.019$. The ratio of spontaneous abortions to unwanted pregnancies (6.8 percent) was significantly higher than that for wanted pregnancies (5.4 percent) $p=0.041$. These higher rates of natural non-birth terminations may signify biological culling and positive selection.

The ratio of therapeutic abortions to unwanted pregnancies (13 percent) was also significantly higher than that for wanted pregnancies (2.6 percent) $p=0.000$. Average schooling was higher for women with unwanted pregnancies who aborted (2.4 years) vs. those with unwanted pregnancies who did not abort (1.7 years) $p=0.0015$. Asset scores and counts of living children in the household were not statistically significantly different between women who aborted

unwanted pregnancies and those who did not. This offers mixed evidence that there may be social selective pressure producing adverse selection on the health of the observable birth cohort.

Of the 4989 observed births there were 457 deaths. Table 2 shows that in bivariate analysis there was an association between having a mother declare unwantedness prior to conception and child death with a p-value of 0.058. Other strong correlates of child death were lower mother's schooling and lower father's schooling. Children who died also had larger household size. Decedent children were not significantly clustered into any of the six geographical blocks, nor in any of the asset quintiles. The percent who died from the treatment area (8.07 percent) was significantly less than the percent who died from the comparison area (10.1 percent) p=0.012. There was no evidence of a direct link between asset score and death with 9.11 percent of the richest quintile and 9.52 percent of the poorest quintile dying

The last four rows of Table 2 shed some light on the presence of adverse selection by revealing a higher than expected probability for dead children to be from a village with a lower quartile of average family planning worker quality and thus more subject to socially adverse selection. These family planning worker differences were not statistically significant.

Table 3 probes these results further. The top row directly compares the proportion dead among unwanted children between those born in the villages with the worst quartile of family planning workers and those in the villages with the best quartile of family planning workers. The two-sided p-value of 0.166 for the Z-statistic is not significant, but a one-sided p-value would be 0.08. Table 3 shows that villages with low quality family planning workers had higher rates of unwanted declarations and higher rates of abortions. They tended to be in the comparison area more so than the treatment area. A more sophisticated analysis of this topic is shown in Figure 3 which corrects for observable confounding between family planning worker and survival. In Figure 3 the survival probability of each child is adjusted using an accelerated failure time model with all of the covariates from Table 4 included. The adjusted survival is plotted against the average quality of the family planning worker in each village and the scatter plot shows weak evidence of an upward slope. Compression of the family planning worker scores into a narrow range may be inhibiting an adequate assessment of the relationship.

Table 4 shows that the unadjusted relationship indicates a higher relative risk of child death for unwanted children, but this disappears when socio-economic confounders, principally household size, are included. Stratifying the analysis across infant wantedness shows no evidence that the coefficients of other covariates are affected by wantedness. A Cox survival analysis confirming these findings is shown in the appendix. The Kaplan Meier survival curve (Figure 2) shows that the bivariate results we do observe in Table 4 are mostly due to differences in survival after 300 days of life. The first part of the survival curves overlap for wanted and unwanted children.

VI. DISCUSSION

Our theory of the relationship between infant wantedness and child death developed an explanation of why a correlation would be difficult to observe. Our empirical results showed that there was no relationship between wantedness and child survival that was robust to the inclusion of modest socio-economic confounders like education and household size.

Our theory posited dueling sources of bias. We believe there can be positive selection in which biological culling prevents the frailest households among those who do not want children from contributing births to the observed cohort. This would weaken our ability to see an effect of wantedness on survival. Simultaneously we believe that there is adverse selection in which more educated women with more social capability are better able to realize their goal of not having unwanted children. This would spuriously create an effect of wantedness on survival.

Our analysis showed evidence to support the hypothesis of biological culling. Rates of stillbirth and spontaneous abortion were higher among unwanted fetuses than wanted fetuses. Our analysis also showed evidence of social culling. Rates of therapeutic abortion were higher for unwanted fetuses and women who sought these abortions had higher rates of schooling than women who did not abort unwanted fetuses. Finally we noted trends to suggest that the presence of higher quality family planning workers was associated with better survival of unwanted children. This last finding was not significant. However, we believe the results are consistent with our theory that the extent to which women self-select their family planning intensity the greater the degree of adverse selection and potential type 1 bias in observing a relationship

between wantedness and child survival. Had we achieved more promising results from the analysis of family planning worker quality as an instrument to control for social selection into the birth cohort, it would have been possible to mount a generalized method of moments IV analysis of the count data on days lived that would have controlled for the social culling and adverse selection. Given that the non-IV multivariate analysis already shows an insignificant effect of infant wantedness we predict that the removal of more of the adverse social selection bias with an instrument would only succeed in showing a null effect of wantedness or unmasking the positive selection effects of biological culling. Although the use of natural experiments and quasi-experiments could potentially reduce the adverse selection bias, we cannot think of a statistical technique to neutralize the positive selection bias of biology.

