FETAL WASTAGE IN A SAMPLE
OF TAIWANESE WOMEN

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In any retrospective study, it is extremely difficult to collect com-
plete and accurate information about pregnancy losses. The task
becomes even harder if one tries to differentiate between types of
pregnancy losses such as neonatal deaths, spontaneous abortions,
induced abortions and stillbirths, because for this purpose one needs
to know the exact period of gestation for each pregnancy. To be-
lieve that respondents are able to give such details accurately is
expecting too much from them. Estimates of fetal wastage based
on data collected in a retrospective survey are subject to two types
of errors: (1) errors in differentiating between types of fetal wast-
age and (2) errors in reporting the complete number of pregnancy
losses.[1] The magnitude of these errors is difficult to assess. Never-
theless, in this paper an attempt is made to estimate the level of
pregnancy loss from the data collected retrospectively for a prob-
ability sample[2] of 2,443 Taiwanese women between the ages 20 to
39 living with their husbands in Taichung City at the end of 1962.
A simple technique is developed for gauging the level of under-
reporting of pregnancy losses. Based on estimates corrected for
memory bias, variations in pregnancy losses are studied by age of
woman, pregnancy order and the use of contraception during the
pregnancy interval prior to the conception.

For the purpose of this analysis, pregnancy losses are classified

into two groups: (1) pregnancies terminated by induced abortions and (2) pregnancies terminated by spontaneous abortions and still-births. The distinction between the two is based on the reports of the respondents; nothing more is known about the accuracy of this distinction. Some induced abortions are probably classified as spontaneous abortions. However, the total wastage rate (induced plus spontaneous) will give a conservative estimate of the level of fetal wastage in Taichung. The fetal wastage rate is defined as the number of pregnancies resulting in nonlive births per 1,000 completed pregnancies reported by the respondents.

Previous studies[3] have consistently shown that the age of women and the pregnancy order are two critical factors affecting the chances of fetal wastage. Fetal deaths for younger and older women are higher than for those of intermediate age. More first pregnancies result in fetal deaths than do second order pregnancies, after which the incidence of fetal wastage increases with the pregnancy order. Little is known, however, about the association between contraceptive use and the level of fetal losses, which will be studied here.

RESULTS

In the Taichung sample, information was collected for about 9,976 completed pregnancies (this excludes pregnancies in progress at the time of interview). Of these, 75 per 1,000 were classified as terminated by spontaneous abortion and 45 per 1,000 by induced abortion, giving an overall fetal wastage of 120 per 1,000 pregnancies (see Table 1).

Women reported that they used contraception regularly or irregularly during about seven per cent of the pregnancy intervals preceding these pregnancies. When contraception is used during the interval preceding conception, the risk of fetal wastage was about four times greater than the risk in the absence of contraception. The main reason for this difference is an elevenfold increase in the induced abortion rates after the unsuccessful use of contraception. The spontaneous abortion rate following use of contraception

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TABLE I. FETAL WASTAGE RATE BY USE OF CONTRACEPTION AND TYPE OF FETAL WASTAGE

Use of Contraception During Pregnancy Interval Prior to Conception	Induced Abortion Rate	Spontaneous Abortion Rate	Total Fetal Wastage Rate	Number of Pregnancies
Yes	292	122	414	665
No	27	72	99	9,311
All	45	75	120	9,976

Rates are based on 1,000 completed pregnancies. Completed pregnancies are those that terminated before the date of interview. This excludes pregnancies in progress at the time of interview.

TABLE 2. FETAL WASTAGE RATE BY USE OF CONTRACEPTION AND AGE OF MOTHER AT TERMINATION OF PREGNANCY

	Use of Contraception During Pregnancy Interval Prior to Conception					
	Yes		No		All	
Age of Mother at Termination of Pregnancy	Number of Pregnancies	Fetal Wastage Rate	Number of Pregnancies	Fetal Wastage Rate	Number of Pregnancies	Fetal Wastage Rate
Less than 20 years	27	74	997	98	1,024	98
20–24	109	248	3,994	78	4,103	83
25–29	254	370	2,957	100	3,211	122
30–34	228	535	1,148	149	1,376	213
35–39	47	638	215	209	262	286
All	663	414	9,313	99	9,976	120

TABLE 3. FETAL WASTAGE RATE IN ABSENCE OF CONTRACEPTION BY AGE OF MOTHER AT TERMINATION OF PREGNANCY AND AT INTERVIEW

	Age at Interview (years)					
Age at Termination of Pregnancy	20–24	25–29	30–34	35–39	All	Number of Pregnancies
Less than 20 years	122	89	91	94	98	997
20–24	95	79	69	80	78	3,994
25–29		110	101	94	100	2,957
30–34			153	147	149	1,148
35–39				209	209	215
All	103	90	94	109	99	
Number of pregnancies	715	2,187	3,121	3,288		9,311

is also higher than the one in its absence; probably in part because of some selectivity on the part of respondents in remembering the miscarriages following the unsuccessful use of contraception, and in part because of some misclassification of induced abortions as spontaneous abortions.

