Fertility and Contraception in Puerto Rico[1]

By GILBERT W. BEEBE and JOSÉ S. BELAVAL

From the National Committee on Maternal Health, New York City, and the Department of Clinical Medicine, School of Tropical Medicine, San Juan, Puerto Rico

INTRODUCTION

PUERTO RICO provides a partial test of the Malthusian population theory, and in its race against the predictions of the gloomy prophet the Island appears to be losing ground. Its roughly thirty-four hundred square miles of territory now support a population of about one million, eight hundred and seventy thousand,[2] virtually twice its 1899 population of 950,000. Rapid population growth is not new in Puerto Rico; part of its long history is given in Figure 1, showing how little the rate of increase has slackened in the course of more than a century and a half. Twelve and a half times as thickly populated as the continental United States, its density compares with that of Japan and the heavily industrialized British Isles and threatens, if unchecked in its advance, to approach that of Java, one of the most crowded agricultural areas in the world.

Populations of the Western Hemisphere generally have increased rapidly without attaining the density of the older regions of the globe;[3] public opinion in the United States is so accustomed to continued growth that concern is frequently expressed as the curve of the continental population begins to level off. In Puerto Rico, on the other hand, few desire to maintain the traditional rate of growth which now threatens economic welfare; there is general agreement on the existence of a "population problem." Puerto Rico has an agricultural economy. Further crowding increases the pressure upon the land itself, and the available arable land now averages less than half an acre per person. Soil erosion is already serious in the acreage under cultivation.[4]

A population study which is not part of a comprehensive social and economic analysis needs especially to attain perspective upon the significance of population in comparison with other factors in an economy. A "population problem" is a complex function of tech-

1. Received for publication August 14, 1941.

2. United States Census Release, August 16, 1940.

3. R. Pearl, "A Comparative Examination of Certain Aspects of the Populations of the New World," *Human Biology*, XII (1940), 359.

4. U. S. Department of Agriculture, *Report of the Puerto Rico Experiment Station, 1937* (Washington: U. S. Government Printing Office, 1938).

nology, resources, and economic organization as well as a function of numbers of people. It is not the population phenomena *per se* which create the problem, but rather their coexistence with a particular set of social and economic (including technological) circumstances. A region may be termed overpopulated only in terms of its economic underpinning, but criteria have not been developed

POPULATION GROWTH IN PUERTO RICO
1765–1940

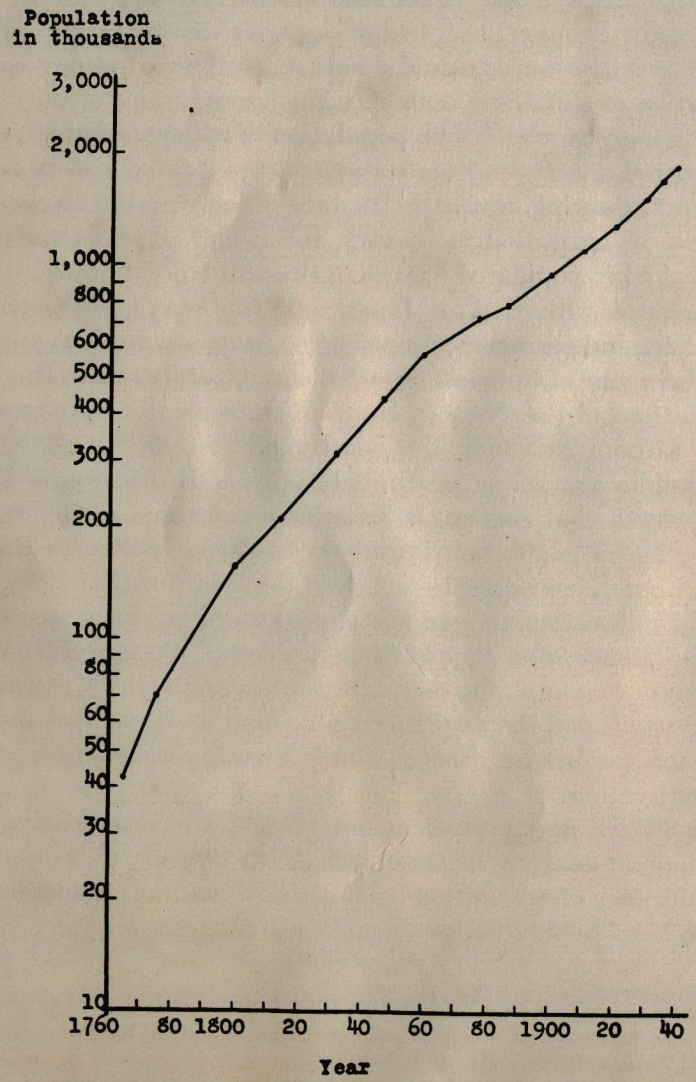

FIGURE 1

for estimating optimum size for a given economic base. In general, standards of living are less sensitive to changes in population than to changes in technology and in the organization of the means of production, but there are complex interrelations among all these factors.

Overpopulation is by no means the only cause of economic distress in Puerto Rico. There is a residual economic problem of long standing, one which may be accentuated by the inclusion of the Island within the larger economy of the United States, especially under the existing political and economic arrangement. Except for wages, its price level is that of the continent, maintained by high protective tariffs and transportation costs. Wages, on the other hand, are but a fraction of wages in the United States. Dependent upon the outside world for its food and manufactured goods, Puerto Rico offers in return its principal crops, sugar, tobacco, coffee, and fruits. Unable to compete in the world markets, it finds the demand for its products in the United States limited by the sugar quota, consumer preferences, and high transportation costs. Industrialization from within offers little hope, for there are few resources to attract manufacturing enterprise, labor is unskilled, and capital visualizes no gain.

Even if it were possible to stabilize the population at about the present level, the essential economic problem would remain. Further worsening of economic conditions would be avoided, but no great betterment could come from stabilization alone. It would not sensibly increase the marginal productivity of labor, without which no great gain would result. From the standpoint of social engineering, significant economic changes are required if opportunity is to be created; educational awakening is imperative if opportunity is to be seized, and a stabilized population is essential if gains are to be held. To expect birth control to substitute for economic reform is to mistake the character of the problem posed by substandard living conditions. Birth control is a palliative rather than a therapeutic instrument of public policy.

No ready means can be proposed for stabilizing population growth in Puerto Rico. There is little prospect that migration and fertility reduction can do more than alleviate[5] the mounting population pressure. Migration to the states is limited by the presence of other vulnerable spots in the larger economy, other areas of high fertility,

5. For a brief recent discussion of birth control and migration from this point of view, see L. R. Chenault. *The Puerto Rican Migrant in New York City* (New York: Columbia University Press, 1938).

poor or insufficient resources, and low economic opportunity. These areas already contribute a large excess of unskilled labor. Fertility reduction requires deliberate and voluntary resort to contraception. In Western culture, where it has been most extensively practiced, birth control serves individual and family ambitions for superior standards of living. It tends to follow, rather than precede, improved living conditions. The social and economic milieu of Puerto Rico is not characterized by that high degree of mobility and competition for status which tends to develop the small family system. Its depressed economic condition invites skepticism of the possibility of effective family limitation designed to secure greater economic advantage and, doubtless, its greatest impetus would come from improved economic conditions themselves.

In 1937 there was established in Puerto Rico a contraceptive service[6] which provides data pertinent to the population problem at important points. First, detailed study of the reproductive histories of low-income families, admitted to the service, throws considerable light upon the basis of the present high fertility of the island population as well as upon the likelihood of its continuance. Second, the experience of these families, after admission to the contraceptive service, shows the impact of the service upon their fertility, testing the view that Puerto Rico might respond to an organized birth control effort. Finally, intensive analysis shows why the service was no more effective than it was and suggests many implications for the conduct of future contraceptive services on the Island, whether the objective be therapeutic contraception or general fertility reduction.

DESCRIPTION OF SAMPLE

The present sample of 1,962 families was not chosen in a random fashion, the two major points in its selection being indigence and interest in contraceptive advice. The social and economic aspects of its selection can be offset, in large part, by the presentation of results for social and economic groupings, but no comparable allowance can be made for the interest shown in contraception. Other studies[7] have shown that selection for interest in contraception draws

6. Under the auspices of the *Asociación pro Salud Maternal e Infantil de Puerto Rico.*

7. E. Charles, *The Practice of Birth Control* (London: Williams & Norgate, 1932).
R. K. Stix and F. W. Notestein, *Controlled Fertility* (Baltimore: Williams & Wilkins, 1940).
G. W. Beebe, "Differential Fertility by Color for Coal Miners in Logan County, West Virginia," *Milbank Memorial Fund Quarterly*, XIX (1941), 189.

a sample of unusually high fertility, and this expectation is borne out by the present sample. Plainly, therefore, conclusions about the general population must be tentative. Considered as a sample of that portion of the general population which desires contraceptive aid, the 1,962 families are doubtless somewhat more representative, but there is no basis for a statistical test of this belief.

The composition of the sample is summarized in Table 1. The families are mainly rural,[8] but the size of the urban portion approximates very closely that of the entire population and is sufficient for rural-urban comparisons. The patients represent the admissions of fifteen clinics, four of which were located in the urban centers of Caguas, Humacao, Lares, and San Juan. Two were situated on sugar centrals, the Central Ejemplo in Humacao and the Central Roig in Yabucoa. The remaining nine were in the following rural *barrios*, the second name in each set being that of the municipality of which the *barrio* is a part: Almirante Sur in Vega Baja; Buena Vista in Bayamón; Magueyes in Barceloneta; Medianía Alta in Loiza; Montellano in Morovis; Quebrada Arenas in Toa Alta; Río Cañas in Caguas; Sábana Seca in Toa Baja, and Turabo in Caguas.

The education of the wife varied widely, from 20 percent without formal schooling to 2.5 percent who had entered college, and averaged 5.15 completed grades. In coding the occupation of the husband, the Edwards code[9] was reduced from six to three categories; farm owners and tenants were not classified with proprietors and managers. In the first, or white-collar group, were placed all professional persons, proprietors (except farm owners), managers (except farm tenants), officials, clerks, and kindred workers. The second, or skilled group, includes foremen, skilled workers, semiskilled workers, and farm owners and tenants with an income of six dollars or more per week. In the third rubric are the unskilled workers, including agricultural laborers and small farm owners or tenants with weekly incomes below six dollars. The percentages in these groups are 13, 32, and 55 in the above order.

The employment status of the husband was recorded at the time of enlistment, mainly during the calendar year 1937, when 17 percent were unemployed. Total family income was obtained on a

8. Rural families are those dwelling in rural *barrios*, and urban families, those in villages, towns, cities, or in Hato Rey. Almost three fourths of the urban families lived in San Juan or in Humacao.

9. A. M. Edwards, *A Social-economic Grouping of the Gainful Workers of the United States* (Washington: U. S. Government Printing Office, 1938).

TABLE 1

Summary of Descriptive Statistics for 1,962 Families Given Contraceptive Instruction

Characteristic[a]	*Mean*[b] *or Percent*
Residence	
Rural	68
Urban	32
Social and economic characteristics	
Completed grades of schooling, wife	5.15 (± .07)
Occupation of husband	
Mainly clerical workers	13
Skilled workers and larger farmers	32
Unskilled workers and smaller farmers	55
Employment status of husband	
Employed	83
Unemployed	17
Weekly family income,[c] in dollars	7.8 (± .18)
Age at enlistment[d]	
Wife	28.2 (± .14)
Husband	34.1 (± .19)

[a] See text for definitions.

[b] Means are stated as plus and minus one standard error. $\left(\bar{X} \pm \sigma_{\bar{X}}\right)$

[c] The median income of $5.2 ± .23 is a more representative average and may be compared with $4.9 computed from the data of Morales Otero *et al* (P. Morales Otero *et al*, "Health and Socio-economic Studies in Puerto Rico," *P.R. J. Pub. Health & Trop. Med.*, XII [1937], 405), for 745 families living at Central Lafayette, when it was acquired by the Puerto Rico Relief Administration.