Our results cast doubt on the promise of ever producing an unbiased estimate of the effect of wantedness on a child's own survival. One can never know for any sample the relative strength of biological selection and social selection in biasing any observed correlation. Our data set had several important strengths in terms of size, long follow-up and ante-natal registration of whether a woman wanted more children.

Our theoretical model should help readers better interpret studies that purport to find an association between wantedness measured at the time of pregnancy and subsequent child survival. From a policy perspective, the best arguments for supporting better and more available family planning services are still those worked out in Cairo in 1994. Helping families achieve their fertility preferences is the essence of what a developed society does. The statistical obstacles to proving that unwanted children are less likely to survive make the assertion an insecure basis for advocating family planning.

TABLES

Table 1 Bivariate Tabulation of correlates of infant wantedness

	Non-Pregnant Woman Says "Don't Want" in 1990			Non-Pregnant Woman Says "Want More" in 1990			P-value	
	Count	Mean or Proportion	SD	Count	Mean or Proportio	SD		
Current Family Planning User	3866	62%		3193	33%		0.000	***
Number of living sons	3866	2.5	(1.2)	3193	0.8	(0.9)	0.000	***
Number of living daughters	3866	2.1	(1.3)	3193	0.9	(1.1)	0.000	***
Has no son	3866	57%		3193	98%		0.000	***
Has no daughter	3866	55%		3193	94%		0.000	***
Total living children	3866	4.6	(1.7)	3193	1.7	(1.3)	0.000	***
Age of woman	3866	36.4	(6.9)	3193	25.5	(5.2)	0.000	***
Years of schooling	3866	1.5	(2.5)	3193	2.1	(2.9)	0.000	***
Asset Score	3543	3.1	(1.4)	2910	3.0	(1.4)	0.046	**
Susbsequent pregnancies [1]	1470	38%		4390	137%		0.000	***
Subsequent live births	1121	29%		3920	122%		0.000	***
Subsequent stillbirths	58	2%		119	4%		0.000	***
Subsequent spontaneous abortions	100	3%		236	7%		0.000	***
Subsequent therapeutic abortions	191	5%		115	4%		0.0446	**
Any pregnancy	3859	27%		3202	79%		0.000	***
Any live birth	3859	23%		3202	76%		0.000	***
Any still birth	3859	1%		3202	3%		0.000	***
Any spontaneous abortion	3859	2%		3202	6%		0.000	***
Any therapeutic abortion	3859	4%		3202	3%		0.06	*

[1] All birth outcomes observed between 9 mos and 7 years after wantedness interview

Table 2 Bivariate tabulation of correlates of child survival

	Child Survived			Child Died			P-Value
	Count	Mean or Proportion	SD	Count	Mean or Proportion	SD	
Not pregnant and "don't want" additional son or daughter	3888	22%		382	27%		0.058 *
Not pregnant and "unhappy" if additional son or daughter	3888	22%		382	23%		0.778
Child is girl	3888	49%		382	52%		0.230
Years of schooling of mother	3682	1.96	(2.8)	359	1.41	(2.38)	0.000 ***
Years of schooling of father	3888	3.36	(4.25)	382	2.93	(3.71)	0.055 *
Distance to primary school in meters	3882	386.34	(221.43)	382	381.13	(216.67)	0.660
Household size	3888	8.65	(4.25)	382	10.28	(5.69)	0.000 ***
Proportion abortions/pregnancies in village over 11 years	3888	3%		382	3%		0.910
Average of FPW responsiveness to questions (1 Never-4 Always) by village	3888	3.39	(.34)	382	3.38	(.33)	0.563
Treatment Block A	3888	9%		382	7%		0.211
Treatment Block B	3888	19%		382	20%		0.747
Treatment Block C	3888	11%		382	8%		0.158
Treatment Block D	3888	10%		382	8%		0.123
Comparison Area North	3888	15%		382	17%		0.157
Comparison Area South	3888	36%		382	40%		0.196
Asset Score in 1996	3531	2.97	(1.38)	350	2.94	(1.39)	0.764
Poorest Asset Quintile	3531	19%		350	21%		0.562
2nd quintile	3531	21%		350	21%		0.697
3rd quintile	3531	20%		350	20%		0.921
4th quintile	3531	22%		350	22%		0.894
Richest Asset Quintile	3531	17%		350	17%		0.823
FPW Worker Least Responsive Quartile by Village	3888	26%		382	27%		0.758
FPW Worker 2nd Quartile	3888	25%		382	28%		0.235
FPW Worker 3rd Quartile	3888	25%		382	22%		0.244
FPW Worker Most Responsive Quartile by Village	3888	24%		382	23%		0.722

