OCCUPATIONAL ASPECTS OF DIABETES

A thesis presented to the Faculty of Medicine, University of Glasgow for the degree of Doctor of Medicine by

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ACKNOWLEDGEMENTS

My interest in diabetes began when I worked as a Senior House Officer with Dr. RJ Weir, Gartnavel General Hospital, Glasgow. As a registrar this interest increased in my work with Dr. BM Frier, Gartnavel General Hospital. When I entered the field of occupational medicine I was encouraged to pursue research in diabetes with special reference to problems of employment by Dr. IS Symington, Director - Occupational Health Service, Greater Glasgow Health Board.

I am responsible for the work presented in this thesis including statistical and epidemiological methods. I am grateful to Mr. WH Gilmour and Professor AJ Hedley for their instruction in these fields. In addition, I wish to thank Dr RA Welch for supplying a copy of his M.Sc. thesis; Dr AD Watt and Dr G Sharp for their advice ; Dr BM Frier for allowing me to study patients under his care; Mrs Jane Rossiter of the Society of Occupational Medicine for supplying the names of occupational physicians surveyed; Miss V Louden for secretarial assistance; Mrs Lewis, Librarian, Faculty of Actuaries, Edinburgh and the staff of the Medical Library, Southern General Hospital who helped provide references reviewed in this thesis, and Mrs Melanie Scott who translated references from German. Finally, I am grateful to my wife, Moira, for her support and encouragement during the preparation of this work.

SUMMARY

This thesis is a report of six studies on diabetes and employment. Four of these studies (Studies 1 - 4) relate to insulin treated diabetic patients registered with the diabetic clinic, Gartnavel General Hospital, Glasgow who were surveyed between January and April 1987. The fifth study is a survey of occupational physicians employed in major United Kingdom businesses. The final study is an analysis of early retiral cases from Strathclyde Regional Council during 1987.

1. Unemployment among insulin treated diabetic patients in Glasgow, Scotland.

The first study is a survey of the prevalence of unemployment among insulin treated diabetic patients (IDDs). The unemployment rate for IDDs registered with the diabetic clinic was compared to that of the City of Glasgow. One hundred and three patients were men, mean age 36.5 +/- 12.2 (SD) years and 78 were women, mean age 36.9 +/-12.3 (SD) years. Ninety-three (90.3%) men and 52 (66.7%) women were economically active. Of those economically active 28 (30.1%) men and 8 (15.4%) women were unemployed. An age adjusted rate of 26.8% for men and 14.5% for women compared well with the rates for men (28.4%) and women (13.8%) at the time of the study in the City of Glasgow. The 95% confidence interval for male diabetic unemployment does not include the population rate

suggesting significantly less unemployment in this group.

2. A case control study of sickness absence among insulin treated diabetic workers.

The second analysis investigates the effect of diabetes on sickness absence using company sickness absence records. Fifty-nine IDDS of mean age 36.2 +/- 11.3 (SD) years with median duration of diabetes of 10 years (interquartile range 4 - 17 years) were compared to 59 controls of mean age 36.4 +/- 11.3 (SD) years. IDDs had a similar frequency of absence to controls (mean spells: 2.0/year and 1.7/year respectively). Greater numbers of working days lost (13.3 days/year vs. 5.7 days/year; $p<0.03$) and greater average length of spell of absence (5.6 days vs. 2.5 days; $p<0.02$) occurred in the diabetic group. Males, manual workers and those under 40 years of age accounted for significant absence, though absence was also greater for diabetic workers than controls in the other groups. Twenty-one diabetic workers were absent for 10 or more days; only 10 of the controls had this level of absence in 1986 ($p<0.05$). Absence for respiratory (4.4 days/spell vs 2.8 days/spell) and non-respiratory (5.4 days/spell vs 3.7 days/spell) reasons was greater on average for IDDs than controls. Sickness absence of IDDs is greater than that of matched controls.

3. Sickness absence and control of insulin treated diabetes.

The third study examines the effect of control of diabetes as assessed by glycosylated heamoglobin on sickness absence. The sickness absence records for 1986 were obtained for 63 employed diabetic patients who had HbA1 measurements during that year. One subject whose absence was associated with attempts to improve control because of pregnancy was excluded from the analysis. Fifteen had good control (HbA1 8.5% or less) and 47 had poor control (HbA1>8.5%). The groups were similar for sex, age, duration of diabetes and occupational grading. The distribution of sickness absence showed greater frequency of absence (median spells 2.0 vs. 0, $p<0.05$),greater numbers of working days lost (4.0 days/year vs. 0 days/year, $p<0.02$) and greater average duration of absence (2.3 days/spell vs. 0 days/spell, $p<0.04$) among those diabetic workers with poor control compared to those with good control. Because some individuals with poor control had no absence HbA1 measurement cannot be recommended on its own to identify those workers who will be absent from work. Its use may lie in indicating a level below which sickness absence is minimised.

4. Employment Status and control of insulin treated diabetes.

The fourth study compares the effect of employment

status on control of diabetes as assessed by mean HbA1. One hundred and seven employed IDDs (37.3 +/- 11.4 years) and 36 unemployed IDDs (38.0 +/- 12.3 years) had HbA1 measurements performed during the period January 1986 to April 1987. Median HbA1 among employed IDDs was 9.55% (interquartile range 8.8%-10.4%). Among unemployed IDDs median HbA1 was 9.18% (7.65%-10.43%) ($p=0.18$). 8.4% of employed diabetics had a normal HbA1 wheras 30.6% of unemployed diabetics had this level of control ($p<0.01$). Non-manual unemployed diabetic subjects had significantly lower HbA1 levels than those in employment ($p<0.01$). No such difference was noted for manual diabetic subjects. Employment status may be a factor in determining control of diabetes with certain employed subjects having poorer control than those not employed.

5. Employment and diabetes - a survey of occupational physicians.

The fifth study reports the results of a postal survey of 40 occupational physicians who were asked to supply information on numbers of diabetic workers known to be employed within their companies. In addition information on restrictions placed on such workers and on any review which the physicians performed was requested. The prevalence of known diabetes among workers was 7.5/1000. the prevalence of insulin treated diabetes was 2.6/1000 and other diabetes was 4.9/1000. The figure for insulin treated diabetes is lower than that expected from

population studies (2.8 - 3.9/1000). The restrictions placed on insulin treated diabetic workers in employment include shift work, work at heights, dangerous areas, driving duties, civil aviation, emergency teams, offshore oil work, and work overseas. No physician performed medical review of diabetic workers. Certain companies within the chemical, oil, steel, confectionary and drinks industries had lower than expected numbers of diabetic workers and merit further study.

6. Diabetes and Ill-Health Retiral.

The aim of this study was to investigate the morbidity associated with diabetes as assessed by early retirement on the grounds of ill-health. A retrospective survey of local government employees who attended Greater Glasgow Health Board, Occupational Health Service during 1987 for assessment of suitability for early retirement occurred. Five hundred and five medical retirals occurred in 1987. Two hundred and ninety nine were male and 206 female. Thirty (5. 94%) subjects had diabetes of whom 4 were insulin treated. Twelve of these subjects retired because of diabetes and diabetic complications; 10 retired because of the former and other pathology and 8 retired because of other pathology but had diabetes incidentally at the time of assessment. The expected prevalence of diabetes in the 20-69 year old group from recent population studies is 9.2 - 10.1/1000 population. The figure of 59.4/1000 is significantly greater than this. Excluding those who had diabetes incidentally at the

assessment reduces this figure to 43.6/1000 which remains significant. Morbidity from diabetes as assessed by numbers of retirals with diabetes indicates that this is greater than expected.

PUBLICATIONS

1) WACLAWSKI ER. Employment and diabetes: a survey of the prevalence of diabetic workers known by occupational physicians, and the restrictions placed on diabetic workers in employment. Diabetic Medicine 1989;6: 16-19.

2) WACLAWSKI ER. Diabetes in industry - a survey of occupational physicians. Diabetic Medicine 1987;4:577.(Abs.)

3) WACLAWSKI ER. Unemployment and insulin-dependent diabetics in Glasgow, Scotland. Diabetic Medicine 1988;5(Suppl 1):27.(Abs).

4) WACLAWSKI ER. Employment status and control of insulin-dependent diabetes. Diabetic Medicine 1988;5 (Suppl 2):31-32.(Abs.)

5) WACLAWSKI ER. A case-control study of sickness absence among insulin-dependent diabetic workers. Diabetic Medicine 1988; 5 (Suppl 2):31.(Abs)

6) WACLAWSKI ER. Sickness absence and control of insulin-dependent diabetes. Diabetic Medicine 1989; 6: (in press).(Abs)

7) WACLAWSKI ER. The employment of diabetics. Practical Diabetes 1989 (letter - in press).

8) WACLAWSKI ER. Sickness absence among insulin treated diabetic employees.Diabetic Medicine 1989 (accepted for publication).

In addition to the above published articles and abstracts information based on this thesis has been presented at the following meetings of learned societies:

1) WACLAWSKI ER. Diabetes in industry - a survey of occupational physicians. British Diabetic Association, Autumn meeting, 1987.

2) WACLAWSKI ER. Sickness absence and insulin-dependent diabetes. Society of Occupational Medicine, Scottish Group, March 1988.

3) WACLAWSKI ER. Unemployment and insulin-dependent diabetes in Glasgow, Scotland. British Diabetic Association, Spring meeting, April 1988.

4) WACLAWSKI ER. Employment status and control of insulin-dependent diabetes. British Diabetic Association, Autumn meeting, September 1988.

5) WACLAWSKI ER. A case-control study of sickness absence among insulin-dependent diabetic workers. British Diabetic Association, Autumn meeting, September 1988.

6) WACLAWSKI ER. Diabetes and employment. Society of Occupational Medicine, 147th meeting, October 1988.

7) WACLAWSKI ER. Sickness absence and control of insulin-dependent diabetes. British Diabetic Association, Spring meeting, April 1989.

8) WACLAWSKI ER. Employment and diabetes. Strathclyde Diabetic Group, October 1989.

Papers included in this thesis were used in support of my application for Membership of the Faculty of Occupational Medicine.

INTRODUCTION

There have been many improvements in the care of diabetes. New regimes of insulin and new methods of delivery of insulin have allowed the physician to control insulin dependent diabetes better and have allowed for improvement in quality of life for the patient. Home blood glucose monitoring allows the patient to become involved in maintaining good control. Glycosylated haemoglobin measurement allows the clinician to objectively assess control over the preceding weeks. Treatment of certain complications has also improved outlook with laser photocoagulation helping diabetic eye disease, and dialysis and transplantation improving life for those with renal disease.