[d] Age is stated to the nearest year.

weekly basis and could not be transformed into monthly or yearly estimates without more accurate employment statistics. The largest single class is that reporting an income of two and a half to three and a half dollars, and the median, or 50 percent point, is $5.2 ± .23.[10]

Brief mention should be made of the outstanding interrelations among the social and economic factors, age, and residence. Superior education is associated with urban residence, favored occupation, high income, and comparative youth. The highest occupational group is predominantly urban in residence, the middle group about evenly divided, and the lowest, mainly rural. Occupation is also

10. The less representative mean, under the pull of the higher values, is $7.8 ± .18.

associated positively with employment status and income, and negatively with age of the wife. Income varies with residence, rural workers having the lower incomes within the same occupational class. While these relationships indicate that families favored in one respect are likely to be favored in others, and that there is a small, relatively homogeneous group at the top of the several social and economic scales, it must not be forgotten that the sample is composed of the relatively indigent and underprivileged. The range of comparative advantage within the sample is far smaller than that of the entire population of Puerto Rico.

TABLE 2

Percentage Distribution of Women by Age at First Marriage

Age[a]	*Percent*	*Age*[a]	*Percent*
9[b]	0.1	26	1.7
10[b]	0.2	27	0.7
11	0.6	28	0.8
12	1.2	29	0.1
13	3.3	30	0.4
14	5.2	31	0.3
15	9.6	32	0.2
16	9.4	33	0.3
17	12.2	34	...
18	12.9	35	0.1
19	11.3	36	[c]
20	8.7	—	...
21	6.8	44	0.1
22	5.4		
23	3.7	Total	100.0
24	3.1	Number of women	1,962
25	1.6		

[a] To the nearest year.

[b] Reports of very early marriage (one for age nine and four for age ten) were rechecked with the patients, but no investigation was made to insure the reliability of their report.

[c] Less than half of one percent.

PATTERNS OF FERTILITY PRIOR TO ENLISTMENT

Within the limits set by its selection, the sample of 1,962 families possesses considerable value for an understanding of the high fertility of the island population. Of possibly even greater interest is the evidence it provides that fertility differentials, similar to those found throughout Western culture, have already set in. The discovery of differentials within a sample drawn principally from the lowest economic and social groups warrants the belief that similar,

if attenuated, patterns apply to the general population. The specific elements chosen for study include age at first marriage, coital frequency, resort to contraception, several measures of fertility, pregnancy wastage, and mortality among children born.

Age of wife at first marriage: The characteristic age at marriage is lower for the sample than similar statistics for the United States as a whole, as would be anticipated. The mean of 18.6 compares with the means of 20 and over reported by Notestein[11] and by Pearl[12] for large numbers of cases in the United States. Early marriage, of course, effectively lengthens the child-bearing period, at an age when the chance of conception is usually optimal. The entire distribution obtained from the sample appears in percentage form in Table 2, age being stated to the nearest year. It is fairly symmetrical about the modal age of 18, and the median age is 18.1. When compared with other contraceptive series in the United States, however, the distribution appears less unusual. For example, the mean of 18.6 exceeds the mean of 18 calculated for more than eleven hundred white wives of West Virginia coal miners[13] and approximates the means of 18.75 found for about four hundred white, rural-farm families in Kentucky[14] and 18.3 obtained for about seven hundred white, indigent patients of a contraceptive clinic in Nashville, Tennessee.[15]

As an estimate for the general population of the Island, the mean of 18.6 may be low, for the effect of selecting younger women tends to exclude some of the women married later in life. However, the bias from this source may not exceed a half year for the mean and is perhaps even less for the median. This objection also affects the interpretation of the observed tendency for the average age at marriage to increase with time, but it may be obviated by restricting attention to women married before the age of twenty. The increase is illustrated by the decreasing proportion of women married before fifteen among all women married before the age of twenty. The percentages are 21, 12, and 4 for women married ten to fourteen

11. F. W. Notestein, "Differential Age at Marriage According to Social Class," *Am.J. Sociol.*, XXXVII (1931), 22.
12. R. Pearl, *The Natural History of Population* (New York: Oxford University Press, 1939).
13. G. W. Beebe, *Fertility and Contraception in the Southern Appalachians* (Baltimore: Williams & Wilkins, 1942).
14. G. W. Beebe and M. A. Geisler, "Control of Conception in a Selected Rural Sample," *Human Biol.*, XIV (1942), 1.
15. G. W. Beebe and J. Overton, "The Contraceptive Service of the Department of Health, City of Nashville," *J.A.M.A.*, CXVIII (1942), 1045.

years, five to nine years, and less than five years, respectively. It cannot be asserted that a change of such magnitude occurred between 1922 and 1937, but it is very likely that a change in this direction took place.

Within the sample, fairly large and statistically significant[16] differentials occur. Rural residence correlates with a somewhat younger age at marriage, 69 percent of the women of rural residence reporting marriage before twenty in contrast to 60 percent of urban residence. Educational attainment is also positively associated with age at marriage, the percentages marrying before twenty being 73 for women of less than three completed grades, 69 for those of three to seven grades, and 48 for women of eight or more grades. Occupation bears a like relationship, for the percentages are 71, 65, and 49 for the unskilled, the skilled, and the white-collar groups. The percentages married before twenty are 69, 69, and 40 for the income classes under six, six to fifteen, and sixteen or more dollars weekly. Study of women married ten years or more before admission to the service shows that differentials of this character have existed for more than ten years.

Frequency of coitus: Although a basic factor in human reproduction, frequency of coitus is not an important source of variation in fertility. When advice was given, each patient reported her average coital frequency as part of a general reproductive history. While it must not be presumed that patients have a highly accurate notion of their usual habit, apart from any distortion which might arise through the desire of the patient to conform to a norm of conduct, the total mass of responses should accurately portray the average coital frequency of the sample. There is also no reason to expect the sample to be unrepresentative of the insular population of comparable age and mode of life.

The average frequency, calculated from the distribution in Table 3, is 2.4 $\pm$ .04 per week and pertains to the period immediately preceding admission. The standard deviation of 1.53 indicates relatively large variation. The mean of the distribution exceeds similar statistics from two series of whites of similar selection in the United States, and is practically identical with the mean for the Negroes in one of these series.

16. A difference is called significant when it is of a magnitude which might be expected to arise through chance five times, or less, in a hundred trials ($P \leq .05$). In the absence of a contrary statement, any difference, association, or other relationship given in the text has been subjected to an appropriate statistical test and found to be significant in this sense.

TABLE 3

Percentage Distribution of Couples According to Average Frequency of Coitus Reported at Admission to the Contraceptive Service

Reported Frequency[a]	*Percent of Couples Reporting*
Less than 4 per month	10.0
1 per week and 4 to 5 per month	15.7
1–2, or 2 per week and 6 to 9 per month	34.6
2–3, or 3 per week and 10 to 13 per month	27.2
3–4, or 4 per week	6.7
4–5, or 5 per week	1.8
5–6, or 6 per week	0.6
7 to 10 per week, or 1 daily	3.2
11 or more per week, or more than 1 per day	0.2
Total	100.0
Number of couples	1,962

[a] The mean of 2.4 per week was computed by taking as the midpoints the values 0.5, 1, 2, 3, 4, 5, 6, 8, 12 per week.

Prior contraceptive practice: Recent studies[17] have shown the prime factor in differential fertility to be contraceptive practice and, manifestly,[18] the great fertility decline which has swept the Western world in recent decades stems from the practice of such humble methods of birth control as withdrawal, douche, and condom. Opinion may differ as to the power of an organized contraceptive program to reduce fertility in Puerto Rico, but whatever the population itself does about family limitation will certainly have tremendous significance for population growth on the Island. The contraceptive histories of the 1,962 families can be no more than suggestive of the nature and extent of the birth control endeavor of the larger population, but they imply that birth control is already setting in and that, among some groups, it has already made considerable headway.

A third of the couples reported some previous effort at contraception. This compares with 32 percent for the West Virginia Negro

17. Stix and Notestein, *op. cit.*
R. Pearl, *The Natural History of Population* (New York: Oxford University Press, 1939).
18. *Ibid.*
G. Myrdal, *Population* (Cambridge: Harvard University Press, 1940).
Swedish Population Commission, *Report on the Sex Question*, translated by V. C. Hamilton (Baltimore: Williams & Wilkins, 1940).
N. E. Himes, *Medical History of Contraception* (Baltimore: Williams & Wilkins, 1936).

miners, 39 percent for the Kentucky white farmers, 50 percent for the West Virginia white miners, and 65 percent for the Nashville whites of low social and economic status. If Puerto Rico now stands on the threshold of a fertility decline, then one would expect to find a trend toward family limitation led by the relatively privileged groups within the population. Should the trend reach well down into the various social and economic strata of the population, one would conclude that the stage was set. It is just this picture which the sample gives, but which cannot be attributed in full force to the general population because of the way in which the sample was obtained.

Residence, education, occupation, and income are all associated with marked variation in the proportions who reported contraceptive experience. The percentages are 26 and 52 for rural and urban residence, and 21, 27, 44, and 59 for the educational groupings with less than three, three or four, five to seven, and eight or more completed grades. For the low, medium, and high occupational groups, the percentages are 20, 45, and 69, and for the corresponding income classes they are 22, 42, and 66. There is also a marked age trend, especially within the favored groups, women of twenty-five to twenty-nine and thirty to thirty-four reporting contraceptive practice with much greater relative frequency than younger women.

TABLE 4

Distribution of Contraceptive Patients According to Methods of Contraception Practiced Prior to Enlistment

Contraceptive Practice	*Number of Women*	*Percent of Women Reporting*	*Percent of Contraceptors*
Unknown	54		
Contraception never used	1,256	66	
Contraception ever used	652	34	100
Total	1,962	100	
Contraceptors, by Method			
Withdrawal only	301	16	46
Condom only	112	6	17
Douche only	37	2	6
Other methods, used alone	59	3	9
More than one method, including either withdrawal, condom, or douche	140	7	22
More than one method, other	3	[a]	[a]

[a] Less than half of one percent.

The contraceptive history of each patient specified the methods employed, the regularity of their use, and the number of years contraception had been practiced. Table 4, giving the distribution of the entire series according to methods employed, testifies to the relative importance of withdrawal, condom, and douche, for about 90 percent of the contraceptors reported these methods. While this gross finding checks with expectation, the relative emphasis upon the douche is unusually slight. From the dual standpoint of the economic realities and the effectiveness of the three methods, neglect of the douche in favor of withdrawal is both understandable and fortunate. Withdrawal, a "no-cost" good in the economic sense, can be effective under favorable conditions of use, but such cannot be assumed for this population. The relatively expensive condom provides a degree of protection equal to anything the physician can prescribe.[19] Entirely apart from the issue of government-sponsored contraceptive service, any measure which facilitated the distribution of low-priced condoms would probably implement fertility decline, especially for families like those studied here. The present interest in, and funds for, venereal disease prevention, if partly canalized into the dispensing of condoms at no cost, suggest interesting possibilities for added fertility control.

Although the physician or nurse queried each contraceptor about the regularity of her contraceptive practice, no great confidence can be placed in the finding that about 75 percent alleged regular use. She was also asked how long she had practiced contraception, and the necessarily approximate answers distribute themselves as follows: 29 percent reported use occasionally, or for less than six months; 40 percent for one or two years; 18 percent for three or four years; 7 percent for five or six years; and 6 percent for seven or more years.

Judged by continental standards, contraceptive endeavor of this order is unimpressive but entirely consistent with population growth and fertility on the Island. Seen as evidence of the beginning of a trend toward family limitation, however, it possesses considerable significance despite the difficulty of arguing from the sample to the universe. That differentials penetrate so deeply into the social structure as to be uncovered by the present sample seems good evidence that family limitation has already begun in Puerto Rico. On the other hand, the fact that a sample selected for contraceptive interest should report so little previous contraceptive practice does

19. R. L. Dickinson, *Control of Conception* (2d ed.; Baltimore: Williams and Wilkins, 1938)

not encourage belief in the imminence of a spontaneous and precipitous fertility decline; rather it suggests that decades may pass before population control is assured. Those concerned over the population problem, therefore, have little choice but to recommend all reasonable means for encouraging birth control among the population at large.

The chance of conception: From the statistical standpoint, the best measure for gauging the chance of conception is a pregnancy rate of the form,

$$R = \frac{\textit{the number of conceptions}}{\textit{the number of months of exposure}}$$

where a month of exposure is a chronological month in a reproductive history and in which conception would have been possible.[20] The concept of exposure originated with Pearl,[21] and provides a more satisfactory unit of risk than was previously available. From elapsed time are deducted the months of gestation, abstinence, and the like, during which conception cannot occur, and the remainder is designated as the exposure. Discussions of the estimation of the chance of conception appear in a paper by Pearl[22] and in an appendix to the report[23] on the West Virginia study.