Table 3 Exploratory analysis of FP Worker Quality as an Instrument for Whether Unwanted Children are Born

	Lowest Quartile of FP Worker Quality			Highest Quartile of FP Worker Quality			P-Value: Lowest and Highest Quartile	
	Count	Mean or Proportion	SD	Count	Mean or Proportion	SD		
Child died and mother said "don't want" and was not pregnant in KAP Survey	292	12%		189	8%		0.166	
Not pregnant and "don't want" additional son or daughter	1112	26%		1004	19%		0.000	***
Not pregnant and "unhappy" if additional son or daughter	1112	22%		1004	20%		0.365	
Child is girl	1112	49%		1004	49%		0.729	
Years of schooling of mother	1037	2.083	(2.786)	952	1.618	(2.654)	0.000	***
Years of schooling of father	1112	3.275	(3.924)	1004	3.308	(3.963)	0.849	
Distance to primary school in meters	1110	421.712	(210.430)	1003	411.455	(224.791)	0.279	
Household size	1112	8.929	(4.194)	1004	8.262	(4.020)	0.000	***
Proportion abortions/pregnancies in village over 11 years	1112	0.036	(0.027)	1004	0.020	(0.010)	0.000	***
Average of FPW responsiveness to questions (1 Never-4 Always) by village	1112	3.012	(0.150)	1004	3.853	(0.047)	0.000	***
Treatment Block A	1112	0%		1004	25%		0.000	***
Treatment Block B	1112	0%		1004	59%		0.000	***
Treatment Block C	1112	0%		1004	9%		0.000	***
Treatment Block D	1112	1%		1004	7%		0.000	***
Comparison Area North	1112	32%		1004	0%		0.000	***
Comparison Area South	1112	66%		1004	0%		0.000	***
Asset Score in 1996	994	2.899	(1.309)	932	2.925	(1.370)	0.676	
Poorest Asset Quintile	994	16%		932	21%		0.009	***
2nd quintile	994	28%		932	19%		0.000	***
3rd quintile	994	19%		932	22%		0.083	
4th quintile	994	23%		932	23%		0.798	
Richest Asset Quintile	994	14%		932	15%		0.300	
FPW Worker Least Responsive Quartile by Village	1112	100%		1004	0%		.	
FPW Worker 2nd Quartile	1112	0%		1004	0%		.	
FPW Worker 3rd Quartile	1112	0%		1004	0%		.	
FPW Worker Most Responsive Quartile by Village	1112	0%		1004	100%		.	

\. **Multivariate regression models of relative risk of child death**

Logistic Regression of Child Died: Relative Risk of Child Death				
	Full Sample	Full sample	Unwanted	Wanted
Child is girl		1.117	0.876	1.202
		[0.112]	[0.172]	[0.137]
Asset Score in 1996		0.977	0.957	0.981
		[0.0313]	[0.0709]	[0.0348]
Years of Schooling of Mother in Census 1996		0.945**	0.980	0.936**
		[0.0267]	[0.0610]	[0.0274]
Years of Schooling of KAP Husband		0.989	0.976	0.991
		[0.0184]	[0.0370]	[0.0217]
Household Size		1.067***	1.080**	1.063***
		[0.0141]	[0.0371]	[0.0147]
Age of KAP woman at date of interview		1.018*	1.008	1.021
		[0.0101]	[0.0229]	[0.0132]
Treatment Area		0.834	0.842	0.831
		[0.0950]	[0.153]	[0.117]
Non-pregnant mother says "don't want"	1.218*	1.088		
	[0.135]	[0.164]		
Constant	0.0968***	0.0422***	0.0643***	0.0387***
	[0.00624]	[0.0114]	[0.0530]	[0.0139]
	4,989	4,314	860	3,454
Robust exponentiated standard errors in brackets				
*** p<0.01, ** p<0.05, * p<0.1				

Figure 1 Competing effects of birth selection on hypothesis testing.

