Vol. 13, No. 1, March 1998

Contraceptive Failure and Its Subsequent Effects in China: A Two- Stage Event History Analysis

By Duolao Wang, Ian Diamond and Siân L. Curtis *

** Duolao Wang, Population Studies, London School of Economics, London WC2A 2AE, United Kingdom of Great Britain and Northern Ireland (E-mail: D.Wang@lse.ac.uk); Ian Diamond, Department of Social Statistics, University of Southampton, Southampton SO17 1BJ, United Kingdom; and Siân L. Curtis, DHS Programme, Macro International Inc., 11785 Beltsville Drive, Calverton, MD 20705, United States of America.*

Replacement of cheap IUDs with more effective ones could significantly reduce China's high contraceptive failure rate

Information on the determinants of contraceptive failure and the effects or outcome of such failure has important implications for the study of fertility as well as for women's health. Contraceptive failure becomes a progressively more important determinant of fertility as the fertility target of couples declines and as the prevalence of contraceptive use increases. Bongaarts and Rodriguez (1990) showed that, when the fertility target is two or three children, most couples are likely to need protection against unwanted births before the woman's reproductive period ends, i.e. for more than 10 years. However, if contraception is practised with 90 per cent efficacy, more than two-thirds of couples can expect a contraceptive failure within 10 years. Unless couples resort to induced abortion, the births resulting from contraceptive failure would contribute substantially to a population's aggregate level of fertility.

The proportion of births due to contraceptive failure is likely to rise as fertility targets decline to a degree that depends on the aggregate contraceptive efficacy of the mix of methods used in the population. On the other hand, if the contraceptive failure results in an induced abortion this may increase the risk of maternal morbidity and mortality. The need to understand the predictors of contraceptive failure and its outcome is particularly acute in China where there are high levels of contraceptive use (around 70 per cent throughout the 1980s) coupled with high levels of failure (Delfs, 1990; Poston, 1986; Weinberger, 1991).

Although there is quite a substantial literature on contraceptive failure, only limited work is available on the socio-demographic determinants of contraceptive failure (Grady, Hayward and Florey, 1988; Jones and Forrest, 1992; Grady, Hayward and Yagi, 1986; Schirm and others, 1982; Trussell and Kost, 1987), most of which have examined contraceptive failure in the first year of use in the United States of America. Also, data constraints have meant that several contraceptive methods are combined and introduced as a control variable in a multivariate analysis, and it is possible that socio-economic and demographic factors may influence contraceptive failure differently for different methods. In addition, sterilization is excluded from most of the analyses; determinants of sterilization failure should be examined even though the failure rate is very low in most societies. With regard to the subsequent outcomes of failure, to our knowledge, there is no study of the predictors of the outcomes of contraceptive failure.

This study aims to explore the socio-demographic and contraceptive use factors affecting the occurrence of contraceptive failure during the first eight and a half years of contraceptive use and the ways such pregnancies are resolved, by method and urban-rural residence. The data come from China's National Survey of Fertility and Birth Control, often referred to as the "Two-per-Thousand Fertility Survey", which collected information on the complete fertility and contraceptive history of currently married women aged 15-57 and on 27 contraceptive methods as well as on women's background characteristics. Such data make it possible to examine the determinants of the occurrence of contraceptive failure and the resolution of the pregnancy.

Data and methods

The Two-per-Thousand Fertility Survey, which provides the data for this study, was conducted in 1988 by China's State Family Planning Commission. The survey, representing a sample of two per thousand persons in mainland China, targeted ever-married resident women aged 15-57. It was a single-stage disproportionate stratified-cluster sampling survey. The sample fraction was 1.98 per thousand for the entire mainland population; 13,966 sampling points throughout the country were selected. Each sampling point comprised a small area with an average of 150 residents. The sample was stratified by province. However, within provinces, various sample fractions were taken with the aim of obtaining representative data for each province (Chen, 1991; Lavely, 1991).

The central elements of the survey were pregnancy and contraceptive use histories, but data on both husband and wife, on other household members, and on characteristics of the small residence group were also gathered. In the pregnancy history, each woman was asked to provide information on the outcomes of all pregnancies, including live births, miscarriages, induced abortions and still births; breastfeeding; and postpartum amenorrhea as well as the month and year in which the pregnancy ended. In the complete contraceptive history, the woman was asked to name the month and year she had started practising contraception for each continuous period of contraceptive use, the method she had adopted, the date she had stopped using that method and the reasons she stopped at that specific time.

A total of 27 contraceptive methods were listed in the questionnaire.1 For convenience, these have been classified into six types based on the failure rates and number of users: (a) male sterilization; (b) female sterilization; (c) IUDs: (d) pills; (e) condoms; (f) other methods (including a variety of contraceptives such as injectables, vaginal methods, rhythm and withdrawal).