The contraceptive histories permitted[24] estimation of the number of months of exposure to the risk of conception, and pregnancy rates have been computed for groups of women by summing their aggregate exposure and pregnancies and expressing the result as

$$\textit{Pregnancy rate} = \frac{\textit{total number of conceptions}}{\textit{total exposure-months}} \times 1{,}200$$

The factor, 1,200, merely removes decimals and transforms the rate from a per-month to a per-100-woman-year basis. Table 5 presents

20. A logically superior device, preferred by Pearl ("Contraception and Fertility in 4,945 Married Women," *Human Biol.*, VI [1934], 355), is the expression,

$$R = \frac{\textit{the number of ova fertilized}}{\textit{the number of ova available for fertilization}}$$

but clinical studies of the present type can, at best, infer the number of ova from the months of exposure and the transformation adds nothing of practical value.

21. R. Pearl, "Contraception and Fertility in 2,000 Women," *Human Biol.*, IV (1932), 363.

22. R. Pearl, "Factors in Human Fertility and Their Statistical Evaluation," *Lancet*, II (1933) 607.

23. G. W. Beebe, *Fertility and Contraception in the Southern Appalachians* (Baltimore: Williams & Wilkins, 1942).

24. For one reason or another, 4 percent of the histories were incomplete for this purpose.

the pregnancy rates per 100 woman-years of exposure for women of specified duration of marriage at enlistment and according to whether or not contraception was ever practiced. These rates differ from others in the literature,[25] in that the rate for any duration of marriage interval, e.g., 15-19, represents all the experience inter-

TABLE 5

Chance of Conception before Enlistment by Duration of Marriage[a] and Contraceptive Practice

Duration of Marriage in Years	*Number of Women*	*Months of Exposure*	*Number of Pregnancies*	*Pregnancy Rate[b]*
A: *All Women*				
0–4	443	6,832	837	147
5–9	550	24,814	2,198	106
10–14	467	37,914	2,884	91
15–19	272	32,097	2,353	88
20–24	122	18,373	1,305	85
25 and over	29	5,611	358	77
Total	1,883	125,641	9,935	95
B: *Contraceptors*				
0–4	137	2,575	248	116
5–9	197	9,494	788	100
10–14	181	15,740	1,042	79
15–19	89	10,778	720	80
20–24	32	5,029	317	76
25 and over	8	1,672	94	67
Total	644	45,288	3,209	85
C: *Noncontraceptors*				
0–4	306	4,257	589	166
5–9	353	15,320	1,410	110
10–14	286	22,174	1,842	100
15–19	183	21,319	1,633	92
20–24	90	13,344	988	89
25 and over	21	3,939	264	80
Total	1,239	80,353	6,726	100

[a] The experience is not specific by duration of marriage. On any line the exposure and pregnancies are all those which occurred between marriage and admission to the service.

[b] Pregnancies per 100 woman-years of exposure to the chance of conception. $R = 1{,}200 \times$ *pregnancies/months of exposure.*

25. Stix and Notestein, *op. cit.*
G. W. Beebe, *Fertility and Contraception in the Southern Appalachians* (Baltimore: Williams & Wilkins, 1942).
Beebe and Geisler, *op. cit.*

vening between marriage and admission to the contraceptive service. Thus they are not specific by duration of marriage and do not represent the risk of women while in each interval. Specific rates would be uniformly lower than those of Table 5,[26] but the totals would be unchanged. The usual duration of marriage trend is evident. Initially high rates, pulled up by the high risk of first conception, fall off rapidly as lactation and amenorrhea enter the exposure[27] and as contraception, pathology, and other factors come into operation. The total rate of 95 may be contrasted with the significantly lower rates of 81 for West Virginia white miners, 85 for the West Virginia Negro miners, 66 for the Kentucky white farmers, 66 for Philadelphia white patients advised in contraception,[28] and 73 for the mainly rural-farm white contraceptive patients of a hospital in Tennessee.[29] Such a significant excess need not mean that the uncontrolled fertility of the Puerto Rican sample is uniquely high, and it probably reflects merely the lesser effort at conception control. The total risk is about 17 percent higher than that of the West Virginia whites, the most nearly comparable large series.

A more pointed comparison restricts attention to the noncontraceptors. The rates for the West Virginia whites and Negroes are 94 and 91, below the 100 obtained for the Puerto Rico sample. Roughly analogous rates from other series are 78 for the Kentucky farmers, 85 for the Tennessee farmers, 83 for South Carolina whites,[30] 99 for the Philadelphia series, 92 for the South Carolina Negroes,[31] 114 for Cincinnati whites,[32] and 168 for New York whites.[33] The last series is especially influenced by high first pregnancy rates and probably represents a more highly fecund stratum of the population than do most contraceptive series. Viewed in the light of such re-

26. None of the simpler interpolation procedures gave impressive results, and hence the data are presented in cumulative form.

27. Some refinement in analysis results if months of postpartum lactation and amenorrhea are omitted from exposure, in view of the very low chance of conception at this time, but it was neither possible nor practically important to attempt this correction. See G. W. Beebe, *Fertility and Contraception in the Southern Appalachians* (Baltimore: Williams & Wilkins, 1942); R. K. Stix, "Factors Underlying Individual and Group Differences in Uncontrolled Fertility," *Milbank Memorial Fund Quarterly*, XVIII (1940), 239.

28. G. W. Beebe and C. J. Gamble, "Clinical Contraceptive Results in a Small Series of Patients," *J.A.M.A.*, CXV (1940), 1451.

29. M. A. Geisler, "A Small Jelly Alone Series in Rural Tennessee" (unpublished).

30. R. K. Stix, "Contraceptive Service in Three Areas," *Milbank Memorial Fund Quarterly*, XIX (1941), 171.

31. *Ibid.*

32. *Ibid.*

33. Stix and Notestein, *op. cit.*

sults, the uncontrolled fertility of the Puerto Rican sample is in no way exceptional.

The differences between the rates for contraceptors and those for noncontraceptors, while highly reliable statistically, may seem small. The rates for contraceptors do not give the chance of conception while contraception was practiced, but during the entire marital experience of women who ever resorted to contraception. Rates for the purely contraceptive portion of their experience would be of the order of 50 to 60 pregnancies per 100 woman-years of exposure, if the experience of the West Virginia miners is a reliable guide. While a risk of this magnitude is far from satisfactory in the eyes of the clinician giving advice for medical contraindications to pregnancy, it would have tremendous population significance if contraception were extensive. A rate comparable to the 85 calculated for the contraceptors of the Puerto Rican sample, but more influenced by contraception, is 76 pregnancies per 100 woman-years of exposure computed for contraceptors among the West Virginia whites.

The noncontraceptors were subdivided by residence, education, occupation, and income, but no significant variation was observed. This agreement with Pearl's hypothesis[34] of homogeneity among social and economic classes with respect to innate fecundity does not mean, of course, that it is not possible by appropriate procedures, deliberately or unwittingly, to select groups of women of probably exceptional fecundity. In view of the probable similarity of social and economic classes in their innate fecundity, some function of which is studied here[35] in the form of the chance of conception among noncontraceptors, differences among groups of contraceptors may reasonably be attributed to either more extensive or more efficient contraceptive endeavor, or both. Contraceptive efficiency, in turn, depends not only upon the methods and materials employed, but also upon their mode of use. The contraceptors who alleged regular use, however long precautions were taken, have a pregnancy rate of 82, while all others have a rate of 94. The difference, which is statistically significant, is almost as large as that between contraceptors and noncontraceptors and is of the same nature. Since about a fourth of the contraceptors fell into the irregular or sporadic use

34. R. Pearl, "Contraception and Fertility in 4,945 Married Women," *Human Biol.*, VI (1934), 355.

35. By which the authors mean that the effect of innate fecundity is modified by human behavior and by acquired pathology, and that only the resultant of a complex system of forces is open to direct observation

class, it is clear that the distribution of their experience among the various social and economic classes constitutes one source of variation in risk. Similarly, division of the contraceptors into women who reported five or more and less than five years of contraceptive endeavor results in pregnancy rates of 66 and 99. Since the lower rate represents over 40 percent of the total experience of the contraceptors, variation in the length of contraceptive practice among social and economic classes also would tend to produce variation in the chance of conception.

These results, together with the previous evidence of differences in resort to contraception, help to explain why marked differences are to be found in the rates for contraceptors of different social and economic classes. The rates are 89 and 80 for rural and urban residence, and 93, 88, and 72 for low, medium, and high education. For the three occupational classes they are 94, 86, and 73, and for the three income classes 97, 83, and 70. Although these differences testify in striking fashion to the permeation of family limitation, it will be noted that the highest rate in each set is rather close to the rate of 100 for noncontraceptors. This shows that no appreciable fertility reduction occurs among families where the wife has less than three years of schooling, or where the husband is unskilled, or is a small farm owner or tenant with a weekly income under six dollars, or where the weekly income is below five dollars. It also shows that, even among the economically most favored classes, the fertility decline is not well advanced. Again the data support the view that contraception is beginning to reach down into the bulk of the population but that large changes in fertility cannot be expected from contraceptive efforts of the character and extent revealed by the analysis.

Pregnancy wastage: Pregnancy wastage, or the failure of conceptions to terminate in live birth, increasingly commands attention, not only as a factor in maternal mortality and morbidity, but also for its influence upon population growth, especially in cosmopolitan centers. Pregnancy termination constitutes an essential part of the reproductive histories of the 1,962 patients given contraceptive advice. Such observations, obtained verbally at admission, are open to criticism.[36] Women do not always know whether or not they have been pregnant, or whether or not the expulsion of a previable ovum

36. V. C. Hamilton, "Some Sociologic and Psychologic Observations on Abortion," *Am. J. Obst. & Gynec.*, XXXIX (1940), 919.

may be attributed to interference.[37] On the other hand, it is generally accepted that the rapport established between patient and physician, or between patient and nurse, when contraceptive advice is given, probably minimizes conscious distortion of the facts by the patient.

Study of the more than ten thousand reported conceptions reveals that 15.3 percent were wasted, 7.7 percent in spontaneous abortion, 4.8 in stillbirth, and 2.8 percent in induced abortion. Primarily because of the low incidence of induced abortion, the total wastage is less than in many other series.[38]

Differentials in total wastage within the sample correlate inversely with the observed differentials in the chance of conception. The percentages for total wastage are 13.6 and 19.9 for rural and urban residence, and 13.7, 15.5, and 20.2 for low, medium, and high education. The three occupational groups have percentages of 14.1, 15.6, and 21.7, and the three income groups, of 13.9, 16.1, and 23.1. The pattern of induced abortion follows very closely that of total wastage. The percentages are 1.0, 2.7, and 9.4 by education, 1.1, 3.9, and 10 by occupation, and 1.2, 3.5, and 11.9 by income. Stix and Wiehl[39] have also found a positive association between income and frequency of induced abortion, but Pearl did not observe this result in his large series.[40] That induced abortion should govern wastage and correlate with interest in and practice of contraception is to be expected from the fact that contraception and induced abortion minister to the same needs. Only sound health education can effectively separate them in the public mind.

Of greater numerial importance than induced abortion in this series, stillbirth is less variable and follows a reversed pattern among social and economic subgroups. The percentages are 5.3 and 3.6 for rural and urban residence; 5.4, 4.7, and 3.3 for low, medium, and

37. Alleged drug abortions were disregarded in coding, and histories which recorded more than two induced abortions were referred back to the nurse or physician for verification.

38. Stix and Notestein, *op. cit.*

G. W. Beebe, *Fertility and Contraception in the Southern Appalachians* (Baltimore: Williams & Wilkins, 1942).

Beebe and Geisler, *op. cit.*

Geisler, *op. cit.*

R. K. Stix and D. G. Wiehl, "Abortion and the Public Health," *Am. J. Pub. Health*, XXVIII (1938), 621.

R. Pearl, "Fertility and Contraception in New York and Chicago," *J.A.M.A.*, CVIII (1937), 1385.

D. G. Wiehl, "A Summary of Data on Reported Incidence of Abortion," *Milbank Memorial Fund Quarterly*, XVI (1938), 80.

39. Stix and Wiehl, *op. cit.*

40. R. Pearl, *The Natural History of Population* (New York: Oxford University Press, 1939).

high education; 5.4, 4, and 2.4 for the occupational groups; and 5.6, 3.9, and 2.4 for the three income groups. These differences doubtless reflect the substandard health and living conditions of the poorer groups within the sample.

