the observed survival experience of the study population is identical with that of the standard population. A relative survival of less than 100 indicates that factors other than age are causing the study population to live a shorter than expected amount of time. In part the use of measures of relative survival corrects for discrepancies in the age distribution; however, if relative survival is a function of age, the relative survival approach will not totally account for age differences between the groups and adjustment for age will be necessary.

In the analysis which follows relative survival was considered both for all causes as well as for those specifically due to cardiovascular diseases. Because the cause of death used in this study was not always what was specified on the death certificate as the underlying cause of death, the value of relative survival with respect to cardiovascular mortality is only approximate. However, since the determination of the cause of death was made prior to the determination of treatment group, discrepancies between the "true" relative survival and that indicated by the results of this study may be assumed to be present equally in all treatment groups. Further, since in 95% of the cases, the cause of death was identical to that on the death certificate, the problem is of minor importance.

The non-random allocation of individuals to treatment increased the likelihood that the distribution of risk factors, at entry, especially ones associated with disease severity was not similar in each of the groups. In order that the survival results be more comparable between the groups as well as more comparable with those presented by the UGDP, analysis of survival was restricted to individuals with newly diagnosed diabetes. (known duration of diabetes less than or equal to one year prior to entry to the study). This reduced the size of the insulin group to 789, the tolbutamide group to 702 and the diet group to 676.

The major difficulty encountered in analyzing these data was the high degree of confounding between treatment and blood glucose. Because of the non-experimental nature of this study, patients received treatment according to the severity of their diabetes—persons with the mildest diabetes were treated by diet alone while persons with severe diabetes required insulin. The best measure of both the severity of the disease and the degree of control obtained was the mean blood glucose for an individual during the duration of his Joslin Clinic visits. As was expected, the levels were highest for persons treated with insulin and lowest for those controlled by diet alone. Because of the deleterious effect of poor control or high blood glucose values on survival, differentiation of the treatment from those of blood glucose was desirable. However, the large degree of confounding between these two factors made such a distinction difficult.

RESULTS

Description of the study population

The distribution of the "clinical" characteristics of this population by treatment and sex are given in Table 1. Of the total 2167, 1065 or 49.1% were females. The proportion of females varied by treatment: 417 of 789 (52.9%) of people on insulin, 335 of 702 (47.7%) of those on tolbutamide and 313 of 676 (46.3%) treated by diet alone were female. The mean age of the population was 53.4 years and the mean ages in the three groups were similar to the overall mean although the tolbutamide group was slightly older than either of the other two groups. The mean age for females was consistently higher than that for males. Although the mean ages were similar between the groups, the distribution of those ages were different. For patients on tolbutamide 46.5% of those on insulin and 59.6% treated by diet alone were under 60. Both males and females exhibited a similar trend in the distribution of age at entry to the study.

The severity of the diabetes at the time of entry to the study was controlled to some extent by considering only patients with known duration of diabetes= one year at the time of entry. However, this control was not sufficient to assume that the groups be comparable with respect to disease severity at entry. As was stated previously the groups differed in the levels of the mean blood glucose. For persons treated by diet alone it was 101.8 mg/100 ml, for persons on tolbutamide it was 131.9 mg/100 ml, and for those on insulin 169.3 mg/100 ml. In addition, the distribution of blood glucose values was quite different in the three groups; the values in the diet group were concentrated at the lower end of the scale, the tolbutamide values in the middle ranges and the insulin values at the upper end. The distribution of values by sex showed similar trends; and in general males had slightly lower values than females.