An answer to the question, How much can we reasonably expect to do? can be gained from inquiries into differential incidence. Thus the fact that rheumatic fever, infantile deaths, and stillbirths are of relatively scarce incidence among people living in socially favoured conditions provides us with a vision of a goal which could be attained by social policy. The same can be said for the experiences of other countries. The fact that in 1939 the infant mortality rate for New Zealand was 31 while that for Malta was 227 provides for the Maltese and the rest of us a standard to which we can reasonably aspire. By such comparisons we can also learn something about the causes of infant mortality and also about remedies. When diagnostic terms used in different countries can be matched with each other as closely as can figures for infant deaths, then we shall be better placed than we are to-day to profit from the findings of other countries' surveys.

We in this country are surely on the threshold of a period when the social survey, the pilot inquiry, can be more usefully employed than ever before. The value of pilot investigations was well appreciated by the Nuffield Foundation when this body was concerned with exploring the possibilities of co-operation between the voluntary and municipal systems of hospital administration. How much greater can be their usefulness in the future when the structure of our medical services will be more uniform. Indeed, many will base their judgment of centralized medical services on the extent that universities and other unofficial organizations are encouraged to make pilot investigations. Unofficial bodies have in the past played the part of advance guards, reconnoitring new territories into which, when positions are established, the ponderous main body moves into occupation. The main body has now become large and ponderous: all the more need for scouts, patrols, and guides.

Conclusion

I began this paper by commenting on how the early American social surveys and our own—the Booth and Rowntree surveys—were concerned with the effects of inequalities in the environment. If hopes are fulfilled by the new order we will witness a narrowing of the gap which separates the over-opulent from the slum home. There will be a general equalizing of those features of the environment which influence health. Differences between human beings will then be better recognized as being partly determined by innate qualities. For man is not only the product of his environment; he is also largely its architect.

Speaking at the Silver Jubilee National Safety Congress organized by the Royal Society for the Prevention of Accidents and held at Brighton from Oct. 6 to 10, Mr. Duguid said that only a few American States—notably New York and California—had safety legislation comparable to that in Great Britain. Other States either had very little legislation or else had laws which were not well enforced. America had nothing to teach us about the fencing of machinery. Dust and fume removal in American factories was good, but general factory ventilation was not. Mr. Tugman said that he went to America to learn what he could about safety methods and therefore visited only the best factories. What he had seen was not necessarily typical of American industry as a whole, but he was satisfied that the best results achieved in America were better than the best results achieved in Great Britain. Making all allowances for different methods of calculation, he had come to the conclusion that in the best American works the accident rate was only one-quarter of the lowest figures recorded in this country. One reason for this was that, in the best firms, the drive from the top was more apparent than in Great Britain, and there seemed to be a greater emphasis on managerial responsibility for accident prevention. More staff was employed to encourage, co-ordinate, and advise on safety at all levels of management. On the subject of protective clothing we did not have much to learn from the U.S.A., and guarding of machinery was not practised to nearly the same extent as in this country.

CHILD-BEARING AND PULMONARY TUBERCULOSIS

BY

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Just how commonly do pregnancy and tuberculosis occur together? Routine radiography and screening of women attending antenatal clinics show that the rate of incidence of pulmonary tuberculosis is no greater among pregnant women than among others in the same age group (Nicol Roe, 1946; Jacobs, 1946; Dawson, 1945).

Rich (1944) estimates that in America one woman in eight of those aged between 15 and 30 years is pregnant at any given moment. A similar estimate for the population of Middlesex for the years 1943-4 shows that of women of child-bearing age (15 to 45) 1 in 12 to 1 in 16 were delivered of children in each year. The peak incidence of tuberculosis in females occurs during the same age period, hence it is clear that chance alone will ensure that a considerable number of women will be pregnant in a reasonably close time-relationship to the onset or course of a tuberculous illness. It is therefore wise to admit an aetiological association only if it is established that tuberculous disease is more frequent in women who have gone through pregnancy than in an otherwise comparable group. Such a comparison is in practice extremely difficult.