Mortality among children: Despite the comparative youth of the population of Puerto Rico, its crude death rate is more than 50 percent higher than that of the United States. In part this difference stems from the health hazards faced by infants and children.[41] The 1,962 families reported on the number of children lost through death, and Table 6 gives the percentage lost by women of various lengths

TABLE 6

Percentage Mortality Among Children, by Duration of Marriage of Mother When Contraceptive Advice Was Received, with Comparative Data for West Virginia Whites

Duration of Marriage in Years	*Puerto Rican Series*			*West Virginia White Miners Percent Deceased*
	Number of Women	*Children Born Alive*	*Percent Deceased*	
0–4	470	713	8.0	5.7
5–9	571	1,901	13.5	8.7
10–14	477	2,508	14.5	13.8
15–19	284	2,031	16.2	14.6
20 and over	155	1,456	18.7	15.9
Total	1,957	8,609	14.9	12.1

of marriage at admission. In all, about 15 percent of the children born alive were no longer alive when contraceptive advice was given the mother. A loss of this magnitude is about 20 percent above that observed for the West Virginia white miners, a summary of whose experience also appears in Table 6.

Large variations in mortality are evident when the families are classified by education, occupation, and income. The percentage mortality is 19, 13, and 8 among the low-, medium-, and high-education groups; 17, 13, and 8 among the occupational groups; and 16, 13, and 10 among the three income classes. Residence is a significant factor only within the lowest income group, the urban mortality of

41. The 1939 crude death rates are 10.6 and 17.7. Diseases taking an especially heavy toll of Puerto Rican infants and children are diarrhea and enteritis, malaria, syphilis, nephritis, and tuberculosis (U. S. Bureau of the Census, Vital Statistics, Special Reports: *Puerto Rico, Summary of Vital Statistics, 1939;* and *U. S. Summary of Vital Statistics, 1939*, Part I [Washington: U. S. Government Printing Office, 1941]).

20 percent being reliably above the 14 percent for rural families. The direction of the differentials points to a considerably higher risk of mortality among children born into families in poorer circumstances, the excess approaching 100 percent in relation to the most favored segments of the sample.

Children under five years of age: It has been stated above that the fertility of the sample is higher than that of the general population, but no estimate of the size of the differential has been given. Among the available fertility indices, the number of children under five per married woman permits the best comparison with official statistics on the fertility of the island population. From the average number of children under five in the sample, estimates were made of the number which the 1935 population would have included if children under five had been as frequent in the general population as they

TABLE 7

Children under Five per Wife, by Age of Wife, for Two Contraceptive Samples and for the Populations Sampled

Age of Wife, in Years	Sample Values: Puerto Rico, by Residence — Rural: Number of Women	Rural: Children per Wife	Urban: Number of Women	Urban: Children per Wife	Total: Number of Women	Total: Children per Wife	West Virginia Whites, Rural Non-Farm: Number of Women	West Virginia Whites, Rural Non-Farm: Children per Wife
15–19	41	1.27	38	1.29	79	1.28	126	1.35
20–24	381	1.91	180	1.79	561	1.87	343	1.88
25–29	323	2.11	177	1.82	500	2.01	335	2.04
30–34	262	2.04	111	1.60	373	1.91	213	1.83
35–39	219	1.79	80	1.38	299	1.68	109	1.76
40 and over	58	1.34	23	1.22	81	1.31	38	1.32
Total	1,284	1.92	609	1.66	1,893	1.84	1,164	1.83
	Population Values[a]							
Observed[b]	1.25		.87		1.12		.92	
Expected[c]	1.87		1.59		1.77		1.78	
Difference as a percent of observed	50		84		59		93	

[a] The West Virginia population is that of native white married women of rural-nonfarm residence in 1930.

[b] From Census data. (U. S. Bureau of the Census, *Fifteenth Census of the U. S., Population*, Vol. III, Part II, and unpublished tabulations of the Bureau; U. S. Puerto Rican Reconstruction Administration, *Census of Puerto Rico, 1935, Population* [Washington: Government Printing Office, 1937]).

[c] If the population had conformed to the contraceptive sample with respect to the relative frequency of children under five years of age.

were in the sample.[42] The number expected, on this basis, exceeds by 60 percent the number reported by the Census for that year. From this result the fertility of the sample may be taken as roughly 60 percent above that of the general population.

Table 7 gives the observed age-specific rates for the sample according to residence, together with expected values for the insular population. Comparison may be made with similar statistics for the West Virginia sample and the population from which it was drawn. It will be seen that the rural and urban groups differ in the degree to which they fail to represent the average fertility of their respective populations, the urban group being the less representative with an excess of more than 80 percent. Another manifestation of the same process is the large discrepancy between the two West Virginia values.

This finding bears directly upon the problem of inferring patterns for Puerto Rico from those found in the contraceptive sample. The previous discussion has assumed that selection for fertility and contraceptive interest should draw a sample with differentials in fertility and in resort to contraception which might be more marked than those existing in the general population, but that the effect of the selection for low social and economic status should partly offset this. In other words, it was argued that to find differentials imbedded in a sample drawn from the lowest socio-economic strata showed that somewhat similar differentials pervaded the general population. That the urban sample is even less representative than the rural sample with respect to fertility confirms this position by showing that the sample gives too little weight to the low-fertility segment of the urban population, within which differentials are more marked. The fertility comparison between sample and population, therefore, gives additional reason for paying serious attention to the patterns emerging from the analysis of the contraceptive sample.

Family size: A final index, giving the net result of all the various reproductive trends within the sample, is the average size of family. Estimates of family size have been obtained by adding two persons to the average number of children alive at enlistment. Table 8 presents such averages for the entire sample classified by duration of marriage. The mean is 5.74 persons per family, very similar to the mean of 5.64 found for the West Virginia white miners. The steady

42. Age-specific averages of children under five per woman were obtained from the sample and applied to the distribution of the married women in the 1935 Census. The fact that the Census grouping subdivides the age-interval 15 to 44 into only four classes means that some age influence probably remains, but this in no way detracts from the validity of the argument which follows.

TABLE 8
Average Number of Living Children per Family, by Duration of Marriage

Duration of Marriage, in Years	*Number of Families*	*Children per Family*
0–4	470	1.40
5–9	571	2.88
10–14	477	4.50
15–19	284	5.99
20 and over	155	7.60
Total	1,957	3.74

increase with lengthening duration of marriage may be exaggerated by the selection of the sample.

The intra-sample comparisons underscore the previously well-established pattern of fertility. The rural families average 5.9 persons; the urban families, 5.4 persons. For the low-, medium-, and high-occupational groups the means are 5.9, 5.8, and 5.2; for the three occupational groups, 6.1, 5.4, and 5.1; and for the three income classes, 5.9, 5.7, and 5.2.

Summary: Although the reason for the high fertility of the Island is evidently the lack of cultural and economic pressure to limit family size, there is evidence to suggest that the swing to birth control has begun.[43] Although the argument is weakened by the selection of the sample for interest in contraception, it is strengthened by the fact of selection for indigence and the exclusion of urban families of low fertility. The existence of appreciable differentials in contraceptive practice and fertility at low economic and social levels sampled by the contraceptive service cannot be ignored as evidence that Puerto Rico is now in an early stage of a process familiar throughout the Western world. What its development will be, only the future will disclose, but rapid fertility decline in the near future is not suggested by these findings.

If the desire to practice contraception is beginning to penetrate even the lowest social and economic classes, the present resources of information and contraceptive materials available to the population must be regarded as very limited. To judge from this sample,

43. Morales Otero *et al* have shown that age-specific fertility is probably on the decline in Puerto Rico. P. Morales Otero *et al*, "Health and Socio-economic Studies in Puerto Rico," *P. R. J. Pub. Health & Trop. Med.*, XII (1937), 405.

most of the contraceptive practice depends upon withdrawal. Fertility reduction would be implemented if the population possessed better knowledge of birth control measures and readier access to contraceptive materials, especially condoms. A clinical program to encourage the practice of contraception might also be effective and, in subsequent pages, an effort will be made to draw from the experience of the contraceptive service any implications for such a program. The basic fact remains, however, that fertility reduction can proceed no more rapidly than it is driven by the aspirations of family life.

NATURE OF THE SERVICE OFFERED

Origin and Organization: Large-scale contraceptive service in Puerto Rico was first attempted in 1935 by the Federal Emergency Reconstruction Administration at the suggestion of Mrs. Dorothy D. Bourne and with the technical assistance of Miss Gladys Gaylord, of the Cleveland Maternal Health Association. A few months after government support was withdrawn late in 1936, financial aid was secured from Dr. Clarence J. Gamble for the organization of the *Asociación pro Salud Maternal e Infantil de Puerto Rico*. From a nuclear clinic at the Presbyterian Hospital in San Juan, the facilities of the *Asociación* increased to twenty-eight clinics serving 3,851 families at the end of 1938. The patients studied here are those whose dates of admission created an opportunity for at least one year of follow-up previous to the inauguration of the study in March, 1939 and, for practical purposes, may be considered as the 1937 admissions. In 1940 the Insular Department of Health assumed responsibility for contraceptive service to indigent patients with medical contraindications to pregnancy, and the work of the *Asociación* has been slowly tapered off in consequence. On September 1, 1941, the *Asociación* operated three clinics located in San Juan, Humacao, and Yabucoa.

Doctor Belaval served as medical director of the *Asociación* and the new service was placed directly in the hands of physicians, whenever feasible. In the more remote areas public health nurses and medically trained social workers were employed, under medical supervision, for both instruction and follow-up; every clinic was organized for adequate follow-up.

Methods and materials: The pressing character of the population problem in Puerto Rico and the lack of information on the likelihood that contraception would be acceptable influenced the nature of the

service, especially in regard to methods and materials. In the San Juan clinic, diaphragm and jelly was the method of choice but, in most of the clinics, foam powder and sponge[44] were prescribed; in Lares, jelly alone[45] was advised. It was hoped in this way to obtain information about the relative effectiveness and acceptability of the three methods, but no randomizing procedures were adopted to insure comparability of either patients or professional care. It was also believed that no widespread contraceptive service was feasible even among women with medical contraindications to pregnancy, unless the advice was simple enough to be given by public health nurses and medically trained social workers under medical supervision. Of the available chemical methods, foam powder and jelly alone seemed rather promising and had been adequately tested for harmlessness under clinical conditions.

One aspect of the service which probably influenced its result was the unavailability of alternative methods for women who found their initial prescription unsatisfactory in some respect. Only in the San Juan and Humacao[46] clinics was there any effort to provide substitute methods and, even in these clinics, this feature was not stressed.

Examination and instruction: In the hospital clinics of San Juan and Humacao, each patient received a thorough pelvic examination, but elsewhere, examinations were not routine. About 6.3 percent of the 1,962 patients studied were thought to have been pregnant at their first visit and have been so regarded throughout the analysis reported here.[47] For some of these cases, diagnosed as probably pregnant upon examination, advice was given at a later date.

Routine instructions[48] in the prescribed methods were given by the nurse or physician, who also recorded any difficulty experienced

44. Mainly P.S. Foam Powder, a product of Philip Stoughton of New York. The quantitative formula given by the manufacturer, on the basis of weight, is: cornstarch, 84.25 percent; Duponol W.A., 14 percent; paraformaldehyde, 1.75 percent. Duponol W.A. is a commercial detergent obtained by sulphonating technical lauryl alcohol.

45. Lactikol B, manufactured by Durex Products, Inc., of New York. The quantitative formula given by the manufacturer is: lactic acid, 2 percent; oxyquinoline sulphate, .05 percent; glycerine, 16 percent, and blended vegetable gum base to make 100 percent.

46. At the Ryder Memorial Hospital. The service was directed by Charis Gould, M.D.

47. At the rate at which conception had been taking place in the sample, less than 5 percent would be expected to have been pregnant at enlistment, unless pregnant women tended to seek out the service. From a tabulation of the days intervening between the last menses and the initial visit, it may be suspected that perhaps 15 to 25 of the 123 patients conceived just after advice was given. If there were an error of this magnitude, it would not disturb the conclusions drawn from the analysis of either period.