Despite these trends some difficult areas remain. Individuals experience problems with employment due to diabetes, its treatment and complications. Clinicians who care for diabetic patients have little knowledge of the legal reasons for restrictions which are placed on diabetic workers and may not be able to advise patients appropriately.

This thesis is concerned primarily with aspects of employment and diabetes. It is in two parts. The first is a review of the literature, and the second is a report of six studies.

LITERATURE SURVEY

Introduction

This literature survey will review sickness absence and diabetes and other indicators of morbidity from diabetes , prevalence of diabetic workers employed, restrictions placed on diabetic workers, and unemployment rates among diabetic patients. A review of glycosylated heamoglobin measurement completes the survey.

Sickness absence and diabetes

The first study of sickness absence and diabetes was performed 17 years after the introduction of insulin by Lawrence & Madders (1). Up until that time the authors noted that diabetics suffered great difficulty in work and obtaining employment because of public misapprehension that they were invalids. 100 unselected employed diabetics attending the clinic at King's College Hospital, London were studied. Seventy five per cent were male, and 73% were under 40 years of age. Eighty three were receiving insulin. The duration of employment was 1-19 years with a mean of 5 years. 77% lost no time from work because of their diabetes after the initial stabilisation. Fifty five per cent lost some time from work due to illness unrelated to their diabetes. Unfortunately this study has no comparison with a control group of non-diabetics and relied on the subjective recall of absence with no objective quantification of absence.

As part of a larger study of physically impaired workers in manufacturing industries in 109 different plants, the U.S. Department of Labor investigated the work record of diabetics in 99 of these plants. Each diabetic worker was matched with one to 3 non-diabetic workers - facts taken into consideration included sex, age, incentives, hazards, shift and experience. The study compared 144 diabetics with 244 matched controls. The total absenteeism rate among diabetics was 4.4 days/100 working days as compared with 3.1 days/100 working days in the control group. 23.5% of diabetics and 26.3% of non-diabetics had no absences. (2).

Beardwood surveyed 31 companies in Philadelphia. He quoted data on absence from companies whose diabetics had better work records than average. The Philadelphia Electrical Company employed over 7,000 workers of whom 116 were diabetics. Absenteeism was 33% less than average among the diabetics - no indication is given as to whether this is spells of absence or days lost. A small insurance company had 10 diabetics among 350 employees. These diabetics had one absence/102 working days as compared with one absence/50 working days overall. (3). These results are crude indicators as no standardisation for age, sex or occupation is noted.

A survey of diabetics in the Metropolitan Life Insurance Home Office in New York City showed that of 89 diabetics at work only 15% had relatively unsatisfactory

work records. No comparison with non-diabetics was made. (4).

Brandaleone and Friedman (5) compared the sickness absence of diabetics with non-diabetics in a transport system in New York over a 9 month period (February to October 1951). Out of 3,508 employees there were 40 known diabetics of whom 35 were employed during the study period. The absenteeism of these 35 was compared with the total group. Sickness absence in the diabetics was 26.2 days per diabetic compared with 11.8 days per worker in the total group. However, when 2 individuals with long absence (one with tuberculosis, one with a foot ulcer) are excluded the time off for illness in the other 33 diabetics was 10.8 days/employee/year. The authors suggest that this implies that the majority of diabetics are good workers. The groups were not matched for age,sex or occupation which may alter the findings. In addition, no attempt was made to exclude non-diabetics with long absence which may have reduced the severity rate of absence in the non-diabetics and a different interpretation could have been reached.

Weaver and Perret (6) surveyed sickness absence in an oil refinery in Baton Rouge. Of 90 diabetics, 49 did not take insulin. The overall sickness absenteeism for diabetics was 9.8 days/ employee/ year. No comparison with a control group was made and no study of diabetics by treatment occurred. Wade (7) who worked for the same oil company noted that the absence was similar to

non-diabetics at the oil refinery though no figures are quoted to substantiate this.

Diabetics employed by the du Pont Company in America had their sickness absence compared with that of age/ sex/ occupation/ location matched controls for 1956. Out of 90,596 employees 408 were diabetic, 370 being men. The diabetics had a higher frequency rate of absences (56.6 spells/100 persons) compared with the controls (47.4 spells/100 persons). In addition, the mean and median number of days of disability were higher, and a significantly greater number of diabetics were disabled for 10 or more days during the year studied. Only 4.1% of diabetics were absent more than twice suggesting that frequency of absence is a problem concentrated in a small number of diabetics. In this study the production employees who were diabetic accounted for the significant level of absence. More frequent absences occurred in those under 50 years of age, and more prolonged disability in those over 50 years. The higher overall frequency of sickness absenteeism among diabetics was primarily due to their diabetes. Other illnesses occurred at similar rates to the control population, though diabetics were disabled for significantly longer from respiratory conditions (25.4% of diabetics and 10.6% of controls were disabled for a week or longer) (8).

Wyshek, Snegireff and Law (9) compared sickness absence among 56 diabetics with controls and also cases of heart disease. The absence rate of diabetics was 12 days/

year/ subject which compares with 8.3 days/ year/ control. First day absence was recorded in all cases. The experience of diabetics was more favourable than that of the "cardiacs".

Apart from Lawrence and Madders the other well known work on sickness absence in the United Kingdom was by Jackson (10). He reported the results of a questionnaire sent to all members of the British Diabetic Association in 1957. Only 18.5% of the membership replied and only 15.7% of the total membership's replies were applicable. The information referred to 3,430 diabetics. 46.2% of males and 34.6% of females had no time off work. 15.8% of males and 19.8% of females had time off due to diabetes of an average of one week each and 1.13 weeks respectively. For time off due to other causes 30.9% of males were away for an average of 1.44 weeks and 40.5% of women for 1.35 weeks. These figures were based on the recall of the diabetics which may have produced a bias as may the greater numbers of members in the higher social classes. In addition, no comparison with a control group of non-diabetics was made which limits interpretation of this data.

Nasr, Block & Magnusson examined the sickness absence records of 213 diabetics and an equal number of matched controls at the Ford Motor Company, Rouge Plant. Because absences of less than 5 days were not routinely reported to the Medical Department only absences of 5 or more days were included in the analysis. They further

analysed the absence of black and white diabetics, though the black diabetics were younger overall than the white. There was a 2.25 fold increase in days absent between white diabetics and controls and a 3.2 fold increase between black diabetics and controls. Absences of more than 60 days per year were six times more frequent in the diabetics. The lack of information on absences of less than 5 days is a limitation of this study.(11).

Pell and D'Alonzo reviewed the sickness absence pattern of the du Pont workforce and the diabetics employed by the company again in 1963. They compared 622 diabetics and 626 matched controls. They again showed that the frequency of absence in general was worse among diabetics (107 spells/100 diabetics vs 74 spells/100 controls). For those with more than one absence the median number of days disabled was 10.5 days for diabetics and 6.8 for controls. In addition, following the onset of disability the diabetics returned to work at a slower rate than non-diabetics. There was somewhat more sickness absence among insulin treated diabetics than non-insulin treated diabetics. Both production and salaried diabetics had greater frequency and duration of absenteeism. A substantial proportion of the excess absenteeism was related to the diabetes in terms of episodes and days of disability (12).

Emara examined employment problems in 100 male diabetics employed in transport work in Egypt. He noted that 62% of the diabetics were absent for less than 1 week

per year and 16% were absent for greater than 1 month per year. No comparison with a control group of non-diabetic workers is made and little interpretation can be made of this information without this other data (13).

Moore and Buschbom studied the absenteeism of 108 diabetics in a Washington company and compared them with 291 non-diabetics. The mean sickness absence for diabetics was 6.3 days/year. In every age group the absence rate was less than that of non-diabetics. There was less absenteeism among insulin dependent diabetics than those not requiring insulin (4.89 days/year and 7.99 days/year respectively) (14). This last finding is likely to be due to the different age structure of the two groups. The diabetics were only matched to controls by age. No matching by sex or occupation occurred which may alter the findings.

Ocumares, Blasco and Albarran studied the sickness absence in a factory in Madrid with 11,453 workers in 1978 and 1979. There were 11 insulin treated diabetics and 76 non-insulin treated diabetics. The mean proportion of working days lost was highest in the insulin treated group (10.1% of working days lost in 1978). The non-insulin dependent workers also had a higher proportion of working days lost than controls though this was less than those requiring insulin (6.08% and 5.28% respectively in 1978). It was noted that less than 1% of absenteeism was certified as due to diabetes in those with the condition (15). Interpretation is limited by the small number of

diabetics receiving insulin. In addition no matching of controls to diabetics occurred.

The most recent published British study by Welch identified diabetics working for the Post Office and compared sickness absence over a 5 year period (1980-1984) with age/sex/grade matched controls. During this period diabetics had more days absent (17.1 days/person/year) than controls (9.4 days/person/year). The diabetics also had more spells of absence than controls - 3.01 spells/person/year and 2.22/person/year respectively. 19% of the diabetics' absences were certified as due to their diabetes. The insulin treated diabetics (n=35) had more spells of absence (median 12 vs 9) but less days absent (median 58 vs 84) than non-insulin treated diabetics(n=15). The insulin treated group was younger than the non-insulin treated workers (16). No comparison between these sub-groups and matched controls occurred to identify whether one sub-group was associated with the excess absence noted.

There are a number of criticisms of some of the above studies. Those without a control group cannot be interpreted as showing a favourable level of absence (1,4,6,10,13). Where results have been shown to suggest such a situation other problems have been noted such as selective presentation of good results which have not been matched properly for variables such as age and sex (3). Others have not matched the data for control subjects by these variables (15). Absence of data on all time lost

from work is another factor which limits interpretation of the work by Nasr, Block and Magnusson (11). The only study to suggest a favourable absence level which had controls was matched by age only (14). Fuller matching by sex and occupation could alter this finding.

The other studies with matching of controls to diabetics by at least age, sex and occupation have all shown greater absence. Most of this work is from America (2,8,9,12). Only one study with such matching has occurred in the United Kingdom (16) which supports the view that more absence occurs in diabetic workers. There is some evidence that insulin treated diabetics account for this excess of absence from the work of Pell & D'Alonzo (12) and Ocumares, Blasco and Albarran (15).

There is a need for further study of this problem as it relates to diabetic workers in the United Kingdom. Study of diabetics receiving different treatments would help to identify whether a sub-group is responsible for the excess noted in previous studies which would allow for intervention to improve this situation to be targeted at those who require it.