The data for this analysis come from a 10 per cent randomly selected subsample of the Two-per-Thousand Fertility Survey. The unit of analysis for contraceptive failure is the use interval, with the sample being restricted to all use intervals that began since 1980 following the introduction of the one-child policy. The resulting number of method use-intervals is 30,027, representing the experience of 17,887 currently married women aged 15-57. Among the 30,027 periods of contraceptive use, 4,053 eventually ended in contraceptive failure within the study period. Failures occurring within nine months of the interview are excluded from the analysis of the subsequent outcome of contraceptive failure because their exposure to the outcome may be censored. The sample for the analysis of the determinants of the outcome of contraceptive failure thus consists of 3,658 failures.

Contraceptive failure is here defined as a pregnancy occurring while contraception is being practised. This definition of failure includes both method failure and failures attributed to inconsistent or incorrect use, which is also called "use failure" (Jejeebhoy, 1990)2.

The outcome of contraceptive failure is modelled as a two-stage process: stage one is the occurrence of a contraceptive failure, and stage two is the outcome of the pregnancy given that contraceptive failure has occurred. This two-stage process model has been used by Yamaguchi and Kandel (1987) and Mensch and Kandel (1992) to study the predictors of pre-marital pregnancy and its outcome.

For the first step, either continuous-time or discrete-time hazards models can be employed. Here log-rate models for piece-wise constant rates for continuous time are used to estimate the method-specific hazard models of contraceptive failure (Trussell and Hammerslough, 1983) in the first stage of the analysis. This technique has been used frequently in the study of contraceptive use dynamics (Schirm and others, 1982; Hammerslough, 1984; Grady and others, 1986 and 1988; Jones and Forrest, 1992).

In the second stage, logistic regression is used to model the conditional probability of the accidental pregnancy resulting in a live birth rather than abortion. In order to understand the predictors of a particular outcome of contraceptive failure, multinominal logistic regression should perhaps ideally be performed to estimate the determinants of multiple outcomes (i.e. live birth, abortion, spontaneous abortion or still-birth). In this study, just two outcomes of contraceptive failure (live birth and abortion) are considered while spontaneous abortion and still birth are excluded from the analysis, because the reported incidence of the last two of the four outcomes is relatively very small. Therefore, the influence of the predictors of experiencing a live birth versus an abortion is estimated by logistic regression. Since independence of parameters is assumed between the two steps, the parameters for each step are estimated independently.

The analysis focuses on three sets of factors likely to influence the occurrence of contraceptive failure and the decision to terminate it: socio-economic, demographic and contraceptive-use factors. Each of the independent variables is defined as a categorical variable and is measured at the time of initiating the particular period of contraceptive use. The variables in each group are described below and the categories defined for each variable and percentage distribution of use periods by method are presented in table 1.

Table 1. Percentage distributions of variables used in method-specific hazards models for China

Variables/categories	Sterilization		IUD	Pill	Condom	Other
	Male	Female				
Socio-economic characteristics						
Residence:						
Urban	5.4	10.5	28.3	34.2	78.7	70.4
Rural	94.6	89.5	71.7	65.8	21.3	29.6
Geographic region of residence:						
North	4.0	16.9	17.1	26.4	43.4	25.1
North-East	0.1	10.0	14.9	7.5	15.1	7.3
East	33.0	27.3	27.5	28.5	20.5	25.9
South	34.4	26.4	20.5	12.2	9.0	17.9
South-West	26.8	5.6	10.8	6.6	5.8	8.6
North-West	1.7	13.8	9.2	18.7	6.2	15.3
Education:						

No school	58.1	46.5	26.3	24.6	3.3	8.9
Primary	25.5	32.7	25.4	25.8	12.0	14.9
Junior	12.5	15.2	30.7	31.3	38.7	38.2
Senior +	3.8	5.6	17.5	18.2	46.0	38.0
Occupation:						
Agriculture	95.4	87.8	69.7	62.3	19.2	27.9
Others	4.6	12.2	30.3	37.7	80.8	72.1
Ethnicity:						
Han	90.3	93.3	92.0	88.2	94.5	90.5
Minority	9.7	6.7	8.0	11.8	5.5	9.5
Demographic characteristics						
Age at the beginning of the use interval:						
≤24	10.0	13.9	35.7	29.0	24.2	20.9
25-27	20.0	23.1	28.0	26.2	32.7	26.8
28-30	28.6	27.1	18.7	19.7	21.6	19.8
≥31	41.4	35.9	17.7	25.2	21.5	32.5
Number of living children:						
0	0.0	0.2	0.4	3.8	10.6	7.8
1	0.8	1.4	50.8	48.0	72.4	59.8
2	39.4	46.7	28.8	26.8	12.8	18.8
3+	59.8	51.7	20.0	21.5	4.2	13.5
If there is a son:						
No	10.2	8.0	29.7	33.6	50.3	40.8
Yes	89.8	92.0	70.3	66.4	49.7	59.2
Contraceptive use characteristics						
Prior use:						
No	46.0	44.2	71.8	55.2	55.0	45.6
Yes	54.0	55.8	28.2	44.8	45.0	54.4
Prior use failure:						
No	77.1	80.8	83.9	73.1	68.0	67.0
Yes	22.9	19.2	16.1	26.9	32.0	33.0
Motivation of use response to campaign:						
No	7.7	10.5	11.2	25.4	24.2	27.6
Yes	92.3	89.5	88.8	74.6	75.8	72.4
Period at the initiation of use:						
<1984	49.8	55.5	42.1	38.9	32.3	37.5
≥1984	50.2	44.5	57.9	61.1	67.7	62.5
Duration of use						
0-11	23.8	21.4	33.3	41.8	41.8	38.2
12-23	19.0	18.6	21.7	23.3	23.1	22.4
24-35	16.1	16.6	15.0	13.7	13.9	14.3
36-47	14.1	15.2	11.0	8.5	8.8	9.1
48-59	11.9	13.1	7.8	5.5	5.5	6.4
60-71	7.9	8.0	5.3	3.5	3.6	4.5
72-83	4.1	3.8	3.2	2.1	1.9	2.8
84-102	3.1	3.3	2.5	1.6	1.5	2.4
Number of cases	1,555	7,646	14,639	3,266	1,753	1,168