48. Dickinson, *op. cit.*

by the patient in learning the advised technique. Patients for whom the diaphragm was prescribed received the requisite anatomical instruction, and their insertion of the diaphragm was checked by the physician. Patients advised in the jelly method were instructed verbally and shown how to fill and empty the applicator with the key attachment on the tube of jelly. The foam powder patients received oral instruction and a demonstration of foam production with the sponge. Dosage was explained, and patients were cautioned not to rely upon a single dose of contraceptive for more than one coition. Patients who were able to pay for materials made this modest contribution to the cost of the service.

Follow-up and supply: All patients were instructed to return to the clinic from two to four weeks after admission. Following this initial checkup visit, the patient was asked to report every two or three months. The return visits facilitated renewal of supplies and the keeping of a detailed reproductive history. The average follow-up period was 13.2 months, during which there were 3.9 follow-up visits, or a visit every 3.4 months.

Follow-up did not depend entirely upon the initiative of the patients, however, for the nurses and social workers made home visits to patients who failed to report to the clinics. The average number of home visits was 2.2 per patient, appreciably higher than the average number of clinic visits, 1.7 per patient. In this way all histories were kept up to date until patients abandoned the prescribed method and, frequently, beyond this point. Only by making follow-up independent of the experience of the patient can representative results be insured.

ACCEPTANCE OF PRESCRIBED METHODS

Emphasis upon acceptability does not displace the concept of physiological effectiveness as a guiding concept for research in the physiology of contraception,[49] but it brings a more realistic orientation to clinical service and to the criteria for its evaluation. Its influence is twofold: in the first place, it substitutes for physiological effectiveness the directly observable phenomenon of use-effectiveness and, in the second place, it draws attention to the factors tending to prejudice continued and efficient use in accordance with instructions.

49. Although, even in this respect, the results of acceptability analysis point to the necessity for the development of long-term protection which is relatively independent of the behavior of the patient, if adequate protection is to be extended to women such as those studied here.

In the study of each element in the complex of acceptability,[50] the sample has been subdivided, not only according to the method prescribed, but also according to descriptive and other factors in the individual history which might affect the result. The reader is cautioned that classification of the sample according to method prescribed does not yield groups directly comparable with respect to social and economic status. It also seems probable that the degree and excellence of professional care are not equalized among the three method-groups. Whenever possible, the analysis controls such factors as social and economic status and prior experience, but the degree of statistical control thus obtained cannot always be relied upon to render the groups comparable. In consequence, it will be appreciated that differences in behavior cannot readily be attributed to the characteristics of methods, and that they reflect, in large part, the heterogeneity of the patients themselves.

Ease of learning: The printed history form contained the question: does the patient learn easily? The answers represent subjective judgments by the clinician and reflect his success in communication as well as the interest and knowledge shown by the patient. In addition to the 2 percent with no report, 14 percent are recorded as having experienced some difficulty and 84 percent as having learned easily.

The percentage who had some difficulty varies among the three methods, being 8, 14, and 21 for diaphragm and jelly, foam powder, and jelly alone. On a purely objective basis, with differences controlled among patients and among physicians, a prediction based upon current clinical opinion would probably reverse this order of relative difficulty. The result is not determined by residence, for among urban women diaphragm and jelly was the more easily learned, and among rural women, jelly alone was the more difficult. Comparisons of the three methods within each of the relatively homogeneous social and economic groups obtained from the classifications by education, occupation, and income show the differences to derive mainly from the lowest groups. For example, in the lowest educational group, the percentages are 5, 17, and 41 for the three methods in the above order. Similar variations characterize occupation and income. At the highest levels within the sample, as judged by these three factors, the three methods appear to have been learned with equal ease. Part of the difference observed among the poorest patients may arise out of variation in professional care or in the subjective criteria applied by the clinician, but such an explanation should not be allowed to obscure the fact that the allegedly more complicated diaphragm and jelly method, possibly because of superior teaching, was easily learned by women in the lowest socio-economic group. The unexpected difficulty with jelly alone is the initial step in a consistently less favorable experience.

Trial of the methods prescribed: Patients must at least try a prescribed method if they are to be protected. In this series, 12 percent of the 1,845 patients with some follow-up never tried[51] the methods advised. This result compares with 5 percent in the Nashville series for both diaphragm and jelly and foam powder patients, 10 percent in the West Virginia jelly alone series among miners, and 19 percent in the Kentucky jelly alone series among farmers. It gives no evidence that the women in the Puerto Rican sample were less prepared to take up contraception than the somewhat similar women advised in the states. The low figure for the Nashville series reflects the influence of an unusually energetic and efficient public health nursing service making frequent and routine home-visits.

The explanations patients gave for refusal to try the prescribed methods are summarized in Table 9. No reliable differences are

TABLE 9

Percentage Distribution of Women Refusing To Try Prescribed Method, by Reason Given

Stated Reason	*Percent*
No exposure: separated from husband, sterilized, or pregnant at admission with no opportunity for use	34
Dislike or other complaint, or lack of interest, on the part of the wife[a]	29
Fear of injury reported by the wife[a]	17
Objection by the husband[a]	9
No reason given	9
Other, including several reasons	2
Total	100
Number of Women	223

[a] With or without secondary objection by the partner.

50. G. W. Beebe, *Acceptability of Contraception. A Research Memorandum on Definition and Measurement* (New York: The National Committee on Maternal Health, 1940). (Mimeographed.)
G. W. Beebe, "Measuring the Acceptability of Contraceptives," *Human Fertility*, VI (1941), 102.

51. A patient is considered to have tried a prescription if she used it on one occasion with contraceptive intent.

evident within the sample, when the relative importance of the various reasons is studied. The table shows that about one-third of the 223 cases had no need for contraception while they were under observation.

The percentage reporting no trial, on the other hand, varies appreciably among the three methods. More women refused to try jelly alone than either of the other two methods, the percentages being 8, 11, and 22 for diaphragm and jelly, foam powder, and jelly alone. The probable clinical significance of this statistically reliable pattern of differential acceptance is attested by the fact that it depends neither upon residence nor upon social and economic status. Even among the lowest social and economic groups the pattern appears in full force. For example, among the families of lowest income the percentages are 12, 12, and 25 for the three methods. The lesser willingness to try jelly alone probably reflects exceptional circumstances surrounding its prescription rather than its characteristics as a method of contraception. The only intra-sample comparison which yields a reliable difference between diaphragm and jelly and foam powder is that for urban women, who display a greater willingness to try the diaphragm and jelly method.

Apart from method prescribed, the sample is relatively homogeneous with respect to trial. The differences found among social and economic groups, advised in the use of the same method, are too small to have great practical importance or to discourage efforts to prescribe for even the poorest families.

Reaction to prescribed method: During the follow-up period the patient had an opportunity to register her own reaction[52] to the prescription as well as that of her husband. Since the entire history was taken into account in the coding, expressed satisfaction means that no objection was made during the entire period of observation, whereas a particular complaint may have appeared at any point in the history.[53]

The reactions of the 1,622 wives who tried the prescribed contraceptives are detailed in Table 10. The percentage without complaint is 69, rather similar to such figures as 61 and 80 percent for whites and Negroes in the West Virginia jelly alone series, 57 and 74 for

52. The authors consider such verbal behavior a significant part of the total clinical picture, but acknowledge the pertinence of such questions as its validity, its reliability, and its dependence upon the professional agent, upon the particular preparations prescribed, and the like.

53. Slightly different results would obtain if the reaction at the final visit were studied, for example.

TABLE 10

Reaction of Wife to All Methods Prescribed

Stated Reaction	*Percent of Patients Who Tried the Prescription*
Satisfaction	69.4
Pain, burning, or other discomfort associated by patient with the use of prescription	8.5
Messiness, or related aesthetic objection	0.8
Sponge or diaphragm felt as obstruction or other interference	0.5
Lack of confidence in prescription, or stated preference for another method	3.0
Apathy, too much trouble, "lack of coöperation"[a]	9.8
Religious or moral objection to contraception	0.3
Pain, burning, or other discomfort in addition to some other type of objection	1.9
Other and unspecified objections	5.4
No report	0.4
Total	100.0
Number of Women	1,622

[a] "Lack of coöperation" is a judgment made by the nurse or physician to describe an attitude of relative indifference.

foam powder and diaphragm and jelly patients in the Nashville series, and 66 percent in the Kentucky jelly alone series. Comparisons within the various social and economic classes of the sample reveal markedly greater satisfaction with diaphragm and jelly than with foam powder, especially, but not exclusively, for the highest social and economic groups. Among the urban women given each method, for example, 72 percent expressed satisfaction with diaphragm and jelly and 59 percent with foam powder. Among women of high education the percentages are of 80 and 63 for the two methods. The foam powder method also appears less acceptable to women of lowest income, the percentages being 87 and 74.

Analysis of the set of patients who received foam powder discloses a pattern of greater relative satisfaction among the lowest social and economic subgroups. The urban foam powder experience may have been disturbed by two special factors: in Humacao a powder little used elsewhere was intensively employed for a time; in San Juan diaphragm and jelly was the method of choice, foam powder being reserved for women unsuited for diaphragm and jelly. Both the other method-groups yield the same result when studied in relation to income. The percentages reporting satisfaction with diaphragm

and jelly are 87 in the lowest, and 72 in the two higher income groups considered jointly, and for jelly alone they are 84 and 60. They are 74, 70, and 58 for low-, medium-, and high-income groups among women advised to use foam powder. Moreover, this particular pattern of differential satisfaction is not unique, for in the Kentucky jelly alone series acceptance was reliably more frequent among the economically less-privileged elements of the sample. The hypothesis which fits this result states that women of superior economic and social status are more exacting in their criteria for a contraceptive and better prepared by knowledge and interest to obtain other methods and materials.

The distribution of complaints given in Table 10 is striking on two accounts. One is the infrequent admission of lack of confidence or preference for another method. The other is the high relative frequency of complaints of pain, burning, and the like. Religious and moral objections are negligible, but the selection of the patients tends to make this result inevitable. That 10 percent should find either the method too much trouble or their own motivation too weak is also not unexpected. Table 11 compares the Puerto Rican series with several other series with respect to salient reactions of the wife to prescribed methods. Of special interest is the resemblance between the two diaphragm and jelly groups. Among the jelly alone series, the Puerto Rican patients are outstanding for their much less frequent preference for another method, or lack of confidence in the prescription. In comparison with the Nashville patients given the same prescription, the urban foam powder cases report fairly similar reactions, although with some differences. On the other hand, more of the rural foam powder patients manifest apathy, and fewer report preference for another method or lack of confidence, burning, pain, and the like. The differences suggest that the Puerto Rican patients were less critical and, possibly, less prepared for efficient contraceptive practice than patients of other services. This interpretation cannot be extended to the urban patients who received diaphragm and jelly and foam powder, however.

Nonuse at last visit: A crucial test of the ability of a contraceptive service to meet the needs of its patients is their willingness to continue to protect themselves with prescribed materials. Among the 1,622 women who reported trial of the methods advised, 48 percent were no longer using these methods at the last follow-up visit, an average of thirteen months after enlistment. In comparison with

TABLE 11

Comparison of Various Contraceptive Series with Respect to the Percentage Reporting Outstanding Reactions to Prescribed Methods

Reaction of Wife	*Diaphragm and Jelly*		*Foam Powder*		
	Puerto Rico	*Nashville*	*Puerto Rico*		*Nashville*
			Rural	*Urban*	
Satisfaction	73	74	72	59	54
Pain, burning, discomfort, etc.	12	15	6	17	26
Lack of confidence, preference for another method	4	6	1	8	11
Apathy, too much trouble, "lack of coöperation"	6	3	12	7	3
Religious or moral objection	..	[b]	[b]	[b]	..
Number of Women	188	400	977	322	300

Reaction of Wife	*Jelly Alone*				
	Puerto Rico	*West Virginia*		*Kentucky*	*Tennessee*
		Negro	*White*		
Satisfaction	72	80	61	66	57
Pain, burning, discomfort, etc.	5	2	3	2	17
Lack of confidence, preference for another method	3	8	20	18	15
Apathy, too much trouble, "lack of coöperation"	7	2	4	7	[a]
Religious or moral objection	..	..	2		[a]
Number of Women	135	152	956	328	99

[a] Information not available in this form.
[b] Less than half of one percent.

some other series,[54] a loss of this magnitude is not unusual, as shown by the following estimates: 60 and 53 percent for whites and Negroes in the West Virginia jelly alone series; 38 percent in the Kentucky jelly alone series; and 71 and 44 percent in the Nashville series for foam powder and diaphragm and jelly, respectively. However, all such losses constitute a major challenge to the possibility of really effective contraceptive service among indigent and deprived populations and, in the present instance especially, patients must fall back upon resources of knowledge and materials which are inadequate for their protection.

