

A Change in the Sex Incidence of Diabetes Mellitus

By

J. M. MALINS, M. G. FITZGERALD and MARY WALL

Diabetic Clinic, General Hospital, Birmingham

Received December 7, 1964

Summary. The standardised male to female ratio (M/F) of newly diagnosed diabetics aged 35-49 has changed from 0.65 in 1945-1949 to 1.78 in 1960-1963. A similar but less dramatic change has occurred in the older age groups and the overall standardised sex ratio for newly diagnosed diabetes is now unity. Attention is drawn to the fact that in the last century diabetes was always regarded as being more common in men than women. Diabetic mortality rates also showed this and female mortality did not exceed the male until about 1920. The recent apparent change towards the nineteenth century pattern does not appear to be the result of any difference in the type of diabetic patient seen, and no satisfactory explanation is offered for its occurrence.

Résumé. Le rapport standardisé entre les hommes et les femmes (M/F) atteints d'un diabète récemment diagnostiqué, âgés de 35 à 49 ans, s'est transformé de 0,65 au cours de la période de 1945 à 1949 en 1,78 pour les années 1960 à 1963. Un changement semblable mais moins spectaculaire s'est produit dans les groupes de diabétiques plus âgés et le rapport standardisé des diabétiques récemment diagnostiqués est en définitive, pour les deux sexes, égal maintenant à l'unité. L'attention est attirée sur le fait que dans le siècle passé le diabète a toujours été considéré comme étant plus répandu chez les hommes que chez les femmes.

There is some evidence that in the last century diabetes was more common in men than women. Physicians consistently said so^{1,10} and PAVY⁷ in 1885 gave the figures for his private practice in London (Table 1).

Table 1. Sex Ratio for Different Ages at Diagnosis after PAVY⁷ in 1885

	Men	Women	M/F
10-19	35	22	1.6
20-29	69	28	2.5
30-39	154	70	2.2
40-49	260	79	3.3
50-59	281	137	2.0
60-69	138	44	3.1
70+	26	9	2.9

The records of the Registrar-General for England and Wales show a standardised mortality rate from diabetes which in 1861-1870 was twice as great for men as for women. During the later years of the nineteenth century there was a steady increase of mortality from diabetes in both sexes but there are factors which almost certainly influenced the recording of diabetes as a cause of death, especially an increasing tendency to mention contributory causes on death certificates and the increasing use of urine analysis¹¹. The ratio

La mortalité parmi les diabétiques l'a également démontré, et la mortalité des femmes n'a pas dépassé celle des hommes jusqu'à environ 1920. La modification récente apparente dans le sens de celle qui avait été observée au cours du dix-neuvième siècle n'apparaît pas être le résultat d'une différence dans le type de patient diabétique examiné, et aucune explication satisfaisante se présente pour expliquer ce phénomène.

Zusammenfassung. Bei frisch entdeckten Diabetikern zwischen 35 und 49 Jahren hat sich das Standardverhältnis von Männern zu Frauen (M/F) von 0.65 in den Jahren 1945-1949 auf 1.78 in den Jahren 1960-1963 verändert. Bei Diabetikern höheren Alters ist es zu einer ähnlichen, doch weniger starken Änderung gekommen. Für alle Altersgruppen ist das standardisierte Geschlechtsverhältnis der frisch entdeckten Diabetiker jetzt einheitlich. Beachtung verdient die Tatsache, daß man im letzten Jahrhundert das Vorkommen des Diabetes bei Männern für häufiger hielt als bei Frauen. Das zeigte auch die Mortalitätsrate der Diabetiker. Die Mortalität der Frauen überstieg die der Männer erst etwa 1920. Die jetzige offensichtliche Rückkehr zum Verteilungsmodus des 19. Jahrhunderts scheint nicht auf einer Änderung des Diabetikertyps zu beruhen. Eine befriedigende Erklärung kann dafür nicht gegeben werden.