Note: The percentages are for the percentage of women in a particular socio-demographic category using a particular method. Therefore, the percentages for all the categories of a particular variable will sum to 100 for each method of use. Where there are small variations from 100, this is due to rounding errors.

The socio-economic variables in the analysis are educational attainment, occupation and ethnicity. Less educated women in rural areas are expected to have a relatively high probability of contraceptive failure, and are also expected to have a higher chance of a live birth rather than an abortion if contraceptive failure occurs. Because China covers a very large geographic area and has different regulations for fertility control in different provinces, and has also experienced dramatic and uneven changes in its economic development in the 1980s, it is necessary to include also the region of residence. To simplify the presentation, the 29 provinces or municipal cities included in the analysis have been grouped into six large areas: North, North-East, East, South, South-West and North-West3. Couples engaged in agricultural work may be expected to have a higher failure rate than others because of their lower accessibility to family planning services.

There are 55 ethnic minorities in China, accounting for about 9 per cent of the total population. The ethnic minorities enjoy a much more lenient policy with regard to number of children per family; implementation of the family planning policy has never been as intense among minorities as that directed at the Han majority (Tien and others, 1992; Peng, 1991), which might have some influence on contraceptive behaviour.

The demographic variables include age at the start of contraceptive use and fertility history. Age is included in the analysis because previous studies have shown a strong relationship between age and contraceptive failure (Grady and others, 1986 and 1988; Schirm and others, 1982). As age increases fecundity decreases, and advancing age probably strengthens a woman's motivation to terminate childbearing. In this analysis, age is divided into four categories which approximate the quartiles of use intervals.

A woman's fertility history is expected to be associated with the occurrence of contraceptive failure and its outcome (Cleland, Hardy and Taucher, 1990; Grady and others, 1986). As parity increases, a woman's motivation to avoid having additional children may also increase with or without programme disincentives. Whether there is a son in the family may influence the decision to terminate a contraceptive failure as China is a society where there is a high degree of son preference (Tien and others, 1992; Coale and Banister, 1994; Gu and Roy, 1995). On the other hand, parity may also reflect propensity to fail.

Prior contraceptive use and failure, together with motivation for contraceptive use and period of use, are included as factors relating to a woman's contraceptive history and background. Successful prior use of a method is likely to be a powerful predictor of success with another one (Cleland and others, 1990). On the other hand, contraceptive failure may be clustered among a group of women who are likely to experience repeated failures.

The motivation for using contraception is assumed to be a very important determinant of contraceptive failure (Cleland and others, 1990). The 1988 survey collected seven reasons for practising contraception: (a) responding to the campaign, (b) economic, (c) household work, (d) work, (e) study, (f) health and (g) others. The majority of users reported that they were responding to the government campaign. This is especially true of users of sterilization and IUDs as can be seen from table 1. Therefore, whether the reason for use is to respond to the campaign or not is introduced as an indicator of motivation. The period at the initiation of use is introduced as a family planning programme variable to indicate the change in the one-child policy since 1984. Greenhalgh (1986) documented that the Chinese government had eased the enforcement of the one-child policy slightly (referring to this as "opening a small hole"). This policy of leniency, when it happens, is likely to affect contraceptive behaviour. For example, users may be more motivated to use contraceptives so the failure rates may be lower.

In addition, it is well known that the duration of use is a key variable as a predictor and is essentially used to form a baseline hazard function. The distributions of use intervals by durations in table 1 refer to the number at the beginning of each duration.

Further decomposition of table 1 by urban-rural residence shows that despite some variation by residence in the compositional distributions of contraceptive use by method, the basic patterns of relationships are quite similar.