Other indicators of morbidity from diabetes

Apart from the sickness absence data noted above a number of other factors can be used to indicate the morbidity associated with diabetes. Such information includes nationally published hospital statistics for

admissions due to diabetes and the duration of such admissions (17).

Studies have been published on duration of admission for a variety of operations and conditions. Diabetic patients have been shown to have an increased risk of stroke (18), lower extremity amputations (19) and myocardial infarction following sugical procedures such as carotid artery surgery (20) and renal transplantation (21). Following transplantation the diabetic recipient is in hospital for one week longer on average and accumulates twice the in-patient stay of the non-diabetic over the next three years (22). The morbidity post-op is associated with age and the presence of other diabetic complications (23).

For other surgical procedures such as vascular, abdominal and hip surgery morbidity in one centre is similar to that of non-diabetic patients (24,25,26). The morbidity from gall-bladder surgery is overall similar but the presence of associated complications of diabetes can increase morbidity and mortality (27). Post-operative infections are more common in diabetic patients undergoing hysterectomy (28), caesarian section (29), cholecystectomy (30,31) and liver resection (32).

Therefore acute post-operative complications such as infection and myocardial infarction may increase hospital stay. The presence of associated complications can increase morbidity following transplantation and

certain abdominal procedures. These factors and the complications of diabetes such as vascular disease and renal disease can affect the ability of the diabetic worker to attend work. This is reflected in the excess sickness absence noted in the previous section. Such absence has been shown to be a major economic cost to society (33) in association with the lost production due to premature death associated with both acute and chronic complications (34,35,36,37,38,39) and the worse prognosis associated with ischaemic heart disease (40,41,42). This suggests a significant gain to society is possible from improved control.

The only other indicator of morbidity of direct relevance to occupational health is early retiral statistics. Only one study has been published on this subject by Welch. He showed a prevalence of diabetes in retirals of 14/1000 which was not compared to a population prevalence (43). In the Post Office the prevalence of known diabetes is 4/1000 suggesting an increased morbidity as assessed by this method (16).

Further work is required to investigate retirals due to ill-health in another working group. In addition more information could be obtained from hospital discharges for a variety of major conditions and operations.

Prevalence of diabetic workers employed

Few studies have been performed to determine the prevalence of diabetes among those employed. Indirect evidence that adequate numbers of diabetics are employed is present in studies of unemployment among diabetics. However, unemployment statistics exclude those too infirm to work and may not reflect the numbers in employment because of this. Prevalence data is available from some of the studies of sickness absence. These have been related to the total population prevalence of diabetes which limits useful interpretation because of the increase in prevalence of diabetes with age. Including the elderly results in a greater prevalence than that noted in a population restricted to those of working age.

Only once has a survey of employers been published to demonstrate the prevalence of diabetes. This work related to American employers. Brandaleone & Friedman performed a postal survey of 348 companies. Only 63 replies were useful and only 39 contained information on numbers of diabetic workers. These 39 companies employed 286,622 workers of whom 1,485 were diabetic - a prevalence of 0.5%. In their associated study of sickness absence the authors noted that 40 diabetics were known from a total workforce of 3,508 (prevalence 1.1%) (5).

Weaver & Perret (6) knew of 90 diabetics in a workforce of 7140 (1.3%) while Wade (7) found in a larger survey in the same company 266 known diabetics out of

20,446 (1.3%).

Pell & D'Alonzo surveyed the number of diabetics on 2 occasions in the Du Pont Company. The first study (8) identified 408 diabetics in a workforce of 90,596 (0.45%). 7 years later (12) they noted 662 diabetics in a current workforce of 96,000 (0.7%). This apparent increase may have been related to the increased age of the workforce or to a real increase in diabetes. The method of aquiring the data was similar.

Moore & Buschbom (14) found 108 diabetics in a workforce of 8,000 (1.4%). Ocumares, Blasco & Albarran (15) studied a workforce in Spain and noted 87 diabetic workers in a population of 18,528 (0.5%).

In a study of diabetes in a Postal Region of the United Kingdom, Welch (16) found 50 diabetics out of 12,300 workers (0.4%).

Variation exists in these studies in the manner in which knowledge of diabetes was obtained and this is reflected in the prevalence figures. The higher ratio of doctor: worker in the du Pont Company (1:800) allowed for annual examination of each worker with information on diabetes gathered prospectively over one calendar year. Accurate data can therefore be accepted. Within the Post Office study the diabetic workers were identified from personnel records and from recall of attendance at the medical department. Other diabetics may have been employed

but were unknown to these departments, accounting for the relatively low prevalence.

Knowledge of the number of diabetic workers in employment is useful for a number of reasons. It acts as a direct indicator as to whether overall there is any bias against diabetics seeking employment. A low figure may also occur because of increased morbidity from diabetes resulting in premature retiral. Information on numbers of early retirals should be related to numbers in employment to indicate whether there is increased morbidity. Study of employment problems among diabetic workers could be performed where the diabetic workers are known. Assessment of ways of improving control of diabetics employed could also be performed where the diabetics are known.

Restrictions on diabetic workers

Diabetic patients may require to be restricted from working in certain positions. This is an area where little is generally known of the restrictions which occur. There are some physicians who consider that people with diabetes can do practically anything (44,45). This view is made without knowledge in the United Kingdom of relevant legislation such as the Health and Safety at Work Act (46) and the Employers Liability (Compulsory Insurance) Act (47).

Advice on the employment of diabetic patients is

available from the British Diabetic Association (48). Apart from restrictions on driving (HGV,PSV) and those of the armed forces, merchant navy(49) police and fire service the only other restriction noted is that insulin-dependent diabetic patients "should not work in situations where sudden attacks of hypoglycaemia could endanger themselves or others". This is an unsatisfactory statement which without examples can lead to disappointment among diabetic patients who apply for positions without being aware of the nature of restrictions. Specific advice on driving is available in Medical Aspects of Fitness to Drive (50).

More detailed advice is given in the ILO encyclopaedia with regard to restrictions and career advice but is not widely known to those who care for diabetic patients (51). More recently, advice has become available on diabetes and employment in Fitness for Work (52) though the review of sickness absence is more selective than the above section on this subject.

The restrictions placed on diabetic workers in the UK by occupational physicians are not known. In addition no survey of the prevalence of general exclusion of diabetic applicants has occurred. An American study from the 1950s showed that 20 of 63 companies surveyed did not employ known diabetic applicants (5).

Unemployment and diabetes

The presence of diabetes may act as a disincentive to an employer when recruiting staff. The effect of diabetes on employment prospects has been studied previously by using unemployment rates in clinic attenders and members of the BDA.

The BDA study of employment among members showed an unemployment rate in 1958 of 1.04% for men and 1.9% for women (10). At the time of the study unemployment was 1.7% in the United Kingdom (53).

Previous work on this subject has been performed in Glasgow. Unemployment rates were given as a percentage of the total surveyed. However, unemployment statistics are usually limited to those who are economically active and exclude those in full time education, housewives and those too infirm to work. When recalculated the prevalence of unemployment in men was 16.6% and in women was 12.5%. These compare to the general population unemployment of 20.2% in men and 9.5% in women at the time of the study (54). No standardisation for differences in age structure of the clinic attenders occurred.

A study of young insulin-dependent diabetic patients from Liverpool showed a 29% unemployment rate compared to 28% among the non-diabetic population of the same age (55). No indication is given to indicate if the figures relate only to those who are economically active.

One American study has suggested that diabetes is associated with both depression and unemployment. 22 of 35 non-diabetic patients were employed but only 7 of 28 diabetic patients were in employment (56).

Glycosylated haemoglobin

Insulin treated diabetic patients previously monitored their urine to determine their control. This method was found to be unsatisfactory as blood glucose could be abnormal despite negative urinalysis. The introduction of home blood glucose monitoring allowed the patient to have the ability to determine blood glucose using strips which react with blood producing a colour change varying with the level of blood glucose. Meters which read these strips provide more precise measurement than using a visual comparison to the changes demonstrated with various ranges of blood glucose. The recording of the results in a diary can be helpful to the diabetologist but can be used to deceive the physician by manipulative patients (57).

Glycosylated Heamoglobin (HbA1) measurement was introduced in the 1970s as an objective method of assessing diabetic control (58,59,60,61). Despite some concern (62,63,64) it has become established as a measure of control reflecting the blood glucose levels over the preceding 4-8 weeks (57) and correlates significantly with clinic glucose measurements (65).

Recent multivariate analysis has suggested that differences in HbA1 can be seen between the sexes and with increasing age in men and duration of disease in women (66). Others have noted the association with duration of diabetes (55). However, the association with age and duration of disease has not been confirmed by other investigators (67). No effect on HbA1 has been shown among depressed diabetic subjects.(68).

Education has been shown by some workers to result in improved levels Of HbA1 (69). Others have shown that subjects with high HbA1 levels had more intense control of diabetes (70). This may suggest a limitation in the usefulness of HbA1 in assessing the suitability of treatment in the short term as an association between supervision over 20 years and overall prognosis has been shown (71).

No previous study has been performed to investigate the effect of employment status on control of diabetes as assessed by HbA1. No study relating control of diabetes to sickness absence has occurred.

AIMS OF STUDY

The six studies which follow were developed from points raised in the survey of the literature. The first is a study of the unemployment rate in insulin treated diabetic patients. The second is a case control study of sickness absence among insulin treated diabetic workers. The third study tests the effect of control of diabetes as assessed by glycosylated heamoglobin on the sickness absence of diabetic workers. The fourth study examines the possible effect of employment status on control of insulin-treated diabetes. The fifth study surveys the prevalence of diabetic workers known by occupational physicians in industry and the restrictions placed on diabetic workers by these physicians. The final study examines the morbidity associated with diabetes by a retrospective survey of ill-health retirals.

PATIENTS AND METHODS

Four of the six studies presented in this thesis are based on insulin treated diabetic patients registered with the Diabetic Clinic, Gartnavel General Hospital who were surveyed between January and April 1987. These patients were identified prior to the start of each clinic by the investigator who reviewed the case notes of all patients and selected for study all subjects aged 16 to 65 years. Those who attended between January and March 1987 were personally interviewed to obtain information on employment status and willingness to participate in a study of sickness absence and diabetes. Non-attenders were surveyed by post with a reminder letter supplied if no response was received after 6 weeks. In April 1987 subjects were identified by review of case notes as above but were all surveyed by post.