of male to female deaths from diabetes fell steadily from 2.05 in 1861-1870 to 1.41 in 1891-1900 and to 1.18 per cent by 1911-1920. In 1921-1925 for the first time female deaths exceeded those of males and in 1936-1939 the Male/Female (M/F) ratio was 0.79. This continuous change in the sex ratio was due in the last century to the greater increase of mortality in women than in men; in the early part of this century male mortality has remained steady apart from the drop during the first World War which affected both sexes, whereas female mortality has increased sharply as shown in Fig. 14. The revision of the classification of deaths for England

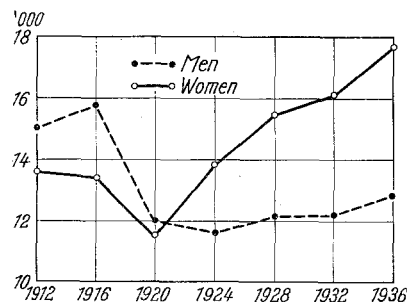


Fig. 1. Standardised Rates of Mortality for Diabetes for Men and Women in England 1912-1936 (After HARRIS and MACARTHUR)

and Wales in 1939 led to an abrupt fall in the recorded mortality rate from diabetes in both sexes. Before this year diabetes was given preference over all except a few causes, but since 1939 deaths are only coded under diabetes when the certifier regards diabetes as the principal cause, excluding those in which it is considered only a contributory cause. Nevertheless the M/F ratio continued to fall, reaching 0.56 in 1958; 0.57 in 1959, 0.50 in 1960 and 0.60 in 1961.

The trend of mortality in other countries with reliable records is the same. Norway and Sweden show parallel falls in the M/F ratio for crude mortality during this century (Fig. 2). In the white population

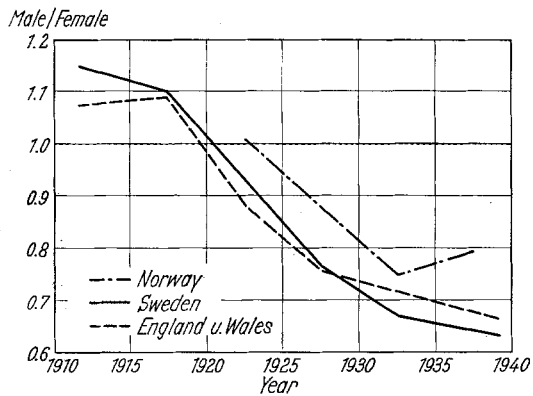


Fig. 2. Ratio of Male to Female Crude Mortality from Diabetes in Norway, Sweden & England & Wales 1912-1939 (After HARRIS and MACARTHUR)

of the U.S.A. a similar fall was arrested in 1950 and from 1950 to 1959 the death rate for men remained constant but for women fell by 16 per cent. It is possible that the striking shift from male to female preponderance is to some extent apparent rather than real. JOSLIN⁵ in 1959 believed that women are held in growing respect throughout the world and are therefore more often investigated. This factor would certainly apply in a country such as India but seems unlikely to be important in England and Wales.

Turning now from mortality to the incidence of diabetes as it is estimated from hospital statistics, there are again possible sources of error. Where more than one hospital clinic exists in a city, practitioners may choose to refer young patients to one clinic and older patients with mild diabetes to another. Mild cases and the aged or severely disabled may never be referred to hospital. Men may be more reluctant to attend hospital because of the time and money lost from work. As far as is known none of these considerations apply to any significant extent to the Diabetic Clinic at the General Hospital from which the material of this enquiry is drawn. Even if they do it is difficult to imagine that a change has occurred in the last twenty years which would affect one sex rather than the other.

The material of this enquiry is provided by the cases of diabetes, previously undiagnosed, seen at the

Table 2. No. of Cases by Year of First Attendance

	Men	Women	M/F
1930-34	128	227	0.56
1935-39	315	598	0.53
1940-44	359	586	0.61
1945-49	515	1069	0.48
1950-54	1007	1613	0.62
1955-59	1317	1624	0.81
1960-63	1408	1584	0.89
1960-64 (estimated)	(1760)	(1952)	(0.90)

hospital clinic from 1930 to 1963 inclusive. In every case the diagnosis was based on clinical assessment with a blood sugar estimation 1-2 hours after a meal and a glucose tolerance test when it was considered necessary.