The statistical package EGRET (Statistics and Epidemiology Research Corporation, 1990) is used to estimate the parameters of the hazards models and logistic regressions. Parsimonious proportional hazards and logistic models are obtained by using a combination of forward selection and backward elimination.

Results

Determinants of contraceptive failure

Table 2 presents the results from the final parsimonious proportional hazards models for the six methods by urban-rural residence. The parameter estimates are omitted here. Instead, the effects of the various covariates are expressed as relative risks, which are calculated as the exponentiated coefficients. These relative risks represent the relative change in the hazard rate of contraceptive failure for the specific category compared to the reference group of this variable, controlling for

other variables. For example, in the hazard model for rural male sterilization users, the relative risk of about 6.8 during the first year of male sterilization means that the risks of experiencing a male sterilization failure are 6.8 times higher than risks for the reference category "after three years of use". The chi-squared statistic compares the final model with the null model which includes only the parameter for the intercept. All variables in these final models are significant at the 5 per cent or higher level.

Initially, seven dummy variables for the first seven 12-month intervals of duration (with reference interval 84-102) were used to estimate the method-specific hazards. After much exploratory analysis the intervals above 36 months were collapsed into one category. Models using this simpler specification of the hazard fit the data almost as well and do not change the results significantly.

Table 2. Estimated relative risks for parsimonious proportional hazards models of contraceptive failure, by method and residence, China

Variable	Sterilization		IUD	Pill	Condom	Other
	Male					
Urban						
Duration of use:						
0-11	x	x	3.94**	2.10**	3.02**	2.48**
12-23	x	x	2.45**	2.32**	2.68**	2.40**
24-35	x	x	1.61**	1.45**	1.71*	1.63
36-102	x	x	1.00	1.00	1.00	1.00
Age at start of use:						
≤24	x	x	1.00	1.00	1.00	1.00
25-27	x	x	1.07	.74	1.05	1.03
28-30	x	x	.66**	.51**	.76	.67
31+	x	x	.44**	.22**	.52**	.42**
Number of living children:						
0	--	--	-	1.00	1.00	1.00
1	--	--	x	.65*	.44**	.50**
2	x	x	x	.48*	.43**	.39**
3+	x	x	x	.51	.13**	.34*
Prior failure:						
No	x	x	1.00	1.00	x	1.00
Yes	x	x	1.51**	1.80**	x	1.38**
Period at initiation of use:						
<1984	x	x	x	1.00	1.00	1.00
≥1984	x	x	x	.68**	.69**	.66**
Chi-square	x	x	239.37	108.21**	167.77**	93.93**
Df	x	x	7	11	10	11
N	84	805	4,143	1,117	1,380	822
Rural						
Duration of use:						
0-11	6.79**	4.13**	2.99**	2.18**	x	x
12-23	4.80**	4.05**	2.54**	2.35**	x	x
24-35	3.84**	1.36	1.95**	1.46	x	x
36-102	1.00	1.00	1.00	1.00	x	x
Age at start of use:						
≤24	x	x	1.00	1.00	1.00	1.00

25-27	x	x	.76**	.72*	.75	.72
28-30	x	x	.42**	.48**	.87	.53
31+	x	x	.18**	.19**	.37**	.14**
Number of living children:						
0	--	--	-	x	x	x
1	--	--	1.00	x	x	x
2	1.00	1.00	1.24**	x	x	x
3+	2.68**	4.01**	1.42**	x	x	x
Prior failure:						
No	x	1.00	1.00	1.00	x	1.00
Yes	x	1.73*	1.67**	1.74**	x	1.97*
Period at initiation of use:						
<1984	x	x	1.00	1.00	x	x
≥1984	x	x	.82**	.72*	x	x
Geographic region of residence:						
North	x	x	1.34*	x	x	x
North-East	x	x	1.39**	x	x	x
East	x	x	1.67**	x	x	x
South	x	x	1.40**	x	x	x
South-West	x	x	1.66**	x	x	x
North-West	x	x	1.00	x	x	x
Chi-square	74.51**	76.94**	749.78**	101.66**	10.18**	37.04**
Df	4	5	15	8	3	4
N	1,471	6,841	10,496	2,149	373	346

Note: - category collapsed with one-child group;
-- category collapsed with two-children group;
x variable deleted (did not improve the fit of the model at the P=.05 level);
* P<.05;
* * P<.01;
N = number of use intervals.

For male sterilization, table 2 shows that duration of use and number of living children are strong determinants of contraceptive failure for rural couples and not at all for urban couples. The duration effect shows that the rate of contraceptive failure decreases rapidly in the first few months and is very rare after 36 months. For rural women whose husbands have been sterilized, the risks of contraceptive failure are 6.8, 4.8 and 3.8 times higher within the first year, second year and third year of use respectively, than subsequently. The effect of the number of living children reveals that rural women with three or more children have a significantly higher rate of contraceptive failure. For example, the hazard of failure is about 2.7 times greater for women with three or more children compared with women who have fewer than three children.