Glycosylated haemoglobin (HbA1) measurements recorded for clinic purposes in the case notes from January 1986 to April 1987 were abstracted. The laboratory analysis had been performed in the Biochemistry Department, Gartnavel General Hospital, Glasgow. HbA1 was measured by electroendosmosis (Ciba Corning Diagnostics Ltd, Halstead,UK). Within batch imprecision of the assay was 3.3% and 2.9% at HbA1=7.1% and HbA1=17.3% respectively and between batch imprecision was 4.5% and 2.8% at HbA1=7.4% and HbA1=17.9%, respectively. In healthy volunteers the mean HbA1 was shown to be 6.3% with a 95% reference interval of 4.9% to 7.8% (88).

Information was obtained from 181 subjects out of 212 surveyed. One hundred and three were men, mean age 36.5 +/- 12.2(SD) years and 78 were women (36.9 +/- 12.3 years).

The first study examines the unemployment rate among those patients surveyed who were economically active and compares this rate to that of the City of Glasgow at the time of the study. Direct standardisation and calculation of 95% confidence intervals for standardised rates (72) are the statistical analyses made.

The second study investigates the sickness absence during 1986 of those diabetic patients surveyed above who were in employment throughout 1986. This absence is compared to age, sex, and occupation matched controls. The analysis is restricted to 59 matched pairs. Statistical analysis is by Wilcoxon Signed Rank test, chi-square test with Yates continuity correction and median test.

The third study compares the sickness absence of 15 diabetic workers with good control (mean HbA1 8.5% or less) to 47 diabetic workers with poor control (mean HbA1 > 8.5%). The groups were so divided to approximate with the lowest quartile of control (n=15) and the other subjects (n=47). Statistical analysis is by Mann-Whitney U test and chi-square test.

The fourth study examines the effect of employment

status on control of insulin treated diabetes as assessed by HbA1 measurement. Employment status was assessed by survey noted above. HbA1 measurement was obtianed from case notes. Statistical analysis is by Wilcoxon Rank Sum Test, chi-square test and Student's t-test (2-tailed).

The fifth study uses information provided by a postal survey of occupational physicians identified by the Society of Occupational Medicine as employed in major UK businesses. This study identifies the prevalence of known diabetes by treatment in the workforces covered by the physicians and any restrictions placed on diabetic workers. Comparison is made to the prevalence of diabetes in recent population studies.

The final study is a retrospective study of subjects attending GGHB OHS for assessment of suitability for retirement on the grounds of ill-health from Local Government departments during the calendar year 1987. The prevalence of diabetes among applicants is calculated and compared to the expected prevalence from recent population studies. Statistical analysis was by indirect standardisation with 95% confidence intervals and Poisson analysis.

STUDY 1

STUDY 1: UNEMPLOYMENT AMONG INSULIN TREATED DIABETIC PATIENTS IN GLASGOW, SCOTLAND

Introduction

In recent years Glasgow has undergone major economic change resulting in a high general level of unemployment. Previous work within this area has shown that diabetic patients had similar unemployment rates to non-diabetic patients (54). Further changes have occurred with higher unemployment than at the time of the previous study. A recent American study has shown a relationship between diabetes and unemployment (56).

The presence of diabetes may act as a disincentive to an employer when considering employing staff. This may be more important when unemployment is high and may be reflected in unemployment rates.

The aim of this study was to determine the level of unemployment among insulin treated diabetics (IDDs) attending the Diabetic Clinic, Gartnavel General Hospital, Glasgow.

Methods

The employment status of IDDs of working age was ascertained at interview in clinic attenders and by

postal survey of non-attenders between January and March 1987. All subjects identified in April 1987 by case note review were surveyed by post. A reminder letter was supplied to subjects surveyed by post if no reply was received after 6 weeks.

The prevalence of unemployment was compared to that of the City of Glasgow at the time of the study. Direct age-standardisation to the 1981 population of the city was used. 95% confidence intervals were calculated for the standardised rates for diabetics (72).

Results

Information was obtained on 181 subjects from 212 surveyed (85.4% response). 103 were men (mean age +/- 1SD: 36.5 +/- 12.2 years) and 78 were women (36.9 +/- 12.3 years). 93 (90.3%) men and 52 (66.7%) women were economically active. Of those economically active, 28 (30.1%) men and 8 (15.4%) women were unemployed (Table 1). An age adjusted unemployment rate for diabetic patients compared well with the rate in Glasgow at the time of the study (Table 2). For diabetic men the 95% confidence interval does not contain the population value suggesting significantly less unemployment among this group.

40% of manual workers and 12.2% of non-manual workers were unemployed. 11 diabetic patients were in receipt of invalidity benefit. Only 6 of these were because of diabetes and its complications (mean duration

of diabetes 21.1 years). Five of these had retinopathy, 2 neuropathy, 1 nephropathy and 1 hypertension. 2 cases had retired early on health grounds.

Discussion

This study has shown that despite a high general level of unemployment, IDDs had a similar level of unemployment to the general population in Glasgow. For male diabetic patients the age-standardised rate was significantly lower than the general population rate. Age standardisation has been utilized to produce a result comparable to published unemployment rates. Further standardisation by social class may have been useful, but the size of the study population limited this.

Some patients who indicated that they were unemployed may have been too infirm to be employed. As such this would lead to the prevalence rates for unemployment being less than those stated.

The present study confirms that within the City of Glasgow unemployment rates are not higher for diabetic patients capable of work than those without diabetes (54). Other workers have noted similar results in young diabetic patients in Liverpool (55). This finding is different from that recently reported from the United States (56) which may indicate a difference in that country in the ability of the diabetic patient to obtain

work.

A recent paper presented to the British Diabetic Association (Robinson N, Bush L, Protopaga LE, Yateman NA. BDA Spring meeting 1988) does suggest higher unemployment among diabetic patients compared to non-diabetic controls. The overall response rate was only 61%, and the unemployment rates relate to total numbers of replies and are not restricted to those economically active. Other criticisms of this work include the fact that the subjects were recruited at diabetic clinics, and the method of choosing controls by giving each patient two forms to pass on to friends results in a bias. The response from control questionnaires was less than 50%. This may not be a true reflection of the unemployment in diabetic subjects in the community.

In the present study the subjects were recruited at a clinic to which all insulin-dependent diabetic subjects in the community were referred at the time of U100 conversion. The rates noted above therefore reflect the population unemployment rate for such diabetic patients, in Glasgow.

TABLE 1: Unemployment among insulin treated diabetics in Glasgow.

	MALE		FEMALE	
AGE (years)	NUMBER	UNEMPLOYED	NUMBER	UNEMPLOYED
16 - 24	6	1	14	4
25 - 34	28	6	12	3
35 - 44	31	12	13	1
45 - 54	18	6	13	0
55 - 64	10	3	0	0
TOTAL	93	28 (30.1%)	52	8 (15.4%)

TABLE 2: Unemployment rate: insulin treated diabetics compared to City of Glasgow. (95% confidence interval for diabetics in parentheses).

	DIABETIC (Age adjusted)	CITY OF GLASGOW
MALE	26.8% (25.6 - 28.0%)	28.4%
FEMALE	14.5% (13.5 - 15.5%)	13.8%

STUDY 2

STUDY 2: A CASE-CONTROL STUDY OF SICKNESS ABSENCE AMONG INSULIN TREATED DIABETIC WORKERS

Introduction

The sickness absence pattern of diabetic workers has been studied in the past. Most of this work is over 15 years old and records the experience of diabetic workers from North America. The absenteeism has been recorded as high as 3.2 times that of non-diabetic workers(11). From the United Kingdom only 3 studies have been published, two of which lacked comparison to a control population (1,10). A recent study has suggested that diabetic workers have nearly twice the number of days absent compared with matched control people (16). Most studies have grouped diabetic workers together. Where the workers have been sub-grouped by treatment greater absence has been shown among workers with insulin treated diabetes than non-insulin-dependent diabetes when compared to non-diabetic controls (12,15).

The British Diabetic Association (BDA) has stated that "the sickness records of diabetics in general are superior to those of non-diabetics" (76). Where this has been suggested there has either been no comparison to a control group (10) or inadequate matching of controls to subjects(14). The majority of the previously published evidence using employers' absence records and comparing diabetic workers to controls does not support this view.

The aim of this study was to compare the sickness absence during 1986 of insulin treated diabetic patients (IDDs) registered at the Diabetic Clinic, Gartnavel General Hospital, Glasgow, Scotland to controls matched by age,sex and occupation.

Methods

Insulin-treated diabetic patients of working age who attended the Diabetic Clinic, Gartnavel General Hospital, Glasgow between January and March 1987 were interviewed. The employment status was ascertained and those in employment were asked to consent to allow the disclosure of sickness absence records for 1986 to the investigator. Non-attenders were surveyed by post and asked to complete a questionnaire giving details of employment and diabetes. A consent form was signed by those willing to participate and returned with the questionnaire. A reminder letter was supplied if no reply was received after 6 weeks. In April 1987 all subjects were identified from clinic lists and surveyed by post.

Information on employment status was obtained from 181 patients out of 212 surveyed. One hundred and nine diabetic patients were in employment. Of these 6 had been in employment for less than one year, 11 were self employed and 10 refused to allow disclosure of absence records. Eighty-two diabetic patients employed throughout 1986 consented to disclosure.

The personnel officer of each diabetic worker's employer was requested to supply information on sickness absence relating to the subject for 1986. A reminder letter was provided if no reply was received after 2 months. A standard form was supplied to record all spells of absence and working days lost per spell. If recorded, the cause of absence was to be noted. The employer was also asked to supply information on 2 other employees of the same age (+/- 2 years), sex and occupation. One of these controls was randomly selected by random number tables to act as a matched control for paired analysis.

Eighty-two diabetic patients consented to participate in this study. Replies were received from 71 employers (86.6% response). Twelve replies did not contain suitable controls. Therefore the analysis is restricted to 59 matched pairs (83.1% of replies). Thirty-one males and 28 females (mean age +/- 1 SD: 36.2 +/- 11.3 years) with median duration of diabetes of 10 years (inter-quartile range 4-17 years) were compared to 59 controls (36.4 +/- 11.3 years).

Absence to attend clinics was excluded from the analysis. All other recorded sickness absence was analysed. Statistical analysis was performed by Wicoxon Signed Rank Test (1-tailed) comparing spells of absence, working days lost, and average length of spell between matched pairs. Other analyses were by median test or chi-square test (with Yates continuity correction) where

indicated.

The groups were analysed by sex, age (<40 years; 40 years and over) and occupation (manual: unskilled, semi-skilled and skilled manual workers; non-manual: technical,clerical and professional grades).