Table 2 shows the number of new cases of diabetes in five-year groups from 1930 to 1964. At the beginning of this period the preponderance of women was already well-marked and there is no significant change in the M/F ratio until 1955-59 when the growth of the female population eases while that of the males progresses steadily. As there have been considerable shifts in the M/F ratio of the general population during the last fifty years as a result of the loss of young men in the First World War and the subsequent increased proportion of male births it is particularly important to relate the incidence of diabetes in the last thirty years to the population at risk and this has been done by standardising the figures against the Census figures for the West Midlands in 1931, 1951 and 1961 and using the Registrar-General's estimates for the intervening five year periods. Fig. 3 shows that the trend suggested by the crude figures is equally present after they are standardised.

In Table 3 the patients are divided into four age groups at diagnosis, omitting those under the age of twenty who are too few for analysis. The standardised

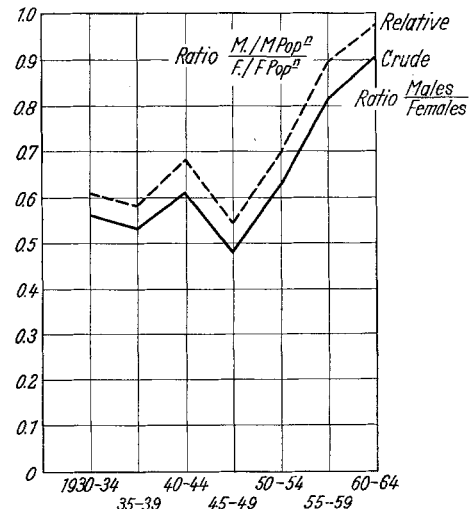


Fig. 3. Ratio of Men to Women by Year of First Attendance Crude Ratio & Ratio of Relative Incidence

Table 3. Ratio of the Relative Incidence of Men to Women (M/F) for each Age Group at Diagnosis

Year	Age Group at Diagnosis			
	20-34	35-49	50-64	65-79
1930-34	1.07	0.59	0.51	0.50
1935-39	1.60	0.69	0.31	0.54
1940-44	1.57	0.72	0.46	0.69
1945-49	1.54	0.65	0.44	0.38
1950-54	1.80	0.96	0.59	0.59
1955-59	1.75	1.47	0.86	0.74
1960-63	1.13	1.78	0.96	0.78

The figures have been standardised for the population at risk in each age group in the different years either by using the Census Figures for the West Midlands in 1931, 51 and 61 or the Registrar-General's Estimates for the intervening years.

M/F ratio is calculated for different ages for each five year period since 1930. Up to 1949 there is no significant change, but after 1950 there is an obvious and striking increase of the M/F ratio in the age group 35-49 and a highly significant increase at the greater ages. Fig. 4 shows that these increases began in each case between 1950 and 1954.

The results suggest that since 1950 the number of men developing diabetes has increased more rapidly than that of women but it is not possible to say with certainty whether there has been a relative increase in the male rate or a relative decrease in the female rate.

Assuming first that the male rate has gone ahead this could be due either to more frequent diagnosis of diabetes in men or to a real increase in the number of men developing diabetes. The former possibility is not without attraction. The use of routine medical examinations for life insurance of employment has extended considerably in recent years and applies to men more than women. Moreover there is reason to believe that routine testings of a normal population will disclose abnormal tolerance in men and women equally in the age group 30-49, but three times more often in men than women in the age group 50-69⁹. Therefore an