For female sterilization, duration of use together with number of living children and previous contraceptive failure are found to be important predictors of contraceptive failure for rural women but not for urban women. The effects of duration of use and number of living children are similar to that for male sterilization but with a smaller effect of duration. In addition, for rural sterilized women, prior experience of contraceptive failure strongly increases the chance of experiencing another accidental pregnancy.

For urban users, table 2 indicates that duration of use, age at the start of use and number of living children are all significant determinants of contraceptive failure for all reversible methods, except for the effect of number of living children on IUD use. Contraceptive failure occurs more frequently at shorter durations of use; older women have a relatively low rate of contraceptive failure. The chance of having an accidental pregnancy for women without a child is much higher than for women with children. For rural users, age at the initiation of use is found to be the only variable that has a significant influence on contraceptive failure for all reversible methods.

Women living in both urban and rural areas with prior contraceptive failure have an elevated risk of another failure for all reversible methods except for condoms.

For rural IUD users, number of living children is positively associated with failure. Regional differentials in failure rates are also observed for IUD users, IUD failure being lowest in the rural North-West.

There are significant differentials in the contraceptive failure rates between the two periods of use for all reversible methods. The results in table 2 indicate that the risk of contraceptive failure since 1984 has been reduced by 32 per cent, 31 per cent and 34 per cent, respectively, for users of the pill, condom and other methods in urban areas, and 18 per cent and 28 per cent, respectively, for users of IUDs and the pill in rural areas compared with the period before 1984.

Education, ethnicity, occupation and motivation are found to have no significant effect on contraceptive failure for each method after controlling for other factors. The presence of a son also has no significant effect on contraceptive failure. These results suggest that in general demographic factors are more important determinants of contraceptive failure than socio-economic variables.

Determinants of the outcome of contraceptive failure

Table 3 presents the distribution of the outcomes of the 3,658 contraceptive failures by method and residence. It shows the striking differences in the way urban and rural couples resolve a contraceptive failure. Only 9.1 per cent of failures result in a live birth for urban couples compared with 42.0 per cent for rural couples. The marked differentials in the outcomes of contraceptive failure also exist among different methods for rural couples. As shown in table 3, for rural couples, 61.7 per cent and 62.4 per cent of contraceptive failures for male and female sterilization, respectively, lead to live births, whereas 45.0 per cent of IUD failures and less than 25.0 per cent of other reversible method failures lead to live births. The distribution of the outcome of contraceptive failure by residence and method may reflect the nature and implementation of the family planning programmes associated with different contraceptive mixes. For example, reversible methods are more prevalent among couples in urban areas and those having a higher education who have more (government-enforced) motivation to avoid births than among sterilization and IUD users in rural areas. Large urban-rural differences are seen in IUD failure outcomes, a situation which probably reflects the Government's pressure on couples in urban areas to have an abortion.

Table 3. Percentage distribution of outcomes of pregnancy given contraceptive failure, by method and residence (weighted), China

Method	Live birth	Abortion	Still-birth/ spontaneous abortion	Total (%)	N
Urban					
Male sterilization	n.a.	n.a.	n.a.	n.a.	2
Female sterilization	n.a.	n.a.	n.a.	n.a.	5
IUD	5.6	93.7	.7	(45.4)	515
Pill	13.8	83.7	2.5	(16.4)	231
Condom	12.0	85.4	2.6	(21.4)	332
Others	9.6	89.1	1.3	(16.2)	224
Total (%)	9.1	89.5	1.5	(100.0)	1,309
Rural					
Male sterilization	61.7	34.8	3.5	(6.8)	120
Female sterilization	62.4	34.2	3.4	(4.0)	95
IUD	45.0	51.4	3.6	(72.3)	1,618
Pill	16.1	81.9	2.0	(12.4)	387
Condom	13.4	81.7	4.9	(2.7)	79
Others	24.9	74.2	.9	(1.9)	50
Total (%)	42.0	54.6	3.3	(100.0)	2,349

Note: Figures in parentheses are compositional proportions of all 3,658 contraceptive failures; N is the number of unweighted contraceptive failures; n.a. = not applicable.

Logistic regression is used to identify the factors which are most important in predicting the outcome of contraceptive failure. The results of the best logistic regression models based on all the contraceptive failures are shown in table 4. They are reported as odds ratios which give the change in the odds of a live birth versus an abortion for a category of a variable compared to the reference category for that variable.