Upper panel shows separate distributions of fitness, H, for unwanted children on the left and wanted children on the right. A is mean fitness for unwanted children and B is mean fitness for wanted children. Hypothesis is that A-B>0

Middle panel illustrates *positive selection.* Left truncation from biological culling prior to birth would shift mean fitness of observable unwanted children towards the right making it more difficult to test that A^C-B>0

Lower panel illustrates *adverse selection.* Right truncation from family planning would shift mean fitness of observable unwanted children towards the left increasing the chance of concluding that A^{FP}-B >0

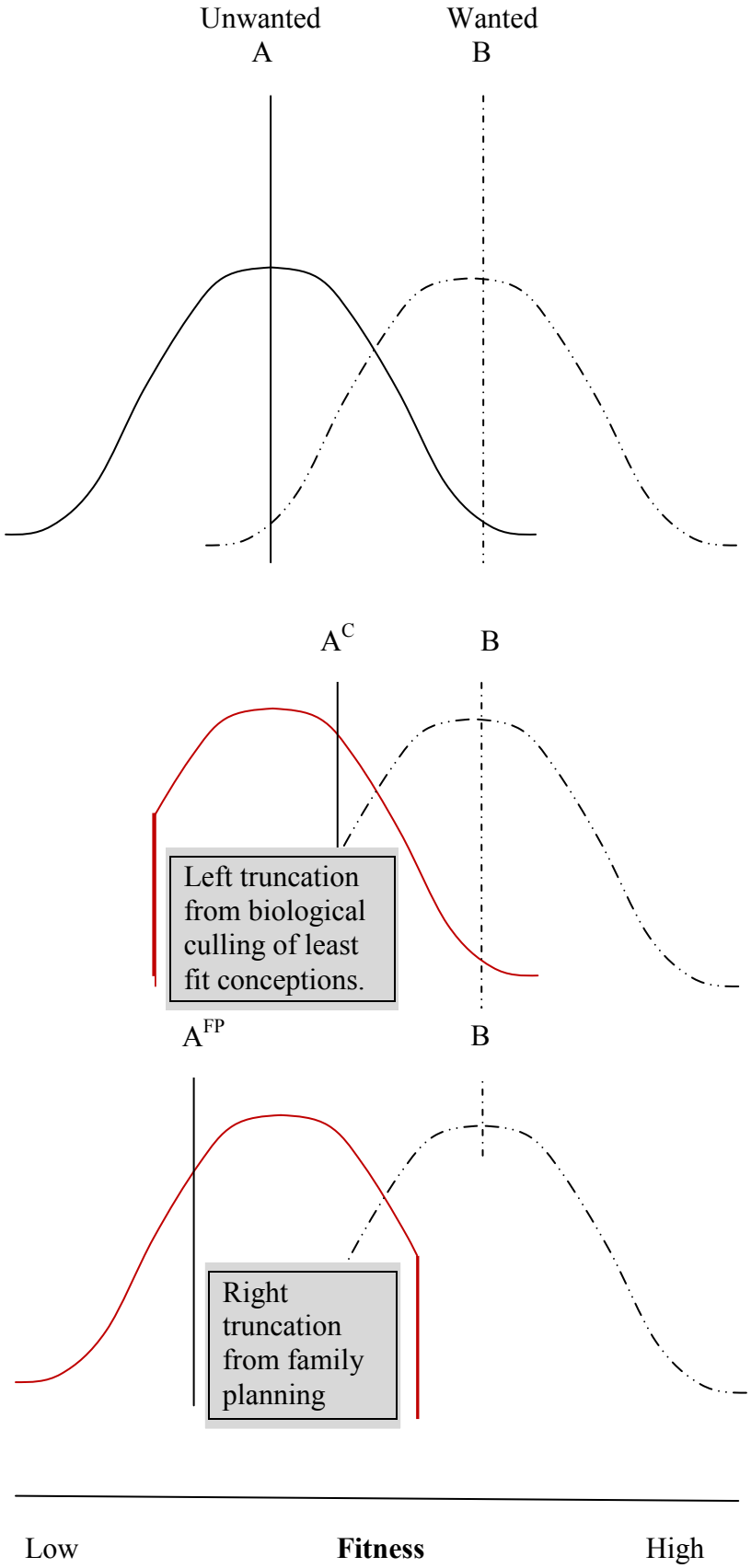


Figure 2 Unadjusted survival curves for unwanted and wanted children in Matlab 1990-2000. Hazard ratio is 0.997 with standard error of 0.124.