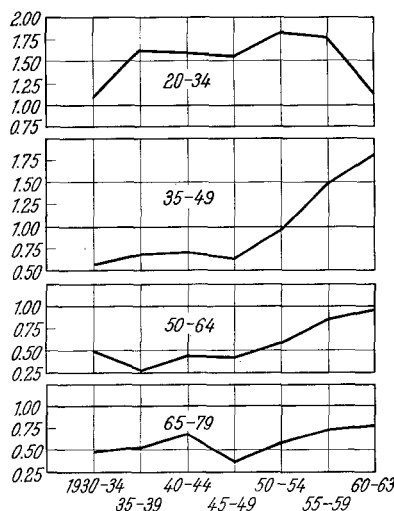


Fig. 4. Change in Ratio of Incidence of Men to Women - by Age Group

increase of routine testing would be expected to produce an increase in the proportion of cases of mild or subclinical diabetes in males. There is some evidence that this has not in fact occurred. Table 4 shows that the mean blood sugar level (taken at 2-3 p.m.) at the first attendance for patients aged 40-49 at diagnosis has not altered between 1945-1949 and 1960-1962, while Table 5 shows that in the same age group the proportion of men with presenting symptoms of diabetes is also unchanged. These statistics confirm a clinical impression that the character of diabetes in men seen at the Clinic has not altered in the last few years.

If the increase in the number of men is a real one the explanation is not obvious. Men have become more idle physically with increasing mechanisation of industry and the use of motor cars and might be expected to wax fat. There is evidence that in the U.S.A. the average weights of men have increased during the last thirty years, but this increase has been only of the order of 2-4 lbs. for men of average height and we have no data for the prevalence of really gross obesity which might play a significant part in the aetiology diabetes. In our Clinic records the recollected maximum weight is stated but this figure has not been regarded as sufficiently reliable for use as evidence particularly as the time interval between the peak of body weight and the diagnosis of diabetes varies greatly. The body weight at diagnosis is sufficiently accurate and in Table 6 the mean figures of the period 1945-1949 are compared with those for 1960-1962 and show no significant change. While it is true that

Table 4. Mean Blood Glucose at Diagnosis Mean and Standard Error for Men and Women Aged 40-49

	1945-49	1960-62
	Men	327 ± 14 (68)
Women	278 ± 8 (86)	286 ± 8 (77)

The figures in parenthesis are the actual number of cases which were a random sample.

Table 5. Percentage with Diabetic Symptoms at Diagnosis Aged 40-49

	1945-49	1960-62
	Men	63 (68)
Women	78 (95)	66 (86)

The figures in parenthesis are the actual number of cases selected at random.

Symptoms are defined as thirst, polyuria, weight loss or pruritus vulvae taking the patient to the doctor and leading to diagnosis.

Table 6. Diabetics exceeding 95th Centile Weight (Normal Standards from KEMSLEY⁶) Aged 40-49 at Diagnosis

	Men		Women	
	45-49	60-62	45-49	60-62
No.	13	47	19	22
Total	68	198	95	113
Percent	19	24	20	19

The cases were selected at random.

the highest weight before diagnosis is a more significant measure of the influence of obesity on the incidence of diabetes it is not easy to imagine that the relation between maximum weight and weight at diagnosis has altered significantly during the last fifteen years. If anything, the increasing use of routine urine tests should have led to the earlier diagnosis of diabetes and therefore to a higher mean weight at diagnosis.

If the change in the M/F ratio is due to a decline in the number of women presenting with diabetes this could hardly be due to the condition being less often diagnosed in them than formerly and this brings us to the final possibility — a genuine fall in the female incidence. We have reasons for considering this seriously. There is already a hint of it in the mortality figures for the U.S.A. which show a fall of 16 per cent in female deaths from diabetes between 1950—1959, whereas the male rate remained steady. We know that the rise in female mortality from diabetes occurred at an earlier date in the U.S.A. than in other countries so that the M/F ratio for mortality fell below 1.0 as early as 1914. Perhaps the reverse trend is also appearing earlier in the U.S.A. and will be followed by similar results in the death rates for diabetes for England and Wales.