Table 4. Estimated odds ratios for parsimonious logistic regression models of live birth versus abortion, by method and residence, China

Variable	Sterilization		IUD	Pill	Condom	Other
	Male	Female				
Urban						
Age:						
≤24	n.a.	n.a.	1.00	1.00	x	x
25-27	n.a.	n.a.	.21	.10**	x	x
28-30	n.a.	n.a.	.04**	.06**	x	x
31+	n.a.	n.a.	.01**	.01**	x	x
Living children:						
0	--	--	-	31.61**	48.06**	--
1	--	--	1.00	1.00	1.00	1.00
2	n.a.	n.a.	242.8**	154.8**	12.12**	29.93**
3+	n.a.	n.a.	1,384**	456.2**	--	--
Chi-square	n.a.	n.a.	139.58**	86.74**	101.60**	36.43**
Df	n.a.	n.a.	5	6	2	1
N	2	5	511	228	324	219
Rural						
Age:						
≤24	x	x	1.00	1.00	x	x
25-27	x	x	.45**	.22**	x	x
28-30	x	x	.14**	.06**	x	x
31+	x	x	.06**	.05**	x	x
Living children:						
0	--	--	-	44.24**	--	--
1	--	--	1.00	1.00	1.00	1.00
2	1.00	1.00	1,009**	274.4**	40.50**	38.89**
3+	22.18**	28.3**	2,977**	794.8**	--	--
Prior failure:						
No	x	x	1.00	1.00	x	x
Yes	x	x	.40**	.32**	x	x
Chi-square	29.81**	119.20**	1,245.19**	164.14**	20.51**	21.10**
Df	1	6	7	1	1	1
N	117	91	1,562	377	76	49

Note: - category collapsed with one-child group;
-- category collapsed with two-children group;
x variable deleted (did not improve the fit of the model at the P=.05 level);
* P<.05;
* * P<.01;
n.a. = category not applicable;
N = number of failures.

The number of living children has a very strong effect for all methods on whether the contraceptive failure will end in a live birth or an abortion. For IUD failures, almost all those which occur among women who have one or no child are aborted

and this holds true for both urban and rural women. However, IUD users with more than one child have a higher probability of having a live birth. The distribution of outcome of contraceptive failures for other reversible methods is similar to that for IUDs. If a woman has a living child and unintentionally becomes pregnant because of reversible method failure, she is almost certain to have an induced abortion. However, the more children the woman has, the more likely she is to have a live birth as a result of contraceptive failure.

It can also be seen from table 4 that IUD and pill users in all age groups over 24 years old have significantly lower odds of a live birth than the reference group for both urban and rural users. The results indicate that older women have higher odds of an abortion compared with their younger counterparts. In addition, women with a previous contraceptive failure are more likely to have the current failure end in an abortion rather than a live birth when compared with women with no prior failure.

The duration of use in which the contraceptive failure occurs and other variables, such as occupation, ethnicity, son preference and motivation, are found to be insignificant in determining the outcome of failure.

Discussion and conclusion

Using the 1988 Two-per-Thousand Fertility Survey, this study has investigated the determinants of contraceptive failure and its outcome in China in the 1980s through a two-step event history approach. Several socio-demographic factors are found to be associated with the occurrence of contraceptive failure and the decision on how to resolve the pregnancy.

Comparing urban and rural dwellers, rural couples are more likely to become pregnant because of sterilization failure, and they would also be more likely to have a live birth as a result of contraceptive failure. On the other hand, urban couples are more likely to have an induced abortion as opposed to a live birth if contraceptive failure occurs. Although both urban and rural IUD users have about the same chance of having a contraceptive failure, quite different resolutions of the pregnancy may be observed: about 45 per cent of IUD failures for rural women will end in a live birth compared with just 5.6 per cent for urban women. These results demonstrate the importance of analysing separately the determinants of contraceptive failure and its outcome by method and by urban-rural residence.

For sterilization, number of living children is identified as a very strong predictor of contraceptive failure as well as of its outcome for rural women. Rural women with three or more children have a significantly higher rate of contraceptive failure, and also a significantly higher chance of a subsequent live birth rather than an abortion, compared with women having fewer than three children. This suggests that some of the "failures" may be deliberate pregnancies. Table 3 also shows that, for rural sterilization users, over 60 per cent of failures lead to a live birth compared with 45.0 per cent for IUD failures, and less than 25 per cent for other reversible methods. If those are not deliberate pregnancies, then a low motivation to prevent pregnancy may be another cause.

Age at the start of the period of contraceptive use, number of living children and prior contraceptive failure are found to be the important determinants of IUD failure and its outcome, especially for rural IUD users. The IUD failure rate decreases as a woman's age increases. Younger women have a higher risk of failure, and if they experience a failure, they are more likely than older women to have a live birth as opposed to an abortion. This is expected because as a woman becomes older her fecundity decreases; also, advancing age probably strengthens women's motivation to use IUDs effectively and thus restrict their childbearing. Rural women with two or more children experience a higher failure rate than women with no or one child. If IUD failure occurs among women with two or more children, they, whether living in urban or rural areas, are extremely likely to have a live birth as a result of IUD failure. This result is hardly surprising. In China, some women, especially multiparous mothers in rural areas, may have their IUDs removed privately and subsequently get pregnant, and then report the pregnancy as a method failure. In doing this, they can avoid incurring a penalty from the government. Previous contraceptive failure not only increases the risk of IUD failure, but also increases the odds of an abortion versus a live birth compared with women with no prior failures.