Results

The diabetic group had 783.5 days absence over 116 spells during 1986. Two hundred and ninety-four days were certified as due to diabetes and occurred in 11 of the 59 diabetics. The controls had 335 days absence over 98 spells.

The frequency of absence was similar between both groups. Analysis of matched pairs showed a significant difference in working days lost ($p<0.03$) and average length of spell of absence ($p<0.02$) (Table 3). Male diabetics had significantly more days lost ($p<0.05$) and longer average length of spell ($p<0.005$) than controls. Though an excess of spells of absence and days lost was seen in females these were not statistically significant (Table 4).

Analysis by age showed an excess of days lost and longer average length of spell among diabetic workers. This was significant in those under 40 years of age for working days lost ($p<0.04$, Table 5). When analysed by

occupation there was a significant difference in days lost ($p<0.01$) and average length of spell ($p<0.01$) for manual diabetic workers compared to controls (Table 6).

The diabetic group required greater use of doctors' certificates for absence (22% of absences) than controls whose absences were self-certified in 93% of episodes (chi-square = 8.363, $p<0.005$) . This is reflected in the greater number of diabetic workers absent for 10 or more days in 1986. 21 diabetic workers were absent for 10 or more days but only 10 controls had this absence ($p<0.05$,Table 7). One third (7/21) of these diabetic workers were absent for 10 or more days because of diabetes.

By convention, mean values are quoted in Tables 3-6. However, sickness absence is not normally distributed. Median values are shown in Table 8 for those who had sickness absence in 1986. The median days lost and average length of spell are significantly greater for the diabetic group.

Analysis of absence by cause suggests that the diabetic worker is disabled for longer on average with respiratory and non-respiratory conditions. The relatively small number of spells limit more detailed analysis of this by cause and system affected (Table 9).

Discussion

Only insulin treated diabetic patients were studied because all in this group had to register with the clinic for U100 conversion. The clinic group is representative of the insulin treated diabetic population in the community. Non-insulin-dependent diabetic patients do not all attend the clinic which means that study of this group may be biased towards those with problems referred from the general practitioner.

Only 3 previous studies have been published relating to sickness absence among diabetics within the United Kingdom. Lawrence and Madders studied 100 unselected employed diabetic patients attending the clinic at King's College Hospital, London (1). Jackson reported the results of a questionnaire survey sent to all members of the BDA in 1957 (10). In both these studies there was no verification of absence from company sickness records and a recall bias may be present. Lack of comparison with a control group limits interpretation of this data, as does the low response rate in the BDA study(10). The most recent published UK study by Welch compared the absence of diabetic postal workers to matched controls. Over a 5 year period diabetic workers had nearly double the days absence of controls (17.1 days/person/year vs 9.4 days/person/year) (16).

Of 9 published studies comparing the sickness absence of diabetic workers to controls only one has

suggested that the absence is favourable. In this paper, the absenteeism of 108 diabetic workers was compared with 291 non-diabetic workers matched only by age. In each age group there was less absenteeism among diabetic workers. No comparison between diabetic workers sub-grouped by treatment and controls was made.(14). The other 8 studies have shown more absence among diabetic workers (2,5,8,9,11,12,15,16). Six of these studies compared absence of diabetic workers to controls matched by at least age, sex, and occupation (2,8,9,11,12,16). Matching of controls by all three of these perameters is recognised as essential in the analysis of absence data(89).

In one study the excess absence in diabetic workers has been recorded at 3.2 times that of matched controls. However, lack of information on absence of less than 5 days limits interpretation of this work(11). The other 5 studies included all absences and have all shown increased absence among diabetic workers. The excess from American studies ranges from 1.4 (2) to 1.95 (8) times the days lost in non-diabetic workers. The most recent published UK study showed 82% more working days lost among diabetic workers over a 5 year period (16). Where the treatment of the diabetes was noted and compared to matched controls the insulin treated diabetic workers had greater absence than those on diet +/- oral agents (12).

Pell and D'Alonzo (12) noted that the diabetic worker with a respiratory problem was likely to be absent from work longer than a worker without diabetes. They also

noted a longer recovery period for non-respiratory problems. They suggested two causes for this. Having diabetes may prolong recovery or the family doctor may be more cautious in caring for the diabetic patient and delay the return to work. In this present study most absence was self-certified (7 days duration or less). The diabetic workers did have longer absence from work on average with respiratory and non-respiratory problems. This may support the view that diabetes prolongs recovery. However, because of the small number of spells in each group further study of a larger group of diabetic workers would provide more useful information on duration of disability.

The BDA has stated that " as with non-diabetics a minority of individuals may contribute disproportionately to overall sickness absence"(48). This work has shown that significantly more diabetic workers were absent for 10 or more days than non-diabetic workers indicating that this is more of a problem for the diabetic worker than the non-diabetic worker.

Improved education has been advocated by tha BDA to reduce complications and improve overall control. This has been shown to be effective in reducing admission rates with diabetic ketoacidosis and amputation rates(77). It is likely that it would also result in improved absence rates and merits serious consideration (Study 3).

The present study has relatively small numbers but still achieved statistically significant results. While

some analysis has been possible further study of larger numbers of diabetic workers would be useful. Such a study would be best performed with the co-operation of a major employer's Occupational Health Service so that comparison with matched controls within an organisation can be made. Studies based on diabetic patients attending clinics or members of the BDA are limited by access to an adequate control group. In this study 2 controls were selected by the diabetic worker's employer and then one of these was randomly selected. A fuller randomisation procedure could be achieved within a single organisation.

Employers considering the employment of diabetic workers should be aware of the level of attendence to be expected. Absence is only one factor which an employer considers when assessing applicants. Other factors such as qualifications, experience and safety will be important. Similar problems with absence exist with other medical conditions. Wyshek, Snegireff and Lowe showed greater absence among people with cardiac conditions than those with diabetes (9).If education does improve this is likely to result in an improvement in the pattern shown in this study.

TABLE 3: Sickness Absence in Diabetic workers and Controls (mean values and range)

	Diabetes	Controls
Spells of Absence	2.0 (0-7.0)	1.7 (0-7.0)
Working Days Lost	13.3 (0-101)	5.7 (0-52)*
Average Length of Spell (days)	5.6 (0-55)	2.5 (0-28)†

Wilcoxon Signed Rank Test (1 tailed) *$p<0.03$, †$p<0.02$

TABLE 4: Sickness Absence by Sex (mean values and range).

	Diabetes	Controls
(a)Males(n=31)		
Spells of Absence	1.7 (0-6.0)	1.7 (0-6.0)
Working Days Lost	15.1 (0-101)	4.8 (0-25.5)*
Average Length of Spell (days)	7.2 (0-55)	1.9 (0-8.5)†
(b)Females(n=28)		
Spells of Absence	2.3 (0-7.0)	1.6 (0-6.0)
Working Days Lost	11.3 (0-64)	6.7 (0-52)
Average Length of Spell (days)	3.7 (0-37.5)	3.1 (0-28)

Wilcoxon Signed Rank Test (1 tailed) *$p<0.05$, †$p<0.005$

TABLE 5: Sickness Absence by Age (mean values and range).

	Diabetes	Controls
(a)<40 years (n=37)		
Spells of Absence	2.2 (0-7.0)	1.9 (0-6.0)
Working Days Lost	14.7 (0-101)	5.7 (0-28)*
Average Length of Spell (days)	5.5 (0-33.7)	2.7 (0-28)†
(b)≥40 years (n=22)		
Spells of Absence	1.5 (0-6.0)	1.2 (0-4.0)
Working Days Lost	11.0 (0-64)	5.7 (0-52)
Average Length of Spell (days)	5.7 (0-55)	2.2 (0-26)

Wilcoxon Signed Rank Test (1 tailed)*$p<0.04$,†$p=0.05$)

TABLE 6: Sickness Absence by Occupational Group (mean values and range).

	Diabetes	Controls
(a)Non-manual (n=32)		
Spells of absence	1.7 (0-6.0)	1.6 (0-5.0)
Working days lost	13.5 (0-101)	5.4 (0-28)
Average length of spell (days)	6.0 (0-55)	2.7 (0-28)
(b)Manual (n=27)		
Spells of absence	2.3 (0-7.0)	1.7 (0-6.0)
Working days lost	13.0 (0-64)	6.1 (0-52)*
Average length of spell (days)	5.0 (0-23)	2.3 (0-26)*

Wilcoxon Signed Rank Test (1 tailed) *$p<0.01$

Table 7: Duration of absence in diabetics and controls.

	Days absent (1986)		
	<10 days	10 + days	Total
Diabetic	38	21	59
Controls	49	10	59
Total	87	31	118

(chi-square = 4.375, $p<0.05$)

TABLE 8: Median Values (1 or more absences)

	Diabetes (n=43)	Controls (n=41)
Spells	2	2
Working Days Lost	9	5*
Average Length of Spell (days)	3.5	2*

Median Test * $p<0.05$

TABLE 9: Reason for Absence.

	Diabetes			Control		
	Spells	Days	Mean Days per Spell	Spells	Days	Mean Days per Spell
Diabetes	20	294	14.7	--	--	---
Respiratory	22	90	4.4	33	93	2.8
Non-respiratory Conditions	74	399.5	5.4	65	242	3.7
TOTAL	116	783.5	6.8	98	335	3.4

STUDY 3

STUDY 3: SICKNESS ABSENCE AND CONTROL OF INSULIN TREATED DIABETES

Introduction

Glycosylated haemoglobin (HbA1) is an objective assessment of control of diabetes (57) and is useful for epidemiological study. No previous work has occurred which has used HbA1 as a measure of control and related this to sickness absence among insulin treated diabetic workers.

The aim of this study was to compare the sickness absence of insulin treated diabetic workers with different degrees of control as assessed by HbA1.

Methods

Insulin treated diabetic patients attending the Diabetic Clinic, Gartnavel General Hospital,Glasgow were studied. Those in employment were asked to consent to allow disclosure of sickness absence records for 1986. The patient's employer was contacted and asked to provide information on absence on a standard form supplied with the request. A retrospective study of HbA1 measurements for 1986 was performed on each case from clinic records. Where more than one measurement occurred the mean value was used.

71 replies were received from employers from 82

requests. In 63 cases HbA1 measurement had occurred in 1986. In one case absence was associated with active management to improve control because of pregnancy and has been excluded from the analysis. The information on absence relates to the other 62 cases. Absence to attend clinics was excluded from the analysis. All other absence was analysed. The diabetic patients were grouped according to mean HbA1 into those with good control (HbA1 8.5% or less) and those with poor control (HbA1 > 8.5%) for analysis.