Table 7. *Estimated Completed Fertility in Great Britain Marriages under 45 years of age only*³

Date of Marriage	Total Number of Live Births per Woman
1870—79	5.8
1880—86	5.3
1890—99	4.3
1900—09	3.4
1910—19	2.7

Two explanations for a fall in female incidence are attractive. First, obesity may be out of fashion in this sophisticated age. Middle-aged women are more careful of their appearance and there is evidence that the average weight of women in the U.S.A. is consistently less than 40—50 years ago. However, the decrease for reported women aged 45 is only 2—3 lbs. and allowing for the lighter clothes of to-day this is not likely to be significant. Secondly the effect of changing parity has to be considered. There is reason to believe that in this country at least there is a close association between the parity of a woman and her chance of developing diabetes in later life^{8, 2}. Therefore the decline in the average number of children in a family which has undoubtedly occurred since the last century might well be followed by a fall in the incidence of diabetes in women. GLASS and GREBNICK³ in 1954 produced fertility rates for marriages since 1870 and Table 7 shows the number of live births per woman for each decade from 1870—1910. It appears that there was a very significant change in fertility between 1880—1886 and 1910—1919, the number of live births per woman falling from 5.3 to 2.7. These data include only women

who were under 45 years of age at marriage and therefore those who were married in 1880—1886 would have reached the age of maximum incidence of diabetes (50—75 years) in 1910—1919 and shown their influence on mortality about 10 years later. Those who were married in 1910—1919 would have reached the maximum incidence of diabetes in 1940—1949 and of mortality in 1950—1959. As parity declined by half between these two groups a very obvious fall in the female incidence between 1910—1919 and 1940—1949 would be expected if parity were the only factor concerned in the incidence of female diabetes. There is no evidence that such a decline occurred and much to suggest that the number of women developing diabetes increased while the M/F ratio fell to its lowest point in 1945—1949.

No satisfactory explanation has been offered here for the recent increase in the M/F ratio of new cases of diabetes. The failure to identify any environmental factor which could have affected one sex more than the other so as to produce this change leads us to the same negative conclusion as HARRIS and MACARTHUR⁴ in 1951 when they drew attention to the relative increase in the female incidence which was then taking place. One may repeat their warning that it is necessary to show considerable caution in applying formal genetical analysis to data collected in periods of comparatively rapid change.

References

- BOUCHARDAT, A.: *De la glycosurie ou diabète sucré*. Paris (1875).
- FITZGERALD, M. G., J. M. MALINS, D. J. O'SULLIVAN, and M. WALL: The effect of sex and parity on the incidence of diabetes mellitus. *Quart. J. Med.* **30**, 57—60 (1961).
- GLASS, D. V., and E. GREBNICK: The trend and pattern of fertility in Great Britain. (Papers of the Royal Commission on Population) H.M. Stationery Office. London, p. 135 (1954).
- HARRIS, H., and N. MACARTHUR: Changes in sex incidence of diabetes mellitus (1912—1947). *Ann. Eugen.* **16**, 109—118 (1951).
- JOSLIN, E. P., H. F. ROOT, P. WHITE, and A. MARBLE: *Treatment of Diabetes Mellitus*. London 10th edit., Henry Kimpton p. 33 (1959).
- KEMSLEY, W. F. F.: Body weight at different ages and heights. *Ann. Eugen. Lond.* **16**, 316—334 (1952).
- PAVY, F. W.: Introductory address to the discussion on the clinical aspect of glycosuria. *Lancet* **2**, 1033—1035 (1885).
- PYKE, D. A.: Parity and the incidence of diabetes. *Lancet* **1**, 818—821 (1956).
- Report of a Working Party appointed by the College of General Practitioners. Glucose tolerance and glycosuria in the general population. *Brit. Med. J.* **2**, 655—659 (1963).
- SAUNDBY, R.: *Lectures on diabetes*. John Wright & Co. Bristol. p. 30 (1891).
- STOCKS, P.: Diabetes mortality in 1861—1942 and some of the factors affecting it. *J. Hyg., Camb.* **43**, 242—247 (1944).

Dr. J. M. MALINS
Diabetic Clinic
General Hospital
Birmingham 4/England