For other reversible methods, the number of living children is a consistently significant determinant of how a contraceptive failure is resolved for both urban and rural women even though the extent to which those variables are influential varies somewhat. Once a contraceptive failure of a reversible method occurs, a woman with one child will almost definitely have an induced abortion, which indicates a strong commitment to the one-child policy by some Chinese women. An alternative interpretation could be that the programme puts pressure on these women to terminate their pregnancy.

The patterns of contraceptive failure and its outcome discussed above show that women's demographic characteristics are more important than socio-economic background with regard to the occurrence of contraceptive failure and the decision to terminate the pregnancy.

The results of this study suggest some potential evidence of defiance of, and resistance to, the family planning policies and programmes by some groups of Chinese women. "Intended" contraceptive failure or deliberate pregnancy before sterilization or removal of an IUD in order to have a child are perhaps examples. Also, some women, who already had two or more children, still preferred to have a live birth rather than an abortion if they experienced a failure.

The finding that there are some reductions in contraceptive failure rates for some reversible methods since 1984 compared with the period before 1984 suggests that the relaxation of the family planning programme after 1984 may have

played some role in reducing contraceptive failure because couples may be more motivated to use contraceptives efficiently when they enjoy a lenient family planning policy. It may also suggest the improved promotion of family planning services.

The results of this study have important policy implications. The distribution of the outcomes of contraceptive failure indicate that there may be a different demographic impact of contraceptive failure by method and area of residence. Contraceptive failure which terminates in a live birth will contribute to the aggregate level of fertility. Wang and Diamond (1995) find that contraceptive failure accounted for about 7 per cent of the general fertility rate in the 1980s; also, 87 per cent of that percentage related to sterilization and, most importantly, IUD failure. On the other hand, contraceptive failure which results in abortion, mainly among young users of reversible methods in urban areas, may increase the risk of disease and even operation-related death for women. Therefore, greater efforts should be made to reduce contraceptive failure for the sake of both birth control and women's health. The Chinese family planning programme should pay special attention to those who are young users of reversible methods; who are multiple-birth sterilization users; who are nulliparous users of reversible methods; and also those who have previous experience of unwanted pregnancy. Motivating users in their commitment to method use is also important to reduce the occurrence of contraceptive failure.

The provision of methods other than IUD for couples with no or only one child may also help to increase user satisfaction, since the wide availability of more contraceptive options facilitates a better meeting of particular individual needs for contraception. The flexibility of switching methods may pose additional demands on services but could increase long-term continuation and user-satisfaction.

The key to reducing the failure rate is to improve the effectiveness of IUDs. Of all contraceptive method failures, 64.3 per cent are due to IUD failure. The IUD discontinuation rates for contraceptive failure and expulsion in China are among the highest in the world, and there are a number of socio-demographic and family planning programme factors that result in the low effectiveness of IUDs (Wang, 1996). Replacement of the cheap and widely use stainless steel ring with newer IUDs such as the copper-T could reduce such high levels of IUD failure. High quality IUDs of various sizes and types should be provided and made widely available for users. Training of family planning workers and the provision of improved information and counselling to clients are also essential.

Acknowledgments

This research was carried out with financial support from the Programme of Research Development and Training in Human Reproduction, World Health Organization, and the New York-based Population Council, while the first author was a Ph.D. candidate in the Department of Social Statistics, University of Southampton, United Kingdom.

Endnotes

1. Those 27 contraceptive methods listed in the questionnaire can be divided into two categories: modern and traditional methods. Modern contraceptive methods include the following: male sterilization (vasectomy, vas deferens sticker blockade and suppository blockade); female sterilization (tubectomy, fallopian sticker blockade and fallopian suppository blockade); IUDs; pills (various types of oral contraceptive methods commonly used in China); injectables (injection and implant); condoms; vaginal methods (barrier methods such as cervical cap and diaphragm and spermicidal methods such as jelly, foam, contraceptive suppository, external contraceptive pill and external contraceptive sponge). The following contraceptives are considered as traditional methods: rhythm (safe period or periodic abstinence); withdrawal (coitus interruptus); and all remaining methods, such as the use of Chinese herbs, natural methods and combinations of several short-term methods. Of all types of contraceptives used, modern methods account for 98.6 per cent, whereas traditional methods account for only 1.4 per cent.

2. Three main measures of contraceptive failure are found in the demographic literature: method failure, user failure and extended-use failure. Method failure includes only pregnancies directly attributable to the method under ideal conditions and perfect use. User failure refers to pregnancies that occur while a couple consider themselves to be users of a method; it includes both method failure and failure attributable to inconsistent or incorrect use. Extended failure includes unintended pregnancies during and subsequent to actual contraceptive use, but prior to a subsequent pregnancy (Jejeebhoy, 1990). In this study, contraceptive failure refers to user failure.