Fetal Wastage Rate and Age of the Mother

When age of the mother is measured at the termination of each pregnancy, the risk of fetal wastage in the absence of contraception is somewhat higher under age 20, minimal from 20 to 24 years and increases monotonically thereafter with advancing age (see Table 2). This trend is consistetnt with the results obtained in other studies.[4] However, following the use of contraception, the risk of fetal wastage is minimum under age 20 and increases monotonically thereafter with advancing age. This deviation in the trend may be the result of a small number of pregnancies following the use of contraception. The age differentials in the fetal wastage rate are probably affected by the memory bias resulting in underreporting of fetal deaths occurring at younger ages to older women.

Memory Bias and the Age Differentials in Wastage Rates

To estimate the magnitude of underreporting and to study age differentials in wastage rates as free from memory bias as possible, total fetal wastage rates in the absence of contraception are presented in Table 3 by age of the mother at the termination of each pregnancy and her age at the interview; that is, at the time of reporting. It is assumed that women aged 35 to 39 at the interview have reported nearly all of their fetal losses occurring between ages 35 and 39. The corresponding assumption is made about the other three age groups: 20 to 24, 25 to 29 and 30 to 34. Hence the rates shown along the diagonal in Table 3 are taken as the "true" level of fetal wastage for ages between 20 and 39 years. No women under 20 were included in the sample; therefore, it can be assumed that the true level of pregnancy wastage for women in the youngest age group is closer to 122, reported by women aged 20 to 24 at the time of interview, than to 98 at ages below 20 years, reported by

all women. Presumably, then, the weighted[5] average of these age-specific rates provides an estimate of overall fetal wastage rate closer to the true level in the whole population. The difference between the estimated level of fetal wastage and the one reported by the respondents gives an estimate of the level of underreporting of fetal loss. However, the estimated rates would tend to underestimate the level of fetal wastage in the past because of improvements in general health conditions of couples during the last few decades. Because of these improvements the differences between the estimated and the reported rates would tend to underestimate the memory bias. At the same time, that bias is also underestimated to the extent that current estimates also fail to include early abortions that are not recognized and thus are not reported by respondents. On the other hand, the bias is exaggerated to the extent that current estimates include a higher level of induced abortions compared to the level in past. This will be so if it is assumed that the level of induced abortions is increasing over time, though no good estimate is available.

Comparisons presented in Table 4 show that, in the absence of

TABLE 4. COMPARISON OF OBSERVED AND ESTIMATED FETAL WASTAGE RATES BY USE OF CONTRACEPTION BY TYPE OF FETAL WASTAGE

Item	Observed Fetal Wastage Rate	Estimated Fetal Wastage Rate	Difference	Difference as Percentage of Observed Fetal Wastage Rate
Spontaneous abortion rate				
Following use of contraceptive	122	130	−8	−7
In absence of contraceptive	72	78	−6	−8
All	75	83	−8	−11
Induced abortion rate				
Following use of contraceptive	292	353	−61	−21
In absence of contraceptive	27	49	−22	−82
All	45	82	−37	−82
Total fetal wastage rate				
Following use of contraceptive	414	483	−69	−17
In absence of contraceptive	99	127	−28	−28
All	120	165	−45	−38

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contraception, the level of fetal wastage in Taiwan is closer to 127 than to 99, yielding an estimated underreporting of 28 fetal wastages per 1,000 completed pregnancies. Following use of contraception, however, about 69 fetal deaths were missed per 1,000 reported pregnancies, probably because of memory bias, resulting in an overall level of underreporting of 45 fetal deaths per 1,000 reported pregnancies. The magnitude of missing induced abortions was much greater than that of spontaneous abortions, which in part could be the result of increasing incidence of induced abortions.