Statistical analysis was by Mann Whitney U test (corrected for tied values) and chi-square test with Yates continuity correction. The groups were compared for spells of absence, working days lost and average duration of absence during 1986.

Results

Fifteen diabetic patients had good control; 47 had poor control. Patient characteristics are summarised in Table 10.

The distribution of sickness absence showed significantly greater frequency (spells), severity (working days lost), and average duration of absence in those with poor control compared to those diabetic workers with mean HbA1 of 8.5% or less (Table 11).

53% (8/15) of those with good control had no absence in 1986 compared with only 28% (13/47) of those with poor control (chi-square= 2.298, p>0.1,NS). In addition 36% (17/47) of those with poor control had absence of 10 or more days. Only 6.7% (1/15) of those with good control had this absence (chi-square= 3.478, 0.1>p>0.05).

Discussion

This study has shown that the group of diabetic patients with poor control had greater absence from work than those with good control. The difference was statistically significant. This suggests that efforts to improve control may be associated with reduced absence rates among insulin treated diabetic workers.

Measurement of HbA1 cannot be recommended on its own as a method of identifying those diabetic workers who are likely to be absent from work as even with good control some had absence of 10 or more days per year. In addition some of those with poor control had no absence from work. It lacks sensitivity and specificity to be used as a screening test in the pre-employment situation. Its use may be to identify a level of HbA1 below which control should be maintained in diabetic workers if at all possible as absence may be limited overall. This would require identification of those workers with diabetes and training of occupational health staff in the care of

diabetes. Such care could be complementary to that provided by the diabetologist and general practitioner.

Though the groups in this study were similar for age, sex, and occupation, the individuals were employed by different organisations which may influence absence from work. Matching of diabetic workers within an organisation would be useful to identify the effect of control of diabetes more accurately.

It should be noted that those diabetic patients who already have complications may not be encouraged to achieve this level of control by their diabetologists as they may consider that the prognosis is unlikely to be affected. Therefore diabetic workers without complications may be the group to target with education to try and improve control of diabetes and overall sickness absence.

Recent work from West Germany suggests that a diabetic training programme resulted in a fall in frequency of absence and working days lost among a group of patients (78). Whilst control (HbA1) was not directly assessed the objective improvement in attendance at work is encouraging. A similar study in the UK would be useful.

A larger number of diabetic subjects requires to be studied to investigate this subject further and also consider the effect of the presence of complications on control of diabetes and sickness absence.

TABLE 10: Study Group Characteristics.

	Good Control (n=15)	Poor Control (n=47)
Sex (M:F)	8:7	25:22
Mean Age(SD) years	37.7(9.7)	38.6(12.1)
Mean Duration of Diabetes (SD) years	10.5(7.7)	14.2(9.8)
Occupation:		
Non-manual	10	29
Manual	5	18

TABLE 11: Sickness Absence and Control of Diabetes.

	Good Control	Poor Control
(a)Spells		
(i) Mean	1.0	2.09
(ii)Median	0	2.0 *
(interquartile range)	0 - 1.0	0 - 3
(b) Working Days Lost		
(i) Mean	2.93	13.82
(ii)Median	0	4.0†
(interquartile range)	0 - 4.0	0 - 14
(c) Average Duration (days)		
(i) Mean	1.2	5.42
(ii) Median	0	2.3‡
(interquartile range)	0 - 2.35	0 - 6.0

Mann-Whitney U test * $p<0.05$, † $p<0.02$, ‡ $p<0.04$.

STUDY 4

STUDY 4: EMPLOYMENT STATUS AND CONTROL OF INSULIN TREATED DIABETES

Introduction

The control of insulin dependent diabetes can be affected by a number of factors. Objective assessment of control can be noted from measurement of glycosylated haemoglobin (HbA1). A number of factors have been found to have an effect on this measurement (55,66,67). No previous work has been performed to determine the effect of employment status on control of diabetes.

The aim of the study was to examine the effect of employment status on control of diabetes as assessed by HbA1 measurement.

Methods

The employment status of insulin treated diabetic patients (IDDs) of working age was ascertained at interview in clinic attenders and by postal survey of non-attenders between January and March 1987. In April 1987 all subjects were surveyed by post. A reminder letter was supplied if no reply was received after 6 weeks.

A survey of glycosylated haemoglobin (HbA1) measurements performed at the diabetic clinic between January 1986 and April 1987 occurred from clinic records.

Where more than one measurement had been performed the mean value was used.

Statistical analysis was by Wilcoxon Rank Sum Test (2 tailed), chi square test with Yates continuity correction, and Student's t-test (2 tailed).

Results

107 employed IDDs (37.3 +/- 11.4 years) and 36 unemployed IDDs (38.0 +/- 12.3 years) had HbA1 maesurements during the period January 1986 to April 1987. Median HbA1 among employed IDDs was 9.55% (interquartile range: 8.8-10.4%). Among unemployed IDDs median HbA1 was 9.18% (interquartile range: 7.65-10.43%). ($p=0.18$, Wilcoxon Rank Sum Test).

Only 9 of 107(8.4 %) employed IDDs had a normal HbA1 (4.9%-7.8%) whereas 11 of 36 (30.6%) unemployed IDDs had this level of HbA1 ($p<0.01$, chi-square test).

The duration of diabetes in the employed IDDs (14.1 +/- 9.4 years) was slightly greater than that of the unemployed IDDs (11.2 +/- 9.7 years). This was not a statistically significant difference. (t test).

Non-manual unemployed diabetic subjects (n=8) had significantly lower HbA1 levels (mean, SD: 7.73%,

1.78%) than those in employment (n=67; mean,SD: 9.37%,1.54%) ($p<0.01$, t test). No such difference was noted for manual unemployed diabetic subjects (n=28; mean,SD: 9.85%,2.35%) compared to those in employment (n=40; mean,SD: 10.15%, 1.70%).

Discussion

This study has suggested a relationship between employment status and control of diabetes. Significantly more unemployed IDDs were able to achieve normal HbA1 than those in employment. The difference noted is related to the control of diabetes in non-manual workers.

Some of the subjects studied only had one measurement of HbA1 during the preceding year. This may limit interpretation of the control of diabetes achieved. Recent evidence suggests that one measurement does predict subsequent control in young diabetic subjects (Young RJ, Macintyre CCA, Young LB, & Prescott RJ. BDA Spring Meeting, April 1988).

Glycosylated haemoglobin levels have been shown to increase with duration of diabetes by some workers (55,66). Others have not shown such a correlation (67). In this study there was no significant difference in duration of diabetes between employed and unemployed IDDs.

The difference noted in HbA1 may therefore associated with employment status. The difference appears to be restricted to those subjects in non-manual grades. Those in manual grades had similar control of diabetes whether employed or unemployed. Work from Germany would have suggested that manual work is related to poor control and can be improved under supervision in the hospital workshop (79). This suggests that other factors require to be considered such as education about care of diabetes. In the present study there is indirect evidence from the difference in control among non-manual workers that lifestyle factors or education may be important. Good control of diabetes is rare but can be improved with education with a resultant reduction in morbidity (77). Education is one factor in controlling diabetes but other factors including environmental become important above a certain threshold (80). Employment may be an important factor for some adult diabetic subjects in relation to control and should be considered in future studies of control of diabetes.

Study of the effects of employment would be useful to identify which factors could contribute to poor control so that education and advice can be given which inludes employment factors to allow the diabetic patient to maintain good control.

TABLE 12: Characteristics of groups by occupation.

	Employed (n=107)	Unemployed (n=36)
(a) Manual (n=68)		
Age (years-mean; SD)	35.9;11.9	37.0;10.9
Sex(M:F)	18:22	21:7
Duration of Diabetes (mean;SD)	15.0;10.1	11.3;8.6
HbA1 (%-mean;SD)	10.15;1.70	9.85;2.35
(b) Non-manual (n=75)		
Age (years-mean;SD)	38.6;11.0	40.6;16.7
Sex (M:F)	39:28	7:1
Duration of Diabetes(yrs-mean;SD)	13.8;8.83	11.2;13.7
HbA1 (%-mean;SD)	9.37;1.54	7.73;1.78

STUDY 5

STUDY 5: EMPLOYMENT AND DIABETES - A SURVEY OF OCCUPATIONAL PHYSICIANS.

Introduction

No survey of major employers has been performed within the United Kingdom to identify the number of diabetic workers employed. It has been suggested that diabetics have similar employment prospects to people without diabetes as unemployment rates among clinic attenders are similar to the non-diabetic population (54,55). A recent UK study of postal workers indicated a prevalence of known diabetic workers of only 4 per 1000 workers (16). This may have been due to their identification being through the occupational health department or personnel department which would only be aware of those who had problems.

Certain restrictions are placed on the diabetic worker by employers. Some of these are indicated by advisory bodies (eg HGV and PSV drivers, aircrew and merchant seamen). Others arise because of concern about safety at work. In large organisations the occupational physician will supply advice. With smaller companies advice may be obtained (with written consent) from the diabetologist, or the general practitioner. The extent and nature of restrictions imposed by occupational physicians are not known.

The aims of the present study were to identify the

number of workers with diabetes known to be employed in major organisations within the UK, the restrictions placed on workers with diabetes by occupational physicians, and the nature of any review performed by the physicians.

Methods

Forty physicians were identified via the Society of Occupational Medicine as employed in one of the top UK 100 companies (as ranked by value of shares at the Stock Exchange), or nationalised industries. A postal survey of these physicians was performed. A reminder letter was supplied if no response was received after 2 months.

The physicians were requested to supply information on the total workforce under their care, and the number of known diabetic workers employed. Where possible the number of workers on insulin was to be supplied. The physicians were also requested to supply information on any restrictions placed on workers with diabetes, and any regular review of diabetic workers performed.

The organisations surveyed were involved in retailing, power generation, electronics, civil aviation, public transport, telecommunications, confectionary manufacture, steel production, engineering, oil production, chemical manufacture, metal production, industrial suppliers, banking, pharmaceuticals and drinks manufacture.

Thirty-two replies were received to the survey request (80% response). In 30 cases the total number of employees was supplied. In 21 cases (66% of replies) the physician was able to identify the number of workers known by him to have diabetes. In 20 cases the number of diabetic workers was shown by treatment. The data shown relate to these 20 replies.