If the estimates given above hold for the whole of Britain it would seem that 2,000 to 3,000 tuberculous women become pregnant each year. The only large series of cases reported recently in this country is from the special unit for pregnant tuberculous women at Black Notley (Cohen, 1946). Because of the paucity of reliable information on the subject it was decided at a meeting of the Middlesex Tuberculosis Association in January, 1944, to keep a central register of pregnancies occurring in women attending chest clinics in the county. It was from this register that the present series of cases was obtained, and from the records of the clinics that the information regarding the patients was collected.

No attempt will be made here to review the extensive literature, as several recent summaries and reviews are available (Friedman and Garber, 1946; Cohen, 1946; Oxenham, 1941; and Brooks, 1940).

Object of Investigation

Our aim was to determine what influence, if any, "child-bearing" has upon the course of pulmonary tuberculous disease in patients already diagnosed as suffering from pulmonary tuberculosis and those whose disease was found during the early months of pregnancy.

A deliberate distinction is made between "child-bearing" and "infant-rearing." By the former is understood the physiological process of conception, maturation of the foetus, and parturition, with the associated metabolic, endocrine, and mechanical changes in the mother. Rearing of an infant includes its care and nutrition. The early months after the birth of the child call for much effort from the average mother—extra washing, preparation of feeds, and sleepless nights often causing a state of tension and anxiety. Common to both these periods for most women are the normal household duties, including shopping; for the period surveyed here these were even more arduous than in peacetime. No attempt is made here to assess the

strain of rearing an infant. It must be admitted that it is difficult to separate these functions precisely: the puerperium, really a part of the child-bearing process, coincides with the early days of the period of rearing. For the above reasons the state of the disease was assessed as near to the beginning of pregnancy as available records allow; this state was then compared with the state three to six months after parturition.

Material

Pregnant Cases

The estimated population of Middlesex for the period of the investigation was 1,900,000; at that time (1944) there were about 4,200 tuberculous females of child-bearing age on the registers of the chest clinics.

From January, 1944, a record of all cases of pregnancy occurring in females with pulmonary tuberculosis attending the chest clinics was kept. Up to June, 1946, 160 women were known to have completed full-time pregnancies, plus a post-partum observation period of six months; 23 of these had embarked upon a second pregnancy. There were also 56 women who had had their pregnancies terminated surgically. With the 20 patients who were lost sight of this gives a total of 236 single pregnancies in a period of 18 months, allowing 15 months for the period of assessment (Table I). These patients were considered in two broad

TABLE I

Stage of Tb.	Pregnant	Non-pregnant
Arrested or quiescent	166 (70.3%)	125 (38.9%)
Active or progressive	50 (21.2%)	114 (35.5%)
Records inadequate	20 (8.4%)	82 (25.6%)
Total	236	321

groups: (1) those with quiescent and arrested disease, totaling 166; and (2) those with active disease (50), including progressive or advanced lesions and unstable but less severe disease. Patients who were "recovered"—that is, written off the clinic register after at least five years of quiescent disease—were excluded, as were patients moved from the county during the period of the inquiry. In Table I these latter cases are included in the line marked "records inadequate."

Controls

In assessing any group of tuberculous patients the question of controls is always a thorny one, and with the added complication of pregnancy the difficulties are in no way eased. Forssner *et al.* (1924), and many workers subsequently, were of the opinion that an adequate control group was impossible to obtain. In the early 1920's Alice Hill (1928) and others attempted it with some degree of success, but their figures would hardly satisfy the statistically minded.

In spite of forebodings aroused by the literature it was decided to try to obtain a control group from the married women of child-bearing age on the register of two of the Middlesex clinics on Jan. 1, 1944; from these were chosen all those who had had no pregnancy between January, 1943, and June, 1946—that is, all patients who might have had pregnancies in relation to the period of observation were excluded. All new patients and those who died in 1944 but who otherwise conformed to the above criteria were included.

There was a total of 321 such cases, 82 of which had to be excluded for various reasons, such as transfer to areas outside Middlesex, or because only inadequate clinical or x-ray records were available, and lastly because some few refused or were unable to attend the clinic for one cause or another. The reason for this disproportionately high number of cases with "inadequate records" among the con-

trols—26% compared with 8% in the pregnant group of patients—was partly due to the fact that the investigation of the pregnant women was planned before the collection of cases; all such cases had clinical and radiological examinations at three-monthly intervals, while the details of the control group of cases had to be collected in retrospect.