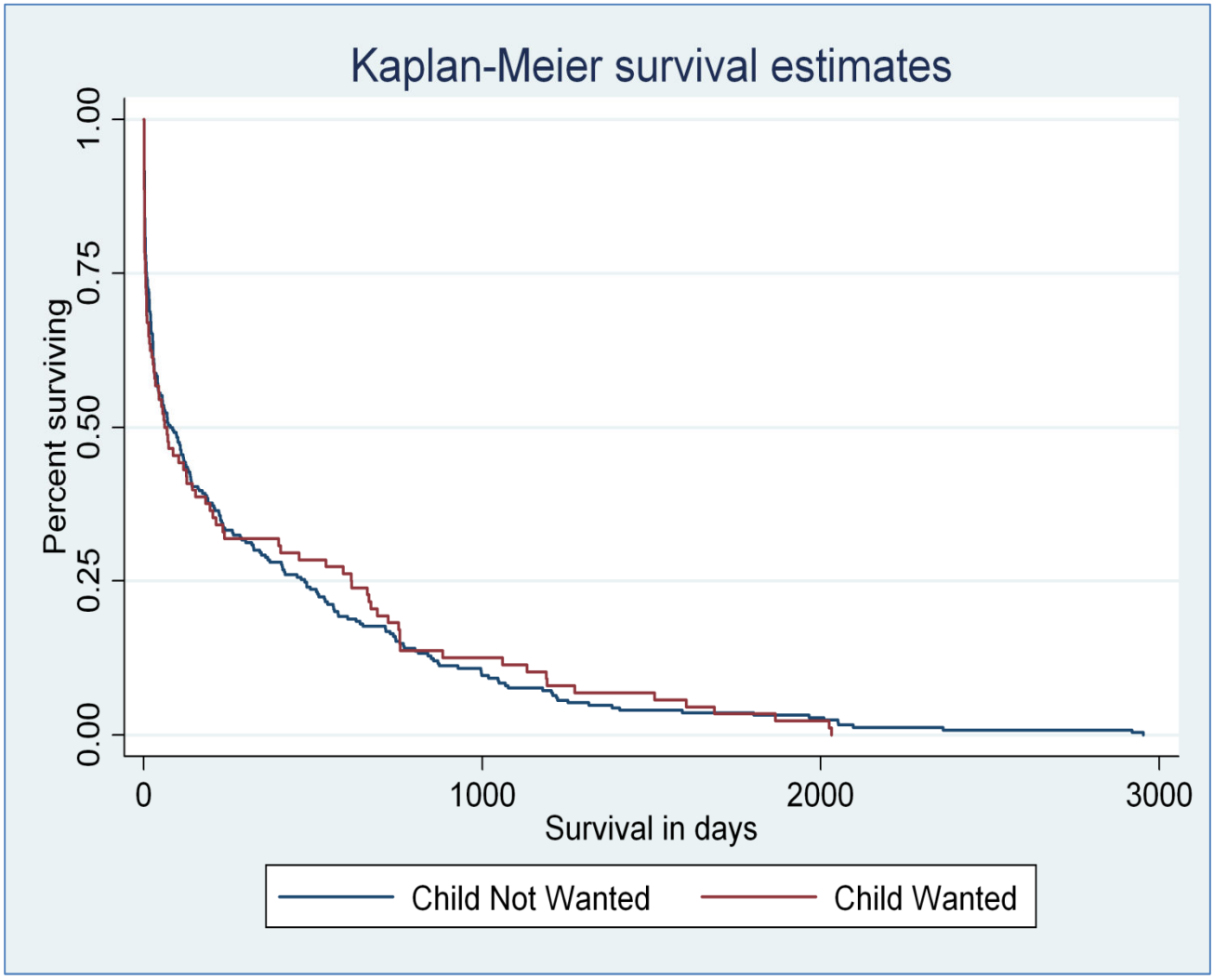