The data returned were grouped to give an overall prevalence of diabetes among the workforce. The prevalence of diabetes according to treatment used was also calculated. Recent population studies from Poole(73), Oxford(74) and Southall(75) on the prevalence of diabetes were used for comparison. The data from the population studies are restricted to those between 20 and 59 years and are obtained from the Oxford study (74).

Statistical analysis was by chi-square test with continuity correction.

Results

There were 2401 diabetic workers known out of a total working population of 320,198. Of these 823 were treated with insulin, and 1578 required diet with or without oral hypoglycaemic agents.

The prevalence of known diabetes in the working

population was 7.5 per 1000 workers. The prevalence of insulin treated diabetes was 2.6 per 1000 and the prevalence of those requiring diet with or without oral agents was 4.9 per 1000. Comparison with recent UK population studies is shown in Table 13.

The prevalence of known diabetes in individual organisations ranged from 2-14/1000. Certain companies within the chemical, oil, steel, confectionary and drinks industries had a lower than expected prevalence of diabetes in their workforces.

The restrictions placed on diabetic workers are shown in Table 14. In only one instance were all applicants with insulin treated diabetes excluded at pre-employment health assessment. The majority of restrictions apply to workers with insulin treated diabetes. In addition one physician restricted insulin treated workers from heavy manual work and work isolated from others. Only in retailing were no restrictions noted.

The size of the workforce was a factor in determining whether the occupational health department was aware of the number of diabetic workers employed (Table 15). Organisations with over 20,000 employees were less likely to know the number of diabetic workers employed.

No organisation had a policy for the regular review of diabetic workers.

Discussion

The present study has shown that the prevalence of known diabetes in the workforce studied was 7.5/1000 workers. This figure is similar to that derived from the population studies of 6.9-7.8/1000. The prevalence of insulin treated diabetes (2.6/1000) was lower than that noted in the population studies (2.8-3.9/1000). The prevalence of other diabetes (4.9/1000) was within the range of prevalence noted in the population studies (3.0-5.0/1000). These figures suggest that overall the number of diabetic workers employed is similar to that expected. The low prevalence of insulin treated workers may be due to a number of factors. Some workers are likely to be unknown to the physician. There may be increased early retiral due to increased morbidity from diabetes. Another reason may be bias against employment of insulin treated applicants. Only one physician admitted excluding such applicants at pre-employment assessment.

Variation was noted between organisations which may also be due to a number of diabetic workers being unknown to the physician. In certain organisations the worker may only come into contact with the occupational health department at commencement of employment. Thereafter only those who have problems such as sickness absence will become known to the department. Another reason may be that there are a large number of positions from which diabetic workers are restricted. Certain companies appear to employ fewer diabetic workers than expected. Further

investigation within these industries would be useful.

The prevalence of known diabetic workers in employment has been quoted in studies relating to sickness absence. Other than the study of postal workers (16) the majority of this work relates to the United States. Because of the higher ratio of doctor to worker (1:800) within a company, accurate prevalence data has been obtained by Pell and D'Alonzo (8,12). A figure of 4.5/1000 workers in 1957 (8) and 7/1000 in 1963 (12) was noted. Others have obtained prevalence figures as high as 14/1000(9). Regional and temporal factors will account for some of these differences as may recruitment policies. An American survey from the 1950s showed that 20 out of 63 companies did not recruit known diabetic applicants (5).

In the present study the size of the organisation was associated with whether the physician surveyed was aware of the number of diabetic workers employed. This may indicate that a lack of manpower is present within the occupational health department in some organisations as knowledge of disabled workers is a function of an occupational health department. Other factors may include the geographic spread of the workforce or the record system used.

Restrictions are placed on diabetic workers for a number of reasons. In certain circumstances the authorities may restrict the work performed such as with HGV and PSV drivers. Other restrictions occur because of

reasons of safety at work. In the UK the Health and Safety at Work,etc Act places a duty on employers to provide as far as is reasonably practicable a safe and healthy working environment for employees (46). This applies not just to diabetic workers, but by nature of their treatment certain workers may be at risk of hypoglycaemia which could result in injury to themselves and/or others. Hypoglycaemia resulting in being taken to hospital has been shown to occur in 9% of insulin-dependent diabetic patients annually (81). The figure for all hypoglycaemic episodes will be higher. Accordingly, most restrictions noted are for workers with insulin treated diabetes. Where public safety is important some restrictions are placed on workers receiving sulphonylureas.

In addition to those occupations noted in Table 2 people with diabetes are not allowed to join the armed forces, the police, the fire brigade, or the merchant navy. In some areas they may not be allowed to hold Hackney Carriage licences. Other dangerous areas such as confined spaces exist and insulin treated workers will be restricted from entry to these areas. Other restrictions may exist in companies not surveyed.

The Medical Advisory Committee of the British Diabetic Association has stated that insulin-dependent diabetes should not be a bar to shift work (48). However,this was one of the most common restrictions noted in the replies received. Problems known to the occupational physician may include rapid rotation of

shifts, irregularity of meal times, and no guarantee of the quantity or quality of the food available. All of these will influence the restriction of the diabetic worker.In certain organisations some insulin treated workers do perform shift work, while others are advised against this work (82). Anecdotally, one physician suggested that the control of one of his diabetic workers was less than ideal because the worker wished to perform shift work without the risk of hypoglycaemia as it was better paid.

A recent paper from East Germany subdivided vocational and professional activities into four groups: 1) basically unsuitable; 2) mostly unsuitable (employment is possible in individual cases); 3) conditionally suited (certain working conditions are required) and 4) well suited. Lists for groups 3 and 4 are shown with 82 and 78 occupations listed respectively and a translation is included in Appendices xi. and xii.. Such lists help to indicate that there is a large variety of work which the diabetic worker is capable of performing (83). This may be more helpful to the diabetic patient than lists of restrictions noted in this study and that recently performed by workers in London (84).

Individuals may experience problems obtaining work if they are seeking a position in which diabetics are restricted. In addition, others in employment may have to be moved if they require insulin or complications occur which limit activity (e.g. reduced visual acuity and

driving).

There is a move towards shared care for diabetic patients between diabetologists and general practitioners. With proper training it may be possible to involve occupational physicians in such care. Being reviewed at the place of work would require less time away from work which would be of benefit to the employer. At present none of the physicians surveyed performed such reviews. This could be further studied to assess the feasability of this idea.

TABLE 13: Comparison of present study to population studies.

	Number in population	Number with diabetes (prevalence)	Number insulin treated (prevalence)	Number diet/ oral agent treated (prevalence)
Present Study (16-64 years)	320,198	2401 (7.5/1000)	823 (2.6/1000)	1578 (4.9/1000)
Poole Study(73) (20-59 years)	45,617	313 (6.9/1000)	177 (3.9/1000)	136 (3.0/1000)
Oxford Study(74) (20-59 years)	21,355	166 (7.8/1000)	60 (2.8/1000)	106 (5.0/1000)
Southall Study(75) (20-59 years)	13,625	99 (7.3/1000)	51 (3.7/1000)	48 (3.6/1000)

TABLE 14: Restrictions placed on diabetic workers receiving insulin in companies surveyed.

Shift Work*	
Dangerous Areas -	Incinerator loading Hot metal areas Moving machinery Work on railway tracks
Heights -	Overhead linesman Crane driving Scaffolding
Driving -	HGV PSV Fork lift trucks Locomotives **/underground trains Professional drivers (chauffeurs)**
Civil Aviation -	Pilots/flight engineers (any form of diabetes) Aircrew*** Cabin crew
Emergency teams -	Fire Security Rescue
Offshore oil work	
Work overseas-	areas with limited medical care

* allowed in some organisations
** some diabetics on oral agents may be ineligible
*** Civil Aviation Authority regulations permit aircrew to hold all types of licence if diabetes is controlled by diet; limited certification is permitted to those controlled by oral hypoglycaemic drugs.

Table 15: Size of workforce and knowledge of diabetic workers employed (30 replies).

		Diabetic workers known		
		Yes	No	Total
Size of Workforce	<20,000	18	2	20
	20,000+	3	7	10
	Total	21	9	30

Chi-square test:8.75, $p<0.005$.

STUDY 6

STUDY 6: ILL-HEALTH RETIRAL AND DIABETES MELLITUS.

Introduction

Diabetes is associated with increased mortality and morbidity. Population studies have demonstrated the increased mortality which has also been reflected in occupational mortality studies. Morbidity has previously been measured by discharges from hospital and by sickness absence. More recently study of early retiral data has occurred (43) but this has been limited by lack of comparison to population data on the prevalence of diabetes.

Study of early retiral data is important to identify if diabetic morbidity results in increased numbers of diabetic employees having to retire early because of health reasons. As early retirement on health grounds is associated with enhanced benifits this situation may result in more money being lost from superannuation funds to pay these benifits than would be due simply because of the number of years in employment.

The aim of this study was to identify the number of local government employees retiring in 1987 who were assessed by Greater Glasgow Health Board Occupational Health Service (GGHB OHS) and the number retiring who had diabetes to identify if an excess existed.

Methods

The Local Government Superannuation (Scotland) Regulations allow for payment of an annual pension for life and a lump sum payment where a pensionable employee is incapable of discharging efficiently the duties of the employment by reason of permanent ill-health (85).

Glasgow Division of Strathclyde Regional Council use the services of GGHB OHS to act as medical advisers in cases of ill-health retiral. Applicants provide a letter of support from their general practitioners and a letter requesting early retiral because of ill-health. The applicant is assessed by GGHB OHS by means of a health questionnaire, history and clinical examination. If the applicant is considered permanently unfit Form S18 (Appendix x) is completed and returned to the employer.

All case notes of local government employees who attended GGHB OHS for assessment under the regulations during 1987 were reviewed. Information was abstracted from case notes to summarise the causes of ill-health. The prevalence of cases who had diabetes at the time of the assessment was calculated and compared to the expected prevalence from recent population studies (73,74,75).

Statistical analysis was by indirect standardisation with 95% confidence intervals (72) using the population data from the Poole study (73) where the prevalence of diabetes was the highest of the population

studies , and Poisson analysis.

Results

Five hundred and five local government employees attended during 1987 for assessment. Two hundred and ninety-nine were men and 206 were women. Thirty (21 males and 9 females) employees (5.94%) of mean age 55.6 (+/-6.7) years) had diabetes (median duration 4 years; interquartile range 2-9 years) at the time of the assessment (Table 16).

The occupations which the diabetic subjects held included labourer, painter, joiner, securityman, home help, supervisor, social work officer, museum attendant, caretaker, scaffolder, janitor, cleaner, engineer, and inspector of work.