These two large groups, composed of 216 pregnant women and 259 non-pregnant women, were compared for (1) age composition, (2) social class, (3) previous pregnancies, (4) duration of disease, and (5) activity or quiescence of disease. It was found that there was no statistically significant difference under headings 2, 3, and 4, but for headings 1 and 5 there was an important distinction between the two groups. After separating the active from the quiescent cases and analysing them separately, comparison of the two active groups then showed that there was no significant difference under headings 1, 2, 3, and 4, while there still remained in the quiescent group a wide difference in the age composition of the pregnant and non-pregnant classes.

Age Composition

In both "active" and "arrested or quiescent" groups the ages ranged from 18 to 43. There is a marked difference

TABLE II

Age Group	Active		Arrested or Quiescent	
	Pregnant	Non-pregnant	Pregnant	Non-pregnant
Under 30	26	52	93	47
Over 30	24	62	73	78
Total	50	114	166	125
				$\chi^2=0.552$; $P: 0.5$ to 0.3
				$\chi^2=9.458$; $P<0.01$

in the age distribution of the two "arrested or quiescent" groups (Table II). Suggested reasons for this are given later in the paper.

Social State and Environment

Middlesex lies to the north and west of London. From a densely populated area bordering London it shades off through typical suburban areas to rural surroundings on the periphery. Largely built upon between the two great wars, it now contains a mixed population derived from its former residents, persons removed from London as a result of slum-clearance schemes, and others from all parts of the British Isles. Many districts have their own industries which absorb the local working population; others are mainly residential and dormitory areas for London.

The period of the investigation covers the latter part of the second world war and the first year thereafter. It was a time when people had to contend with many hardships and restrictions affecting almost all aspects of their daily lives. From June, 1944, to May the following year the area was bombarded from the Continent, causing in many a constant state of anxiety and much loss of sleep. The diet, although possibly adequate in calories, contained the minimum requirements of fat and protein considered necessary for the tuberculous. Tuberculous patients at that time were allowed 14 pints (7.95 litres) of milk a week compared with the healthy civilian's 3 to 5 pints (1.7 to 2.8 litres); pregnant women were also allowed extra meat and approximately two eggs a week, as well as vitamin supplements in the form of orange juice and cod-liver oil.

The social classification used (Table III) was based on broad general lines from reports by welfare officers and health visitors. Patients living in comfortable circumstances and obviously in a position to pay for their treatment in a private sanatorium were classed as good; others living in poverty and overcrowded conditions were classed

TABLE III

Social State	Active		Arrested or Quiescent	
	Pregnant	Non-pregnant	Pregnant	Non-pregnant
Satisfactory or good ..	39	99	143	114
Bad	11	15	23	11
Total	50	114	166	125
	$\chi^2=2.936$; P: 0.1 to 0.05		$\chi^2=1.465$; P: 0.3 to 0.2	

as bad. The great majority were in the satisfactory group, which contains the "black-coated" and "working-class" categories, and a large percentage had husbands serving in the Forces and were therefore living on Army pay and allowances.

Degree of Parity

Table IV shows that the groups are comparable in regard to the degree of parity. Among those who have borne children before it is important to eliminate so far as is

TABLE IV

No. of Previous Pregnancies	Active		Arrested or Quiescent	
	Pregnant	Non-pregnant	Pregnant	Non-pregnant
None	31	54	97	71
One or more ..	19	60	69	54
Total	50	114	166	125
	$\chi^2=2.798$; P: 0.1 to 0.05		$\chi^2=0.694$; P: 0.5 to 0.3	

possible any influence that infant-rearing might have upon the present pregnancy. Knowledge of the spacing and frequency of previous pregnancies is essential for an accurate assessment of this factor. As the records inspected did not give this information it was decided to exclude from the present investigation all patients who had had pregnancies during the year prior to the period of assessment; such are included in Table I under "inadequate records," and they amount to less than 2% of the total in both groups.

Duration of Disease and Obstetric Details

The duration of the active cases is shown in two-year groupings and for the non-active cases in five-year groupings (Tables V and VI). As is only to be expected, the non-active cases show greater chronicity than the active cases.