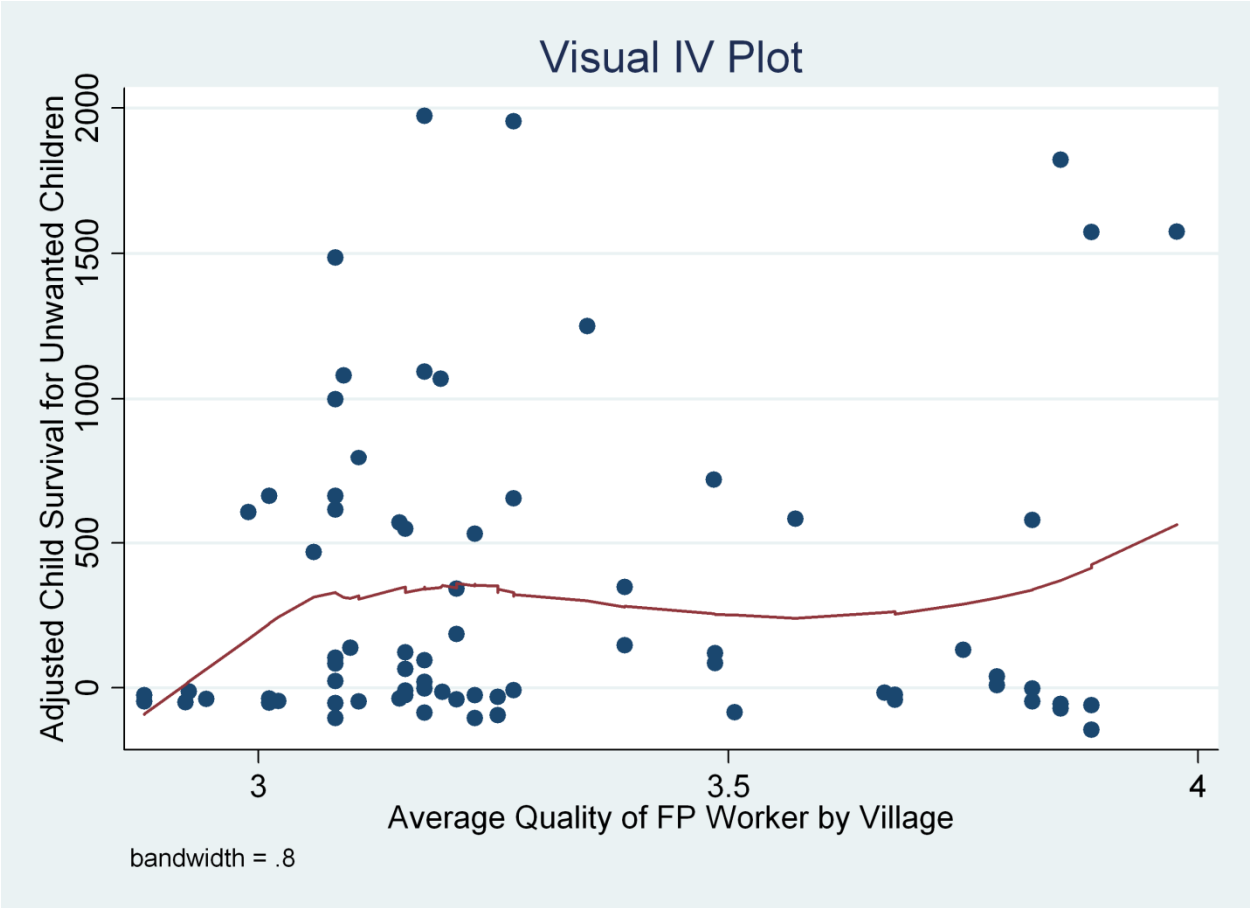