Another way to look at these differentials is to consider the level of underreporting per 100 reported fetal deaths. Results shown in the last column of Table 4 confirm that the level of underreporting induced abortions is higher than that of spontaneous abortions. However, the level of underreporting fetal deaths in the absence of contraception is higher than that following the use of contraception. This confirms the earlier speculation about the process of selectivity on the part of respondents in remembering more fetal deaths following the use of contraception as compared to that in its absence.

TABLE 5. ESTIMATED FETAL WASTAGE RATE RELATIVELY FREE FROM MEMORY BIAS* BY USE OF CONTRACEPTION AND PREGNANCY ORDER

| | Use of Contraception During Pregnancy Interval Prior to Conception | | | | | |
| Pregnancy Order | Yes | | No | | All | |
	Number of Pregnancies	Fetal Wastage Rate	Number of Pregnancies	Fetal Wastage Rate	Number of Pregnancies	Fetal Wastage Rate
1	0	**	452	86	452	86
2	18	**	350	97	368	109
3	31	258	282	81	313	99
4	34	382	276	120	310	148
5	43	512	216	125	259	189
6	35	426	161	199	196	240
7	24	625	109	174	133	256
8 or more	53	679	150	307	203	404
All	238	483	1,996	127	2,234	165

* See text for estimation procedure.
** Base less than 20.

TABLE 6. ESTIMATED FETAL WASTAGE RATE IN ABSENCE OF CONTRACEPTION, BY ORDER OF PREGNANCY AND AGE OF MOTHER AT TERMINATION OF PREGNANCY

Age of Mother at the Termination of Pregnancy

| Pregnancy Order | Less than 30 Years | | 30 Years or More | | All Ages | | Stand-ardized Fetal Wastage Rate* |
	Number of Pregnancies	Fetal Wastage Rate	Number of Pregnancies	Fetal Wastage Rate	Number of Pregnancies	Fetal Wastage Rate	
1-3	1,040	89	44	68	1,084	89	83
4	196	133	80	87	276	120	119
5	100	150	116	103	216	125	136
6 and higher	53	264	367	226	420	231	253
All	1,389	107	607	173	1,996	127	127

* Fetal wastage rates standardized for the age distribution.

FETAL WASTAGE AND PREGNANCY ORDER

For studying the effect of the order of pregnancy on the risk of fetal wastage the fetal wastage rates by pregnancy order are shown in Table 5. These results show that in the absence of contraception the risk of fetal wastage at the first two pregnancies is higher than the risk at the third order pregnancy and increases monotonically thereafter with the order of pregnancy. This trend is consistent with the trend shown in other studies[6] and might be caused in part by the association between wife's age and the pregnancy order.

Fetal Wastage Rate, Pregnancy Order and Age of Mother

Table 6 shows the fetal wastage rates in the absence of contraception by the order of pregnancy and the age of mother at the termination of pregnancy. Because of the small number of cases only two broad age groups are considered and first to third order pregnancies are grouped together and sixth and higher order pregnancies are grouped together. Two features emerge from this table: (1) the fetal death rate increases consistently with the order of pregnancy and (2) the effect of age is mainly the result of its association with the order of pregnancy; its independent effect is not

to incease the level of fetal wastage, but to decrease it. These features are considered separately.

The fetal wastage rate increases by the order of pregnancy for all ages and for the two age groups separately. To eliminate the effect of age, the fetal wastage rates for each pregnancy order are standardized by assuming that the age distribution at each pregnancy order is equal to the overall age distribution. Results, shown in the last column of Table 6, indicate that the relation between fetal wastage and the order of pregnancy is not because of its association with the age of mother.

Row marginal rates show that the overall level of fetal wastage for older women (aged 30 and more) is higher than the level for younger women (under age 30). However, when controlled for pregnancy order, the fetal wastage rates for older women are lower than the rates for younger women at each pregnancy. The overall fetal wastage rate of 108 for older women, standardized for the pregnancy distribution of all women, is lower than the corresponding standardized fetal wastage rate of 139 for younger women. This indicates that the observed difference between fetal wastage rates by age is mainly the result of its association with the order of pregnancy, and the independent effect of age is to decrease instead of increase the fetal wastage rate with advancing age. This is true not only of induced abortion but also of spontaneous abortion rates (see Table 7). The fact that with pregnancy order held constant, wife's age has a negative association with the induced abortion rates indi-

TABLE 7. ESTIMATED* FETAL WASTAGE RATES, IN ABSENCE OF CONTRACEPTION BY AGE OF MOTHER AT TERMINATION OF PREGNANCY AND TYPE OF FETAL WASTAGE

	Estimated		Standardized for Pregnancy Distribution of All Women		
Fetal Wastage Rates	*Under Age 30*	*Age 30 and More*	*Under Age 30*	*Age 30 and More*	*All Ages*
Induced abortions	27	100	56	42	49
Spontaneous abortions	80	73	83	66	78
All pregnancy losses	107	173	139	108	127

* See text for estimation procedure.