54. The comparative series represent a somewhat longer average period of observation, but less than two years.

The influence of residence upon continuance with foam powder is illustrated by the percentages of 46 and 53 for rural and urban discontinuance of the method. Within the rural group, foam powder is clearly preferred to jelly alone, in terms of this index, but no reliable difference exists between diaphragm and jelly and foam powder patients of urban residence. Only within the diaphragm and jelly group is there any clear and consistent relation between continued use and social and economic factors. Tests of the influence of education, occupation, income, and prior contraceptive experience in each instance show a greater proportion continuing to employ the method among the more favored groups. In other words, this index of acceptance also points to the lesser acceptability of jelly alone, but the association between acceptance and social and economic status is limited to the diaphragm and jelly patients and is positive rather than negative in direction.

TABLE 12

Percentage of Patients Who Stopped for Stated Reasons

Reason for Stopping	*Percent*
Conceived while using method not necessarily alone or regularly; no other objection stated	15.5
Conceived while using method not necessarily alone or regularly; some other objection stated	6.3
Stopped before conception because of dislike or apathy on the part of the wife	7.9
Stopped before conception because of pain, discomfort, or fear of injury on the part of the wife	5.2
Separated from husband, sterilized, or other lack of exposure	4.4
Stopped before conception because husband objected out of dislike, discomfort, fear of injury, etc.	4.0
Supplies exhausted before conception	3.0
Other objection	0.8
Reason unknown	0.9
Total	47.8
Using at last visit	52.2
Total	100.0
Number of women	1,622

Patients' explanations for nonuse: The explanation for nonuse given by each patient became an integral part of her history. From these entries, Table 12 has been prepared to show the distribution of the 48 percent according to the reason alleged. Conception during the use of the prescribed method accounts for a loss of 22 percent of all

the 1,622 cases, or about half of all who stopped. Table 12 also divides this element into two parts: the 15.5 percent without and the 6.3 percent with some other objection. The only other large group is the 8 percent who reported dislike or apathy. About 5 percent were not using the method because of pain, discomfort, or fear of injury.

The diaphragm and jelly patients are indistinguishable from the urban foam powder patients in respect to the relative importance of the various reasons for nonuse. A comparison of jelly alone and rural foam powder patients, on the other hand, shows that the jelly alone patients more frequently stopped because of lack of supplies, while the foam powder patients more often gave pain, or fear of injury, as an explanation. Among all the foam powder patients, rural residence is associated with lack of supplies and with conception during use of the prescription but without other objection, and urban residence is associated with pain or fear of injury. Study of all the patients taken together shows that the lowest social and economic groups most frequently explained nonuse by conception, without registering any other complaint. These differences accord with those previously found for the reaction of the wife and reinforce the interpretation that women of rural residence and low social and economic status manifest a less critical and exacting attitude. In addition, they suggest that the rural women either experienced more difficulty or had less interest in keeping themselves supplied, and that the jelly alone patients suffered more than the foam powder patients, in this respect.

Proportion of users at successive intervals after enlistment: By far the most useful and summary measure of acceptability is a curve showing the percentage of users at various intervals following prescription. Elsewhere[55] the construction of this index has been described, and here it is sufficient to note its dependence upon the principles governing the making of life tables. Figure 2 presents four such curves for the Puerto Rican sample, plotted on a semilogarithmic scale to facilitate comparison of the rates of decline. It will be perceived that the time is not elapsed but exposure time,[56] and that

55. G. W. Beebe, *op. cit.*, footnote 50.

56. In this series, a month of exposure time represents about 1.3 calendar months. Women whose stopping coincided with the permanent cessation of exposure have been removed in such a way as not to force the curve down, and .3 of the women pregnant at the last visit as the result of conception with the prescription are deducted. The factor of .3 is based upon a special tabulation of the West Virginia series and assumes that, out of ten women conceiving during the use of a method, only three will for that reason fail later to resume its use.

DECLINE IN PERCENTAGE USING PRESCRIBED METHODS BY METHOD AND RESIDENCE

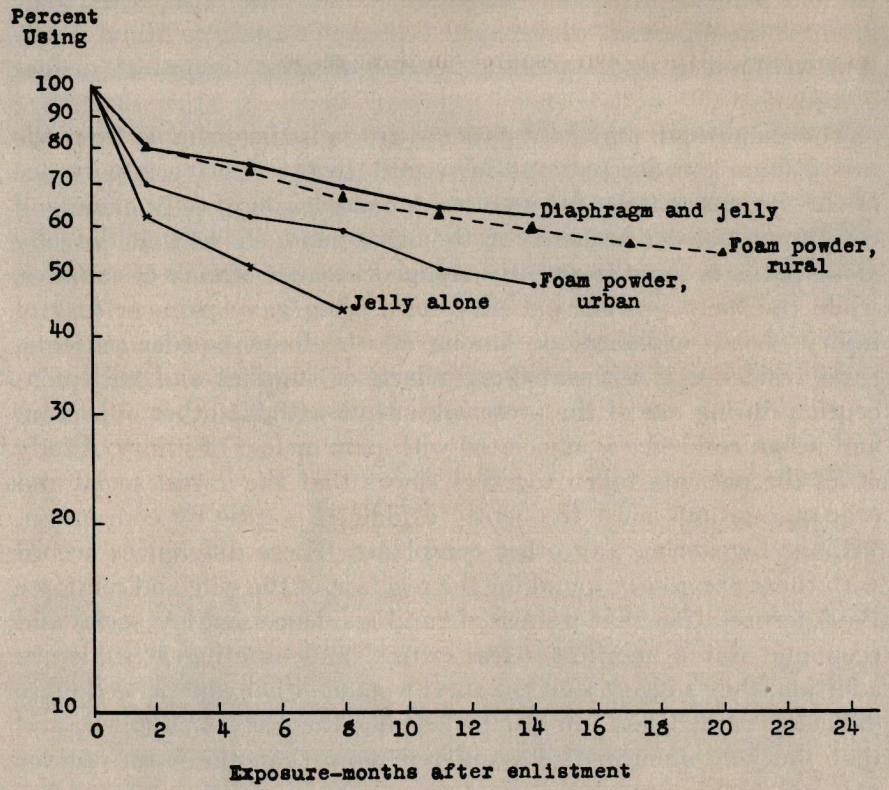

FIGURE 2

each curve answers this question: if time be measured in terms of the months in which there was need for protection, what percentage of women thus exposed to the chance of conception in each month after enlistment were following the prescribed routine? Two curves are given for the foam powder patients in view of the large difference between the rural and urban segments in this respect. The figures are based, not upon all the women advised, but upon the 1,845 with some follow-up.

These curves show how rapidly patients left the service and suggest that its direct influence was being rapidly dissipated. At best, about 50 percent might be expected to be following prescribed methods at the end of twenty-four months of exposure, roughly thirty months after admission. Even this attainment appears unlikely for the urban foam powder patients and for the jelly alone patients. Were these women adequately informed and able to obtain other contraceptive methods and materials, the consequences of their defection might not be severe, but the entire analysis points to the inadequacy of their own resources in these respects.

DECLINE IN PERCENTAGE USING PRESCRIBED METHODS IN TWO SERIES, BY METHOD

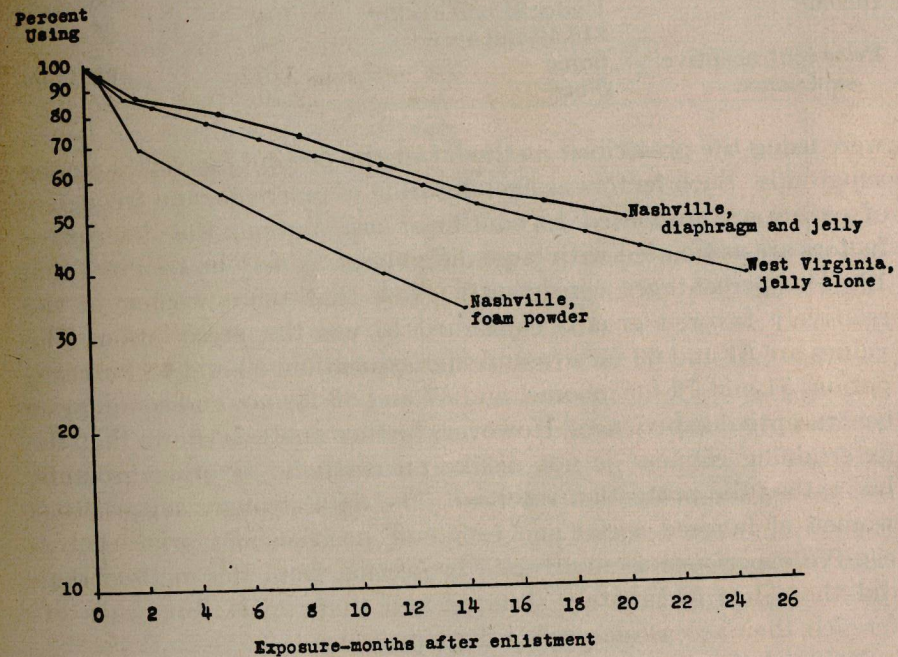

FIGURE 3

Lest it be supposed that such losses are peculiar to this sample, comparable curves for the two Nashville groups and for the West Virginia series are given in Figure 3. Despite numerous differences in patients, service, materials, and the like, these trends are similar to those of Figure 2.

There were 188 diaphragm and jelly patients who reported trial of the method. At the end of eleven exposure months, 59 percent[57]

57. The values appearing throughout the remainder of this section differ slightly from those of Figure 2 for several reasons: women who reported no trial are excluded from consideration; no adjustment was made for women going permanently out of exposure or pregnant at last visit; and no corrections for short follow-up were possible.

TABLE 13

Significant Differences Among the Diaphragm and Jelly Patients with Respect to the Percentage of Users at the End of Eleven Months of Exposure

Factor Tested	*Group*	*Number of Women*	*Percent Using Diaphragm and Jelly*
Education	Less than 8 grades	105	51
	Eight grades, or more	83	69
Occupation	Manual labor	111	53
	Clerical work, etc.	77	68
Income	Under $15.50 weekly	134	54
	$15.50 and over	54	72
Prior contraceptive experience	Some	118	66
	None	70	47

were using the prescribed method, but the percentage varies among subgroups. Such factors as age, duration of marriage, and frequency of coitus are unrelated to continued use, but all the descriptive factors are associated with large differences, as may be seen in Table 13. The percentages consistently show that more women in the relatively favored groups continued to use the prescription. The values are 51 and 69 for low and high education, 53 and 68 for occupation, 54 and 72 for income, and 47 and 66 for no, and some, prior contraceptive experience. However, further analysis shows that the determining element is not dislike on aesthetic or other grounds, but rather the protection received. The data strongly suggest that women of favored social and economic position and prior contraceptive experience secured more protection from the method than did those less fortunately situated and that, apart from this difference, their acceptance was of the same order.

None of the comparisons made among the 134 jelly alone cases yields statistically significant results, but a pattern of differences similar to that of Table 13 is in evidence.

The lesser acceptability of the foam powder method to women of urban residence tends to reverse this expected pattern for the foam powder patients, as will be appreciated from Table 14. The significant differences for education and occupation show the lower group to have manifested the higher acceptance. Moreover, and apparently because the younger women both experienced a somewhat higher chance of conception and more frequently preferred other methods of contraception, women of older age and longer duration of marriage evinced a greater willingness to continue with the foam powder method.

TABLE 14

Significant Differences Among Foam Powder Patients with Respect to the Percentage of Users at the End of Eleven Months of Exposure

Factor Tested	*Group*	*Number of Women*	*Percent Using Foam Powder*
Residence	Rural	977	62
	Urban	323	50
Education	Less than 3 grades	434	64
	Three grades, or more	866	57
Occupation	Unskilled labor	805	61
	Skilled labor and clerical work	495	55
Age of wife	Under 30	742	55
	Thirty or over	556	65
Duration of marriage	Under 10 years	666	55
	Ten years or more	634	63

Summary: The prescribed methods proved far less acceptable than the clinician or the student of population might desire, but more acceptable than might have been predicted for the Puerto Rican population on the basis of experience elsewhere. Learning the prescribed techniques presented few difficulties, and only 12 percent failed to try the methods advised. Relative satisfaction with the prescription was expressed by about 70 percent, pain or burning and apathy being the most frequent complaints. That lack of confidence and preference for another method were seldom reported reflects the obvious fact that the families were more than usually dependent upon the service for their information and materials. About 15 percent varied the prescribed techniques with some method of their own choosing, usually withdrawal.