TABLE V

Duration of Disease in Years	Active Disease	
	Pregnant	Non-pregnant
0-1	23	55
2-3	13	35
4-5	7	12
6+	7	12
Total	50	114
	$\chi^2=1.005$; P: 0.8	

TABLE VI

Duration of Disease in 5-year Groups	Arrested or Quiescent Disease	
	Pregnant	Non-pregnant
0-4	107	89
5-9	46	26
10+	13	10
Total	166	125
	$\chi^2=1.881$; P: 0.7 to 0.5	

The value of these figures is that they give a time picture of the state of the disease and a factual contrast to an opinion based on radiological appearances.

Details of the obstetric history were lacking in most cases, but no obstetric deaths were recorded. Two patients

were delivered by caesarean section on obstetric grounds; another who became ill showed multiple opacities in an x-ray film of the chest, diagnosed as metastatic pulmonary abscesses following puerperal cellulitis. This patient recovered after a long pyrexial illness.

Comments on Tables

Each of the foregoing tables has been submitted to the χ^2 test. The value of χ^2 and the limits of P (probability) are shown for each of the tables.

Where the value of P is greater than 0.05 the degree of difference between the two compared groups has been taken to be of no significance. In only one case—the age distribution of the arrested or quiescent cases—is the difference significant; in this respect, therefore, these two groups are not alike.

Table I shows that the proportion of pregnant women with active disease to those whose disease is quiescent is much lower than in the control series, where there are nearly the same number in each group. This suggests that women with active disease do tend to avoid child-bearing. Among those patients with active disease 11 (22%) were diagnosed during pregnancy; the other 78% became pregnant knowing they were ill and presumably against the advice of their physicians. At two of the clinics from which the control group was obtained it is known that 60 women had pregnancies in the period covered by the investigation (approximately 18 months). This gives an annual rate of pregnancy of one in 12 women of child-bearing age for this particular group of tuberculous women, which is almost the same as the estimated rate for the whole of Middlesex at about the same time. If we are correct in assuming that the woman with active pulmonary tuberculosis avoids pregnancy then it would appear that the rate of conception among those women whose disease has remained dormant for some time is similar to that of the normal population.

There is general agreement that 10% of marriages in this country and in America are naturally sterile (Hamblen, 1942; Report on Conference of the British Social Hygiene Council, 1943); such cases and those women who deliberately avoid pregnancy for one reason or another will appear in the control group. Pregnancy is also more likely to occur in younger women; this accounts (at least in part) for the greater proportion in the higher age group in the non-pregnant control series (see Table II, arrested or quiescent cases).

Assessment

The state of the disease was assessed at the beginning of pregnancy, or in the case of the controls as near to January, 1944, as available records allowed, and was compared with the state 12 to 15 months later. Assessment was based upon clinical notes and radiological appearances in every case, and where available on examination of sputum, gastric contents, and laryngeal swabs for tuberculosis bacilli. In patients who were receiving treatment in hospital the detailed hospital reports, with temperature records, etc., were used. In the cases of non-active disease only relapses are recorded; no deaths occurred in this group. Patients classed as "better" in the group with active disease had become "quiescent"—that is, there had been general clinical improvement, sputum examinations were negative, and x-ray appearances were those of resolution and regression and no sign or symptom suggesting activity was present. Any case remaining active, even though there may have been improvement under one or more of the above observations, was classed as stationary. Relapsed cases showed clear evidence of clinical and radiological deterioration. So

as to obtain as uniform an assessment as possible throughout, all case papers and films were inspected by only one of us (C. J. S.).

Results

The pregnant cases are separated into those that went to term and those in which the pregnancy was surgically terminated, including one case of abortion at the fourteenth week. The similarity of the outcome in the pregnant and the non-pregnant groups both for active and non-active disease is striking (Tables VII and VIII). Note the three

TABLE VII.—Results in Active Cases

Change in State of Disease	Active Disease		
	Pregnant		Non-pregnant
	Artificially Terminated	Full-time	
Better	7 (35%)	11 (36.6%)	42 (36.8%)
Stationary	5 (25%)	11 (36.6%)	35 (30.7%)
Worse	4 (20%)	4 (13.3%)	16 (14%)
Dead	4 (20%)	4 (13.3%)	21 (18%)
Total	20	30	114