Figure 3. Y axis displays adjusted probability of child survival as residuals after adjusting for variables in Table 4. X axis is village average of FP worker's responsiveness to questions.



BIBLIOGRAPHY

Baydar, N. (1995). "Consequences for children of their birth planning status." Fam Plann Perspect **27**(6): 228-234, 245.

Brown, S. and L. Eisenberg, Eds. (1995). The Best Intentions: Unintended Pregnancy and the Well-Being of Children and Families. Washington, DC, National Academies Press.

Chalasani, S., J. B. Casterline, et al. (2007). "Consequences of unwanted childbearing: A study of child outcomes in Bangladesh." from http://paa2007.princeton.edu/download.aspx?submissionId=71482.

Eggleston, E., A. O. Tsui, et al. (2001). "Unintended pregnancy and low birthweight in Ecuador." Am J Public Health **91**(5): 808-810.

Fawcus, S. R., C. A. Crowther, et al. (1992). "Booked and unbooked mothers delivering at Harare Maternity Hospital, Zimbabwe: a comparison of maternal characteristics and foetal outcome." Cent Afr J Med **38**(10): 402-408.

Finer, L. B. and S. K. Henshaw (2006). "Disparities in rates of unintended pregnancy in the United States, 1994 and 2001." Perspect Sex Reprod Health **38**(2): 90-96.

Forrest, J. D. (1994). "Epidemiology of unintended pregnancy and contraceptive use." Am J Obstet Gynecol **170**(5 Pt 2): 1485-1489.

Forssman, H. and I. Thuwe (1981). "Continued follow-up study of 120 persons born after refusal of application for therapeutic abortion." Acta Psychiatr Scand **64**(2): 142-149.

Gage, A. (1998). "Premarital childbearing, unwanted fertility and maternity care in Kenya and Namibia." Population Studies **52**: 21-34.

Gazmararian, J. A., M. M. Adams, et al. (1995). "The relationship between pregnancy intendedness and physical violence in mothers of newborns. The PRAMS Working Group." Obstet Gynecol **85**(6): 1031-1038.

Gipson, J. D., M. A. Koenig, et al. (2008). "The effects of unintended pregnancy on infant, child, and parental health: a review of the literature." Stud Fam Plann **39**(1): 18-38.

Korenman, S., R. Kaestner, et al. (2002). "Consequences for infants of parental disagreement in pregnancy intention." Perspect Sex Reprod Health **34**(4): 198-205.

Kubicka, L., Z. Matejcek, et al. (1995). "Children from unwanted pregnancies in Prague, Czech Republic revisited at age thirty." Acta Psychiatr Scand **91**(6): 361-369.

Magadi, M. A., N. J. Madise, et al. (2000). "Frequency and timing of antenatal care in Kenya: explaining the variations between women of different communities." Soc Sci Med **51**(4): 551-561.

Marsiglio, W. and F. Mott (1988). "Does wanting to become pregnant with a first child affect subsequent maternal behaviors and birth weight." Journal of Marriage and the Family **50**: 1023-1036.

Marston, C. and J. Cleland (2003). "Do unintended pregnancies carried to term lead to adverse outcomes for mother and child? An assessment in five developing countries." Popul Stud (Camb) **57**(1): 77-93.

Matejcek, Z., Z. Dytrych, et al. (1978). "Children from unwanted pregnancies." Acta Psychiatr Scand **57**(1): 67-90.

Montgomery, M., C. Lloyd, et al. (1997). The Consequences of Imperfect Fertility Control for Children's Survival, Health, and Schooling. Calverton, MD, Macro International.

Myhrman, A., P. Olsen, et al. (1995). "Does the wantedness of a pregnancy predict a child's educational attainment?" Fam Plann Perspect **27**(3): 116-119.

Pop-Eleches, C. (2006). "The impact of an abortion ban on socioeconomic outcomes of children: evidence from Romania." Journal of Political Economy **114**(4): 744-773.
Pulley, L., L. V. Klerman, et al. (2002). "The extent of pregnancy mistiming and its association with maternal characteristics and behaviors and pregnancy outcomes." Perspect Sex Reprod Health **34**(4): 206-211.

Appendix Table. Cox regression model of child survival

Cox Regression of Survival Time: Hazard Ratios of Child Death

	Full sample	Unwanted	Wanted
Child is girl	0.835	0.994	0.744**
	[0.106]	[0.254]	[0.110]
Asset Score in 1996	0.985	1.035	0.975
	[0.0350]	[0.101]	[0.0383]
Years of Schooling of Mother in Census 1996	0.960	1.038	0.918*
	[0.0384]	[0.0798]	[0.0405]
Years of Schooling of KAP Husband	1.033	1.004	1.050*
	[0.0256]	[0.0374]	[0.0267]
Household Size	1.024*	1.037	1.025**
	[0.0131]	[0.0338]	[0.0109]
Age of KAP woman at date of interview	0.999	1.028	0.982
	[0.0124]	[0.0259]	[0.0150]
Treatment Area	0.984	1.365	0.948
	[0.114]	[0.305]	[0.138]
Non-pregnant mother says "don't want"	0.914		
	[0.149]		
Constant			
	296	80	216

Robust exponentiated standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1