When last visited, about thirteen months after enlistment, half of the patients who tried the methods advised were no longer using them, principally because of conception during their use. Although the service rapidly lost patients, this applies with equal force to comparable services in the states. However, since these patients are notably deficient in their command of knowledge and access to materials of contraception, the service succeeded in bringing them only a temporary respite from the high chance of conception ordinarily experienced. During this interlude, the protection they secured was evidently so low as to discourage their continuance in the service. Whether the provision of alternative and substitute methods would have retained their active coöperation cannot be determined from the observational data available, but only im-

portant changes in the service could be expected to keep many of the patients out of the ranks of the noncontraceptors.

The evidence on the relative acceptability of the several methods suffers in its lack of experimental controls, but comparisons of the methods, as provided and within relatively homogeneous sets of patients, permit certain tentative conclusions. The least teaching difficulty was experienced with the diaphragm and jelly method, perhaps because the clinician was more experienced. Special difficulty was encountered in the instruction of the jelly alone patients. Women of comparable social and economic background evinced a greater willingness to try diaphragm and jelly than foam powder, and foam powder than jelly alone. Uniformly more favorable reactions were obtained for diaphragm and jelly than for foam powder. In comparison with the Nashville series, the urban Puerto Rican patients reported very similar reactions to diaphragm and jelly and to foam powder.

At other points, jelly alone appeared at a relative disadvantage with foam powder, and foam powder with diaphragm and jelly. The jelly alone patients experienced greater difficulty in maintaining their supplies than did the foam powder patients, but the latter more frequently stopped for such reasons as pain and burning. The curves of continuing use show clearly that the greatest losses occurred among the jelly alone patients, and that the experience of the diaphragm and jelly patients was more favorable than that of the urban foam powder patients. It is interesting to note, however, that the diaphragm and jelly curve for the more critical urban patients is not much higher than the foam powder curve for the less critical rural patients. On the whole, therefore, these comparisons support the view that, apart from comparative social and economic advantage with their presumed importance for both motivation and knowledge about contraceptive technique, but possibly because of differences in professional service, diaphragm and jelly was much more acceptable than foam powder, and foam powder much more acceptable than jelly alone. The unacceptability of jelly alone is especially striking in view of the results obtained in other series.[58]

58. G. W. Beebe, *Fertility and Contraception in the Southern Appalachians* (Baltimore: Williams & Wilkins, 1942).
Beebe and Geisler, *op. cit.*
Beebe and Gamble, *op. cit.*
I. F. Stein, *et al*, "Jelly Contraceptives," *Am. J. Obst. & Gynec.*, XLI (1941), 850.

Considerable importance attaches to social and economic status and to prior contraceptive experience for their influence upon acceptance of the prescribed methods. A strong negative relationship between acceptance and social and economic status appears among the foam powder patients. The proportions reporting satisfaction with the method, as well as the proportions reporting use at the end of 11 exposure-months after enlistment, decrease very sharply with advancing social and economic status and are much lower for urban than for rural patients. Whether this fact reflects differences in the service or in the patients' criteria for a satisfactory contraceptive cannot be determined from these observations. Unless the service was very different for rural and urban patients, however, it does appear as though women with experience in contraception and favored with respect to social and economic status expected much more from a contraceptive than they felt the foam powder provided. Those less favored probably lacked the background of knowledge and experience for such criticism and were more willing to accept what they received. The situation was quite otherwise with the diaphragm and jelly patients. In general, the more favored among them, in terms of education, occupation, income, and previous contraceptive experience, found the diaphragm and jelly method more satisfactory than those less favored in these respects, apparently because they received greater protection during its use.

THE EFFECT OF THE SERVICE UPON THE FREQUENCY OF CONCEPTION

If a contraceptive service is designed to protect patients against undesired conception, it must accept their need as a continuing one, which does not cease because they become dissatisfied with a particular prescription. The evaluation of a service, consequently, cannot be restricted to selected portions of the collective experience of the patients advised, but must be based upon the entire experience in so far as it is known. In order to understand why a service succeeded well or poorly, it may be of the highest importance to estimate the reduction accomplished in the chance of conception during defined portions of the observed experience, but nothing short of the entire experience provides a satisfactory basis for the evaluation itself. For that reason, this discussion starts with the pregnancy rates for all exposure, undifferentiated as to contraceptive practice. In order to explain the result, it then considers the pregnancy rates for the more important types of experience, with and without contraception.

The estimation of reduction in the chance of conception requires a standard of expectation, a level of risk anticipated in the absence of the service. From the pregnancy rates of the contraceptors prior to admission (see Table 5, Part B), a rough estimate of 70 ± 5 pregnancies per 100 woman-years of exposure has been made.[59] Ten percent or more below the rate which would be expected if no contraception were practiced, this estimate assumes infrequent, or desultory, contraceptive practice. Were it believed that the group was on the point of taking up contraception in earnest when the service chanced to become available, this value would be correspondingly lowered, but any rate below 60 would be entirely unlikely, in the opinion of the authors.

TABLE 15

Comparative Reduction in the Chance of Conception During the Entire Period of Observation in Several Contraceptive Series

Series	*Residence*	*Methods Prescribed*	*Pregnancy Rates*[a]		*Percent Reduction*
			Expected	*Observed*	
Philadelphia	Urban	Jelly alone	55	17	69
Kentucky	Rural	Jelly alone	59	26	56
Nashville	Urban	Diaphragm and jelly, foam powder	40	22	45
West Virginia, whites	Rural	Jelly alone	73	40	45
Puerto Rico	Rural and Urban	Diaphragm and jelly, jelly alone, foam powder	70	39	44

[a] Pregnancies per 100 woman-years of exposure.

Total reduction accomplished: The expected rate of 70 declined to 39 while the sample was under observation. In Table 15 this reduction of about 45 percent is compared with similar estimates for other series studied by the National Committee on Maternal Health. The expected rate is so high, however, that a reduction of 45 percent indicates no more than the first stage of contraceptive endeavor and a low order of efficiency. It falls definitely short of the degree of protection the physician seeks for patients with medical contra-

59. The reader will recall that the rates of 67 to 116 in Part B of Table 5 are cumulative rather than specific, and that they include the period immediately after marriage, when the chance of conception is very high. The estimate desired must be specific in form, free from the influence of the early years of marriage and applicable to the period about ten to twelve years after marriage.

indications to pregnancy. At the same time, its magnitude may encourage population students advocating fertility decline for Puerto Rico. If a change of this degree were to occur in a large segment of the population, fertility would suffer a marked decline.

TABLE 16

Risk of Conception During Entire Period of Observation, by Duration of Marriage, Puerto Rican and West Virginia Series

Duration of Marriage,[a] *in Years*	*Puerto Rico*			*West Virginia Whites*		
	Months of Exposure	*Number of Pregnancies*	*Pregnancy Rate*[b]	*Months of Exposure*	*Number of Pregnancies*	*Pregnancy Rate*[b]
0–4	4,211	182	52	4,765	209	53
5–9	5,178	180	42	4,164	142	41
10–14	4,791	149	37	4,006	111	33
15–19	2,941	77	31	2,666	83	37
20 and over	1,704	29	20	1,350	20	18
Total	18,825	617	39	16,951	565	40

[a] At enlistment. Because the period of observation is short, the experience may be regarded as specific by duration of marriage.

[b] Pregnancies per 100 woman-years of exposure to the chance of conception, or $R = 1{,}200 \times$ *conceptions/months of exposure.*

The entire experience is given in Table 16 by duration of marriage, together with similar data for the whites in the West Virginia jelly alone series. Again, these two parallel series follow an almost identical pattern. The total pregnancy rate of 39 for the Puerto Rican patients represents the rates of 31, 43, and 40 for patients advised in the use of diaphragm and jelly, jelly alone, and foam powder, respectively. The statistically significant differences between the rate of 31 and the rates of 43 and 40 measure the increment of protection enjoyed by the diaphragm and jelly patients. Comparisons within the lower social and economic groups disclose no reliable differences among patients given different methods, but within the highest education and income groups very large differences obtain. In each instance, the protection of the diaphragm and jelly patients exceeds that of the foam powder patients.

Within the sample as a whole only education, occupation, and prior contraceptive experience are associated with reliable differences in pregnancy rates. Table 17 gives standardized rates for comparisons on these factors and shows that favored groups enjoyed greater protection. Factors tested and found to have no influence upon the risk of conception include residence, income, frequency of coitus,

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recency of last puerperium before enlistment, alleged regularity of contraception before admission (for contraceptors), and relative frequency of conception[60] before enlistment (for noncontraceptors). The insignificant income differentials, however, are in the expected direction. Interesting results obtain when parallel comparisons are made within each group given one contraceptive method. Consistently, and despite their small numbers, the diaphragm and jelly patients reveal a positive association between relative protection and social and economic status. For the jelly alone patients, only education gives this result and for the large foam powder segment, only occupation. Rates below 20 pregnancies per 100 woman-years of exposure were achieved only within the diaphragm and jelly group, the lowest being a pregnancy rate of 16 for fifty-six women in the income class of sixteen or more dollars weekly.

TABLE 17

Significant Differences in the Chance of Conception During the Entire Period of Observation Among Women Classified by Socio-economic Factors and by Previous Contraceptive Experience

Groups Compared		Risk of Conception[a] During Entire Period of Observation
Education	Low	38
	Medium	44
	High	30
Occupation	Unskilled labor	42
	Skilled labor	41
	Clerical occupations, etc.	27
Prior contraceptive experience	None	43
	Some	34

[a] Pregnancies per 100 woman-years of exposure.

Subdivision of the total risk of conception: A point of major interest concerns the extent to which the low reduction accomplished by the service results from frequent relapse into noncontraceptive practice, or from resort to unprescribed methods of possibly lower efficiency than those prescribed. The clinician will also want to know whether the effectiveness of each method accords with his expectation. To permit such comparisons the exposure and pregnancies of each type must be isolated and compared.

60. Measured as a ratio of conceptions to months of exposure for each case.

TABLE 18

Subdivision of Risk of Pregnancy after Admission According to Nature of Contraceptive Effort

Contraceptive Practice	Months of Exposure	Number of Pregnancies	Pregnancy Rate[a]
Prescribed methods only	13,310	367	33
Variants of prescribed methods	1,560	50	38
Other contraceptive methods	1,615	49	36
No contraception employed	2,291	149	78
Unclassified	49	2	[b]
Total	18,825	617	39

[a] Pregnancies per 100 woman-years of exposure, or $R = 1{,}200 \times$ *conceptions/months of exposure.*

[b] Less than five hundred months of exposure upon which to base a rate.

A classification of all exposure and pregnancies by contraceptive practice appears in Table 18. Almost 80 percent of the exposure after enlistment was with the prescribed methods, 71 percent while the prescription was employed alone, and 8 percent in combination with some other method. Unprescribed methods account for but 9 percent of the total, and only 12 percent is entirely noncontraceptive in character. The high percentage of contraceptive exposure refutes the notion that the total reduction in the chance of conception was no greater than 45 percent because of failure to adopt contraceptive precautions. The percentage of 88 for the relative amount of contraceptive exposure compares with 81 for the West Virginia white miners, 83 for the Kentucky farmers, and 94 for the Philadelphia hospital patients. Although the high percentage might be partly discounted in view of the short period of follow-up, the conclusion seems inescapable that the women took at least one major step toward the effective control of their fertility.

The rates of 33, 38, and 36 for the three types of contraceptive practice in Table 18 may be considered homogeneous from the statistical standpoint. They represent a contraceptive efficiency of 50 to 60 percent, measured in terms of the noncontraceptive pregnancy rate of 78. Their homogeneity by no means proves that the prescribed methods were no more effective in the hands of this population than methods with which they were already acquainted, but it provides no evidence to the contrary. The noncontraceptive rate of 78 is commensurate with the experience of the sample before enlistment.