TABLE VIII.—Results in Arrested and Quiescent Cases

Change in State of Disease	Arrested and Quiescent		
	Pregnant		Non-pregnant
	Artificially Terminated	Full-time	
Stationary or improved ..	33 (92%)	117 (90%)	110 (88%)
Worse	3 (8%)	13 (10%)	15 (12%)
Dead	0	0	0
Total	36	130	125

categories of the "active" patients: though the numbers are not large, we are of the opinion that these may be fairly compared, each containing similar proportions of patients with unstable or moderately active or severe progressive disease. Those patients whose pregnancy was terminated fared no better than those going to term or the control patients who had no pregnancies related to the period of observation.

The effect of the difference in the age distribution in the non-active cases is difficult to assess. Nevertheless it is felt that the figures for this group are worth presenting if they serve merely to demonstrate the difficulty in obtaining comparable unselected control groups. It might reasonably be expected that a higher relapse rate would have occurred among the relatively younger women who had borne children. For this reason the evidence is the more suggestive that pregnancy and parturition have little effect upon the course of stable or healed disease.

Discussion

We feel that our investigation permits the broad deduction that, in general, a single pregnancy has little or no effect upon the course of a tuberculous illness whether the disease be active or non-active. Patients whose pregnancy is artificially terminated would seem to fare no better than their sisters who are allowed to continue to term. Thus it becomes incumbent upon those who advise termination of pregnancy as an almost routine procedure to establish its necessity in each patient rather than assume that it is of obvious and universal value.

These conclusions are supported by the more recent writers on the subject (Cohen, 1946; Ornstein and Epstein, 1939; Jameson, 1938; Mariette, Larson, and Litzenberg, 1942). Particularly in regard to the non-active cases they are agreed that there are no grounds connected with pulmonary tuberculous disease for advising termination. The few but well-documented and carefully reviewed cases of Cutler (1944) give further support to this view.

We wish to stress that in any investigation of this kind cases should be collected and reviewed over a limited number of years because of the variations in the standard of living and methods of treatment. Both are important factors influencing the outlook for the sufferer. These figures were collected during the latter part of the war, at which time the standard of nutrition in this country was fairly uniform and when the general management of patients and treatment by "collapse" therapy for cases in which it was indicated were reasonably consistent throughout the county of Middlesex.

Conclusions

Pregnancy as an event in the course of a tuberculous illness has little or no effect upon the progress of pulmonary disease over a period of fifteen months whether the disease be active or quiescent; deterioration in the state of some tuberculous patients must be expected whether they are pregnant or not.

There is no evidence that surgical termination of pregnancy is necessary in the medical management of tuberculous pregnant women, except in a few selected cases. While it must be left to the physician in full possession of all the details of the individual case to make the proper decision with regard to the management of the patient, pessimism as to the influence which pregnancy has on tuberculosis and undue zeal in the termination of pregnancy are to be avoided.

Summary

The change in the state of active pulmonary tuberculous disease has been assessed over a period of 12 to 15 months (period of child-bearing and early infant-rearing) in 50 pregnant women and 114 married women of child-bearing age who had had no pregnancy in relation to the period of assessment. The two groups were found not to be significantly different in any of the following respects: (a) age, (b) social class, (c) number of previous pregnancies, (d) duration of disease. At the end of the period of assessment in approximately 35% of all cases the disease was found to have become quiescent. Over the same period 30 to 40% in each group had deteriorated or died.

A group of 166 pregnant and 125 non-pregnant women whose tuberculous disease at the beginning of pregnancy was quiescent or arrested was similarly assessed. There was a significant difference in the age composition of these two groups. In each of these groups 8 to 12% deteriorated in a period of 15 months. There were no deaths in either group.

We would like to thank the physicians and their staffs of the clinics from which the records were obtained, particularly Dr. Norman MacDonald and Dr. Nicol Roe, from whose clinics the control group was obtained. To Dr. W. T. Russell and his assistant, Ian Sutherland, of the Institute of Social Medicine, Oxford, we are particularly grateful for much helpful advice on the statistical presentation of the results. We are solely responsible for all statements made and views expressed in this paper.

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