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cates that a higher proportion of younger women are using induced abortion as compared to older women with the same number of pregnancies. On the other hand, the negative association between wife's age and spontaneous abortion rate after controlling for the effect of pregnancy order indicates a possibility that the spontaneous abortion rate is higher following the shorter pregnancy intervals among younger women as compared to that following longer pregnancy intervals among older women with the same number of pregnancies.

Comparison with Other Studies

The level of fetal wastage in Western countries is estimated to be between 100 and 200 per 1,000 recognized pregnancies. It is believed now to be closer to 200 than to 100. In two large surveys in the United States, the Indianapolis study and the national GAF study (1955), the fetal wastage level was estimated at close to 130 per 1,000 recognized pregnancies.[7] In both of these surveys the information about pregnancy losses was collected retrospectively and these estimates were also subjected to the memory bias.

In 11 villages in India, Potter, *et al.*, estimated that 136 out of 1,000 pregnancies were terminated by fetal wastage when the data were collected through monthly household visits, whereas the level of wastage rate based on retrospective data was less than a fifth of that determined prospectively.[8] However, the fetal wastage rate based on prospective data is 129 if one considers only women between the ages of 15 and 39 years.

In the above estimates of wastage rates for the United States and India, no distinction was made between induced abortions and spontaneous abortions, and the rate referred to all pregnancies following the use or nonuse of contraception. Compared to these rates, the overall reported wastage rate of 120 in the present sample is not grossly underestimated. The wastage rate of 165 with adjustment for memory bias among Taiwanese women is quite close to the 200 mark believed to be true in Western countries. Even considering only pregnancies in the absence of contraception, the adjusted rate of 127 is not far below the one reported for India in a

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prospective study. However, if induced abortions are excluded, then the adjusted wastage rate for Taiwanese women is 83. This means that the level of spontaneous abortions among Taiwanese women is far below the levels reported for women in the United States and in India, assuming that the level of induced abortions in these two countries is below the estimated level of induced abortions in Taiwan.

REFERENCES

[1] Recall lapses regarding retrospective demographic events are known to occur, especially when the events refer to loss of a child or pregnancy losses. For example, *see* Som, R. K., "On Recall Lapses in Demographic Studies, *International Population Conference* Vienna, 1959, pp. 50–61.

[2] For a detailed description of the Taichung survey refer to Jain, A. K., *Fecundity Components in Taiwan: Application of a Stochastic Model of Human Reproduction,* unpublished Ph.D. dissertation, University of Michigan, 1968, Chapter II. Also Freedman, R. and Takeshita, J. Y., FAMILY PLANNING IN TAIWAN: TRADITION AND CHANGE, to be published by Princeton University Press, Appendix I-3.

[3] Shapiro, S. E., Jones, W. and Densen, P. M., A Life Table of Pregnancy Termination and Correlates of Fetal Losses, *Milbank Memorial Fund Quarterly,* 40, 7–45, January, 1962; Potter, R. G., Wyon, J. B., New, M. and Gordon, J. E., Fetal Wastage in Eleven Punjab Villages *Human Biology,* 37, 262–273, September, 1965; Freedman, R., Coombs, L. C. and Friedman, J., Social Correlates of Fetal Mortality, *Milbank Memorial Fund Quarterly,* 44, 327–344, July, 1966.

[4] *Ibid.*

[5] Here weights are the number of pregnancies on which the five age-specific rates under consideration are based.

[6] Shapiro, *et al., op. cit.;* Potter, *et al., op. cit.;* Freedman, *et al., op. cit.*

[7] Freedman, R., Whelpton, P. K. and Campbell, A. A., FAMILY PLANNING, STERILITY AND POPULATION GROWTH, New York, McGraw Hill Book Co., 1959, pp. 31–35; Whelpton, P. K. and Kiser, C. V. (Editors), SOCIAL AND PSYCHOLOGICAL FACTORS AFFECTING FERTILITY, Volume 2, New York, *Milbank Memorial Fund,* 1950, p. 312.

[8] Potter, *et al., op. cit.,* p. 264.

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