TABLE 19

Risk of Conception with Prescribed Methods, by Duration of Marriage and by Method Prescribed

Duration of Marriage, in Years	*Months of Exposure*	*Number of Pregnancies*	*Pregnancy Rate*[a]
Diaphragm and Jelly			
0–4	608	19	37
5–9	532	14	32
10–14	440	7	[b]
15–19	160	3	[b]
20 and over	56	..	[b]
Total	1,796	43	29
Jelly Alone			
0–4	206	10	[b]
5–9	255	9	[b]
10–14	242	8	[b]
15–19	178	3	[b]
20 and over	40	1	[b]
Total	921	31	40
Foam Powder			
0–4	2,212	82	44
5–9	2,731	78	34
10–14	2,581	74	34
15–19	1,796	43	29
20 and over	1,273	16	15
Total	10,593	293	33

[a] Pregnancies per 100 woman-years of exposure, $R = 1{,}200$ x *pregnancies/exposure-months.*
[b] Less than five hundred exposure-months upon which to base a rate.

Clinical interest centers upon the relative efficiency of the three prescribed methods summarized in Table 19. The rates of 29, 40, and 33 for diaphragm and jelly, jelly alone, and foam powder differ no more widely than would be expected by chance. The respective effectiveness percentages are 63, 49, and 58. The clinician accustomed to effectiveness estimates of more than 90 percent for diaphragm and jelly will recall that these estimates represent not physiological effectiveness, but use-effectiveness, with its dependence upon the interest, motivation, skill, and knowledge of the patient herself (Table 20). Except for diaphragm and jelly the rates for the Puerto Rican sample fall at the upper end of the scale, but not far beyond the range set by other studies. The protection derived from

TABLE 20

Chance of Conception While Using Prescribed Methods in Several Series, by Method

Method Prescribed and Series	*Months of Exposure*	*Number of Pregnancies*	*Pregnancy Rate*[a]
Diaphragm and Jelly			
Philadelphia[b]	11,219	59	6
New York[c]	8,441	65	9
Nashville[d]	4,336	32	9
Puerto Rico	1,796	43	29
Jelly Alone			
Philadelphia[e]	726	9	15
Kentucky[f]	2,451	41	20
West Virginia[g]	11,252	354	38
Puerto Rico	921	31	40
Foam Powder			
Miami[h]	3,995	75	23
Nashville[i]	2,476	57	28
Puerto Rico	10,593	293	33

[a] Pregnancies per 100 woman-years of exposure; $R = 1{,}200$ x *conceptions/months of exposure.* Rates are uncorrected for minor age differences.
[b] L. Dewees and G. W. Beebe, "Contraception in Private Practice," *J.A.M.A.*, CX (1938). 1169.
[c] R. K. Stix and F. W. Notenstein, *Controlled Fertility* (Baltimore: Williams & Wilkins, 1940).
[d] G. W. Beebe and J. Overton, "The Contraceptive Service of the Department of Health, City of Nashville," *J.A.M.A.*, CXVIII (1942), 1045.
[e] G. W. Beebe and C. J. Gamble, "Clinical Contraceptive Results in a Small Series of Patients," *J.A.M.A.*, CXV (1940), 1451.
[f] G. W. Beebe and M. A. Geisler, "Control of Conception in a Selected Rural Sample," *Human Biol.*, XIV (1942), 1.
[g] G. W. Beebe, *Fertility and Contraception in the Southern Appalacians* (Baltimore: Williams & Wilkins, 1942).
[h] G. W. Beebe, "The Effectiveness and Acceptability of Foam Powder in the Miami Experiment, 1935-1938." Unpublished.
[i] Beebe and Overton, *op. cit.*

the prescribed methods was studied intensively within each of the relatively homogeneous social and economic groups. Differences of statistical reliability appear within the most favored groups. Women of urban residence, high education, and high income received more protection from diaphragm and jelly than from foam powder. Although the differences between methods are statistically insignificant for groups of favored occupational status and previous contraceptive experience, they also are in the expected direction.

It is believed that these differences in protection may reflect something more than the greater acceptability of diaphragm and

jelly among favored groups. It was noted above that the acceptance of diaphragm and jelly seemed to be associated with the protection received. While this interdependence cannot be untangled, in view of the probable homogeneity of method-groups of similar cultural and economic status from the standpoint of basic interest in contraceptive protection, the observations strongly suggest that the more skilled and assiduous the contraceptor the more likely she is to receive greater protection from diaphragm and jelly than from foam powder. The maximum effectiveness with diaphragm and jelly is the 81 percent attained by the highest income group. The foam powder patients of this income level achieved a protection of 44 percent, and the highest protection received by any social and economic group using foam powder is 68 percent.

It will, of course, be objected that irregular and unskillful use should be disregarded and that estimates should be based upon perfectly regular and competent use of each method. Valuable as such estimates would be, they cannot be obtained from clinical observations of the present type. The attempt to classify the Puerto Rican experience in terms of alleged regularity of use was abandoned when it became all too apparent that patients were loath to admit irregular use until after conception had occurred, when many contradicted their former testimony. As a compromise, the conceptions were classified according to the explanations patients gave therefor. While no great confidence can be placed in the results, they are given in Table 21. The percentage distributions give most weight

TABLE 21

Distribution of Conceptions with Prescribed Methods According to Explanation Given by the Patient, by Method Prescribed

Explanation Given by Patient	*Percent of Conceptions by Prescribed Method*		
	Diaphragm and Jelly	*Jelly Alone*	*Foam Powder*
No reason known	36	29	50
Irregular use	55	47	42
Too early removal of diaphragm, jelly, or sponge	2	12	5
Insufficient material used, or wrong insertion	7	9	2
Other error in technique	..	3	1
Total	100	100	100
Number of Conceptions	43	31	293

to those who said they could not understand how conception could have occurred and to those who associated conception with omissions and irregular use. Pregnancies attributed to errors in technique were less than 10 percent of the total.

The sheer difficulty of obtaining data suitable for estimates of physiological effectiveness testifies to the exceptional nature of perfectly skillful and assiduous contraceptive behavior and to the practical importance of variations in risk attributable to the mode of use by the patient herself. So long as the clinician must limit his advice to the methods currently available, he must accept the fact that all present methods give the patient the control over her own destiny, and that what she herself will do may be more important than the specific method advised. Once this is appreciated, all characteristics of methods which enhance the likelihood of their acceptance and sedulous use, and all aspects of the patient-physician relationship which encourage such use, will be recognized as important for the protection of the patient. Beyond this, whenever the alternative to an initial prescription is no protection at all, far less than maximum protection can be anticipated. On the other hand, if patients who abandon an initial prescription can be persuaded to accept other methods, a greater measure of protection may result. To dismiss patients as uncoöperative because they reject an initial prescription is to ignore their continuing need, and to refuse to face the real problem of keeping them at the practice of those methods from which they will derive maximum protection.

Since the behavior of the patient is a determinant of her protection with prescribed methods, interest attaches to differences in protection achieved by various groups of women. Despite the relatively small amount of experience involved, women of highest education and income and women with prior contraceptive experience have a reliably higher protection from diaphragm and jelly than those less favored. The statistically insignificant differences among occupational classes lie in the expected direction. The lowest rate is 15 for the highest income group, but its sampling error is so high that one cannot conclude that it represents a statistically higher chance of conception than the rates of 10, or less, ordinarily reported for diaphragm and jelly series in urban centers.

None of the comparisons made among the jelly alone patients gives a statistically significant relationship. In spite of the large amount of foam powder experience, none of the social and economic factors is related to protection with this method. Only two among

many tests yield significant results. The first shows that women who experienced difficulty in learning the method obtained lower protection, the pregnancy rates being 47 and 32. The second demonstrates that women with more home visits than clinic visits experienced a considerably higher chance of conception. This finding is of some methodological importance, for it constitutes additional evidence that histories based entirely upon voluntary clinic returns by the patient probably fail to represent the average experience of patients given contraceptive advice. Had routine home visits not been made in order to complete the histories of all patients, the bias in the effectiveness data would have been considerable.

IMPLICATIONS FOR CONTRACEPTIVE SERVICE IN PUERTO RICO

The broad implications of this study for any program of contraception and fertility reduction in Puerto Rico are manifold. The beginnings of a contraceptive effort evident in the experience of the sample before admission to the service, the fact of enlistment, the demonstrated capacity to learn modern contraceptive techniques, and the effort made to secure protection all unite in evidence that a portion of the population of lowest social and economic position is ready for contraception without knowing quite what to do about it. Estimates of the relative size of this interested segment would have value, but the present series throws little light upon this question.[61] Of course, women of superior social and economic position manifest greater interest and learning capacity, but only in the exceptional case of the jelly alone patients was there any real failure to seek protection in earnest. The experience of this group suggests the need for appraisal of the methods of selecting and teaching patients. Effective use might be made of some of the newer anatomical models which Dickinson[62] has provided, teaching models which give the essentials of the anatomy and physiology of reproduction in direct visual fashion.

The high risk of conception after admission to the contraceptive service and its significance for discontinuance of the prescribed methods constitute major problems. A reduction of 50 percent can have great population significance but only if it be maintained by an appreciable portion of the population. If abandonment is usual,

61. It is of some interest to note that, in the spring of 1939, rough estimates of the numbers of married women of reproductive age in the *barrios* where the larger clinics were located, showed that several had reached between 10 and 20 percent of the families.

62. R. L. Dickinson, "Models, Manikins and Museums for Obstetrics and Gynecology," *Am. J. Obst. & Gynecol.*, XLI (1941), 1075.

even a 50 percent reduction cannot be continued without either improving contraceptive efficiency or finding new ways of keeping patients engaged in contraceptive practice. On the other hand, other sources of defection are equally important, and both point directly to the necessity for supplementary and substitute methods to prevent the resumption of the habit of taking no precautions against conception. In no series has it been more clearly demonstrated that reliance upon a single prescription cannot succeed under present conditions.

Women of rural residence, of low social and economic position, and without contraceptive experience, have less background for critical evaluation and depend more completely upon what they receive than do women of favored status. Their ability to practice contraception seems so limited that, to some extent, it makes little difference which method they use, so long as they practice contraception in some form. Uncritical though they are, the conceptions which ensue from their inefficient contraceptive endeavors discourage their continuance with prescribed methods and, unless they can be taught to attain higher protection and, possibly, even if they can, they should be encouraged to turn to other methods in the hope of finding one easier to use efficiently. The alternative is to ignore their continuing need for protection and to overlook the fact that their limited environment can offer even less chance of effective protection. Their experience also shows that they had more difficulty in keeping supplied than did other women. The foam powder method was associated with sufficient complaints of pain, burning, and the like to suggest further investigation of this problem and to illustrate the need for alternative methods. The extent to which such complaints arise from objective irritation is not open to study by means of the present observations. Because they were obtained verbally they may be over- or understated, and they may be partly camouflage for apathy or dislike on other grounds.

Patients of urban residence and favored social and economic status manifest an ability to practice contraception more efficiently than women less influenced by the self-regarding values of modern urban life, but their success with foam powder falls short of their success with diaphragm and jelly. While their preference for the diaphragm is clear, their abandonment of even this method is so extensive that only the provision of other methods gives any promise of maintaining their protection. Few methods can be expected to furnish a degree of protection commensurate with their expectation, but other occlusive devices, including the condom, deserve trial. It is also

possible that the Puerto Rican jelly alone experience is very unusual and that it fails to represent the protection which better contraceptors might be able to derive from its use. The high frequency of complaints of pain, burning, and the like[63] among diaphragm and jelly patients merits further investigation.

In general, the basic conditions for highly successful contraceptive practice with modern methods, dependent as it is upon the diligent and skillful pursuit of a complicated routine each time exposure occurs, simply are not met by the living conditions and the aspirations of these patients. From the population standpoint, reductions of 50 percent are very important, but they must be maintained to be truly effective; the cessation of prescribed methods occurs so rapidly that continued attainment of such protection cannot be assumed. On the other hand, undoubtedly there are indirect influences which such a service may have, not only upon women given advice directly, but also upon others, and a long-term program of contraception could risk low protection and perhaps even a rapid turnover of patients, if its educational value were certain. Where therapeutic contraception is the objective, however, the immediate concern must focus upon the patients actually given advice, and nothing short of the best possible prescription should be considered. Such methods as foam powder, and possible also jelly alone, should probably not be prescribed to patients having medical contraindications for pregnancy, unless occlusive devices cannot be employed.

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63. These different complaints were not separated in coding.