3. China can be described as a mosaic of different cultures, living in an area of over 9.6 million square kilometres divided into 31 administrative regions, with each region having its own cultural and geographic characteristics. Also, there is diversity in fertility patterns and family planning programmes (Peng, 1991; Wang, 1996). The grouping of the 29 regions covered in this study into six large areas, namely North, North-East, East, South, South-West and North-West, based on geographic criteria, is somewhat arbitrary. It may conceal internal differences in terms of economic, environmental and cultural heritage, but it still would capture some regional variability.

References

Bongaarts, J. and G. Rodriguez (1990). "A new method for estimating contraceptive failure rates", in: Measuring the Dynamics of Contraceptive Use: Proceedings of the United Nations Expert Group Meeting (New York: United Nations) pp. 52-67.

Chen, S. (1991). "Sampling design of China's fertility and birth control sampling survey", in: Proceedings of the National Conference on China's 1988 Two-per-Thousand Fertility and Birth Control Survey (Hangzhou, China) pp. 10-16.

Cleland, J.G., E.E. Hardy and E. Taucher (1990). Introduction of New Contraceptives into Family Planning Programmes: Guidelines for Social Science Research, Special Programme of Research, Development and Research Training in Human Reproduction, World Health Organization, Geneva.

Coale, A.J. and J. Banister (1994). "Five decades of missing females in China" Demography 31(3):459-479.

Delfs, R. (1990). "Population growth threatens to get out of control: the fertility factor" Far Eastern Economic Review July 19.

Greenhalgh, S. (1986). "Shifts in China's population policy, 1984-1986: views from the central, provincial, and local levels" Population and Development Review 12(3):491-515.

Grady, W.R., M.D. Hayward and J. Yagi (1986). "Contraceptive failure in the United States: estimates from the 1982 National Survey of Family Growth" Family Planning Perspectives 18(5):200-204, 207-209.

Grady, W.R., M.D. Hayward and F.A. Florey (1988). "Contraceptive discontinuation among married women in the United States" Studies in Family Planning 19(4):227-235.

Gu, B. and K. Roy (1995). "Sex ratio at birth in China, with reference to other areas in East Asia: what we know" Asia-Pacific Population Journal 10(3):17-42.

Hammerslough, C.R. (1984). "Characteristics of women who stop using contraceptives" Family Planning Perspectives 16(1):14-16, 18.

Jejeebhoy, S. (1990). "Measuring contraceptive use-failure and continuation: an overview of new approaches", in: Measuring the Dynamics of Contraceptive Use: Proceedings of the United Nations Expert Group Meeting (New York: United Nations) pp. 21-45.

Jones, E.F. and J.D. Forrest (1992). "Contraceptive failure rates based on the 1988 NSFG" Family Planning Perspectives 24(1):12-19.

Lavely, W.R. (1991). "China unveils its monumental Two per Thousand Fertility Survey" Asian Population Forum 5(4):89-92.

Mensch, B. and D.B. Kandel (1992). "Drug use as a risk factor for premarital teen pregnancy and abortion in a national sample of young white women" Demography 29(3):409-429.

Peng, X. (1991). Demographic Transition in China: Fertility Trends Since the 1950s (Oxford: Clarendon Press).

Poston, D.L., Jr. (1986). "Patterns of contraceptive use in China" Studies in Family Planning 17(5):217-227.

Schirm, A.L., J. Trussell, J. Menken and W.R. Grady (1982). "Contraceptive failure in the United States: the impact of social, economic and demographic factors" Family Planning Perspectives 14(2):68-75.

Statistics and Epidemiology Research Corporation (1989). EGRET Reference Manual (Seattle: Statistics and Epidemiology Research Corporation).

Tien, H.Y., T. Zhang, Y. Ping, J. Li and Z. Liang (1992). "China's demographic dilemmas" Population Bulletin 47(1):1-44.

Trussell, J. and C. Hammerslough (1983). "A hazards-model analysis of the covariates of infant and child mortality in Sri Lanka" Demography 20(1):1-26.

Trussell, J. and K. Kost (1987). "Contraceptive failure in the United States: a critical review of the literature" Studies in Family Planning 18(5):237-283.

Wang, D. (1996). "The determinants of IUD discontinuation in China: a discrete-time competing risk model analysis" Social Biology 43(3-4):271-289.

_____ and I. Diamond (1995). "The impact on fertility of contraceptive failure in China in the 1980s" Journal of Biosocial Science 27(3):277-284.

Weinberger, M.B. (1991). "Recent trends in contraceptive behaviour", in: Proceedings of Demographic and Health Surveys World Conference 1:555-573.

Yamaguchi, K. and D.B. Kandel (1987). "Drug use and other determinants of premarital pregnancy and its outcome: a dynamic analysis of competing life events" Journal of Marriage and the Family 49(1):257-270.