Four of these diabetic workers required insulin (median duration of diabetes 13 years); 26 required diet with or without oral agents. Twelve retired because of diabetes and its complications; 10 because of the former and other pathology and 8 (26.7%) retired because of other pathology but had diabetes noted at the assessment. The complications noted are shown in Figure a and other pathology is noted by system affected in Figure b.

Comparison to recent population studies suggests an expected prevalence of diabetes in the 20-69 years age group of 9.2-10.1 per 1000 of the population. The figure

of 59.4 per 1000 is significantly greater than the highest of these population prevalences. Standardisation corrects for differences in age structure between the study group and the population studies and does not remove this significant excess. The 95% confidence interval (standardised ratio: 288.7-610.5) confirms that the prevalence is significantly greater than the prevalence in the general population. Excluding those subjects who had diabetes incidental to the cause of retiral results in the prevalence of diabetic retirals remaining significant (193.1-466.3).

The causes of ill-health retiral in non-diabetic applicants are summarised in Table 17. With increasing age there is an associated increase in the proportion of retirals with multiple pathology. In those under 40 years of age the average number of problems was 1.1 per employee. In those 40 years and over this increased to 1.5 problems per employee. The commonest causes of retiral were disorders of the musculo-skeletal system followed by cardiovascular system and psychiatric disorders.

Discussion

This study has demonstrated an increased prevalence of diabetes among local government employees retiring because of ill-health than would be expected from population studies.

The only previous work on this subject suggested

that 14 per 1000 postal workers retiring for health reasons had diabetes (43). No comparison with other data ocurred despite previous information indicating that the prevalence of known diabetes among postal workers was 4 per 1000 (16). Some diabetic workers may have been unknown to the employer as this prevalence is lower than that expected from population studies. The information on retirals was supplied by the Personnel department of the Post Office which may not have received information on all diabetic retirals. Alternatively, the lower prevalence of retiral among diabetic postal workers may be because fewer are employed or because they are capable of working till normal retirement age because of the nature of the work performed.

In the present study all case notes were reviewed which increased the final number of diabetic employees to greater than would have ocurred if only Form S18 was used to obtain information. The higher prevalence recorded indicates that diabetes results in increased morbidity and this leads to early retirement. Diabetes is therefore one medical problem which results in a more than expected drain on superannuation fund resources. A similar situation in underwriting life insurance risks results in the rating for insurance being greater than that for the non-diabetic applicant (86,87).

This situation is one which may be improved by better control of diabetes in the adult population. Along with sickness absence data which also indicates greater

morbidity the cost to industry can be calculated to indicate how much money could potentially be saved by such improvements in control. Such arguements could result in funding for improved education as cost-benefit analysis could objectively occur. In addition the involvement of occupational physicians in the care and education of diabetic workers may be seen as benificial.

The majority of ill-health retirals (94.06%) were not related to diabetes and indicates that diabetes is a small factor proportionally in this situation though it is ocurring in numbers significantly greater than expected in the present study. This may be peculiar to this employer where criteria for recruitment may not be as stringent as in other organisations. Alternatively it may reflect a problem in this geographical area or it may indicate a more widespread problem. This requires to be further investigated.

TABLE 16: Age and Sex Characteristics of Retirals (Diabetic numbers).

	Male	Female
20-29 yrs	13 (0)	1 (0)
30-39 yrs	24 (0)	8 (0)
40-49 yrs	45 (3)	26 (1)
50-59 yrs	129 (13)	112 (3)
60-64 yrs	84 (5)	57 (5)
?	4 (0)	2 (0)
Total	299 (21)	206 (9)

FIGURE B: Other reasons for retiral (18 subjects).

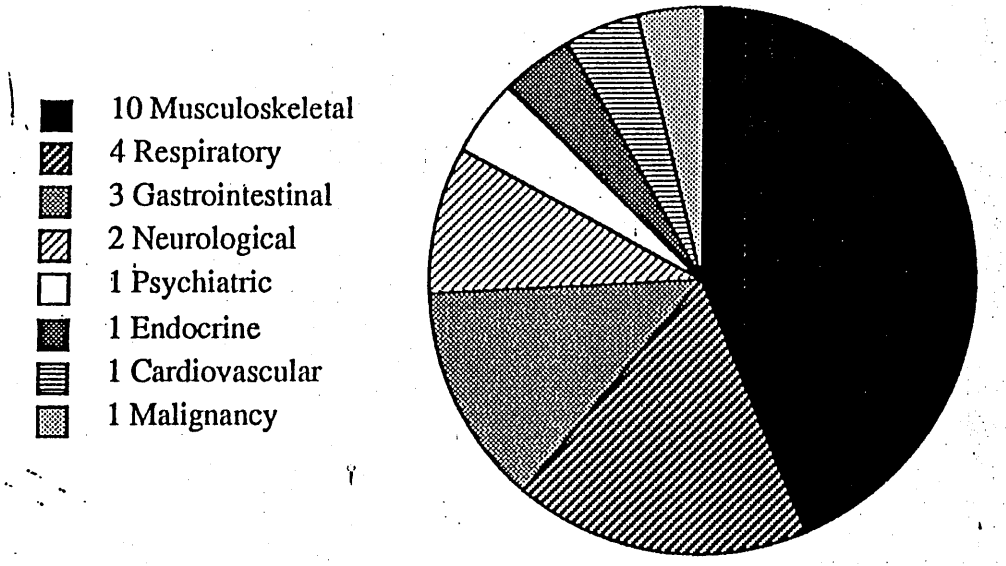

FIGURE A: Complications of diabetes (22 subjects).

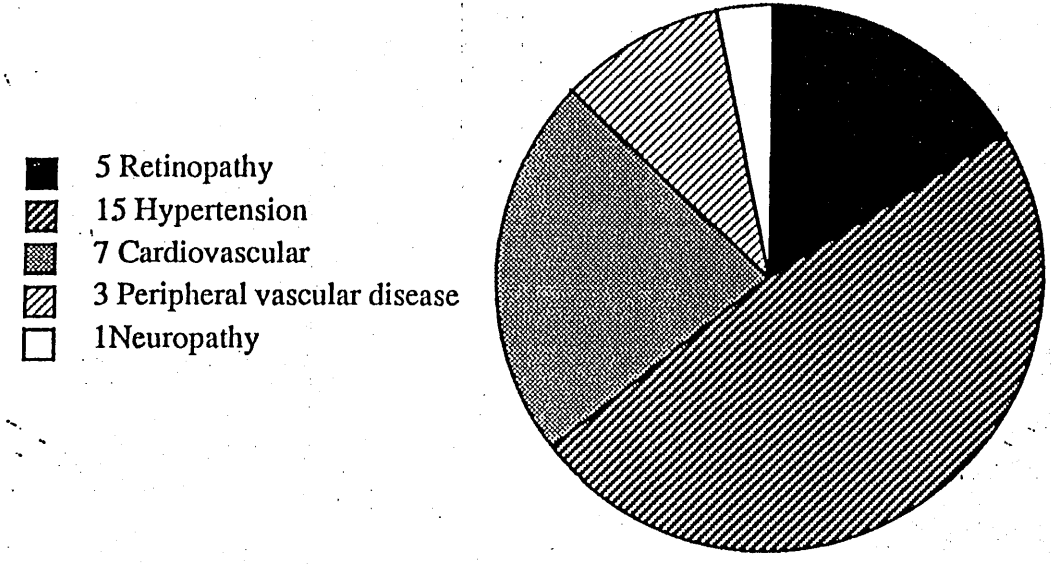

TABLE 17: Causes of Retiral by System Affected in Non-diabetic Retirals.

	20-29		30-39		40-49		50-59		60-69		?		Total
	M	F	M	F	M	F	M	F	M	F	M	F	
Cardiovascular	0	0	2	1	11	4	38	30	38	23	1	0	148
Respiratory	0	0	1	0	4	6	24	19	25	10	0	0	89
Alimentary	0	1	3	0	3	2	13	7	6	6	1	0	42
Neurological	3	0	3	1	3	4	22	13	9	8	1	0	67
Psychiatric	2	1	6	2	6	4	10	21	8	12	0	0	72
Musculo-skeletal	4	0	13	3	20	16	50	55	31	20	2	0	215
Endocrine	0	0	0	0	0	0	1	2	1	1	0	1	6
Haemopoetic	0	0	0	0	1	0	2	3	1	0	0	0	7
Skin	3	0	0	1	0	1	0	4	1	1	1	0	12
Carcinoma	1	0	0	0	0	1	2	4	5	1	0	0	14
Other	1	0	0	0	0	0	2	1	0	0	0	0	4
Total	14	2	28	8	48	39	166	159	125	82	6	2	674

CONCLUSIONS

This thesis has presented information on aspects of employment and diabetes.

The first study has indicated that unemployment among economically active insulin-treated diabetic patients in Glasgow is not greater than that occurring in the population of the City of Glasgow.

The second study has shown that the severity of sickness absence of insulin-treated diabetic workers is significantly greater than that of age/sex/occupation matched controls.

The third study suggests an association between control of insulin-treated diabetes and sickness absence. In those with good control of diabetes there were less spells of absence and less working days lost compared to those with poor control.

The fourth study has shown a relationship between employment and control of diabetes in a sub-group of non-manual diabetic subjects. No such difference in control was noted between employed and unemployed manual workers.

The fifth study reported the results of a postal survey of occupational physicians. This indicated that overall the numbers of diabetic workers known to be

employed was within the expected range from recent population studies. There was a lower than expected number of insulin-treated workers employed. Most of the restrictions noted relate to insulin-treated workers.

The final study has shown a significantly greater proportion of subjects attending for ill- health retiral assessment had diabetes than would be expected from population studies. This reflects the greater morbidity associated with this condition.

The lower than expected number of insulin-treated workers noted in the fifth study may occur for a number of reasons. The results of the first study suggest that it is not because of a significant bias against employing such workers, as unemployment rates are not increased. Other factors must be present such as increased early retiral rates noted in Study 6 , death in service or lack of knowledge of some diabetic workers by occupational physicians.

Given the increased absence among insulin-treated diabetic workers noted in Study 2, the relationship between control of diabetes and sickness absence noted in Study 3, and the effect of employment on control of diabetes in non-manual workers shown in Study 4 there appears to be a role for the occupational physician in the management of diabetes.

Identification of those with diabetes would be a

useful first step in providing this care. Thereafter, education of management and workers about diabetes would be useful. Specific education of diabetic workers about the importance of control of diabetes and the methods for improving blood glucose levels could occur. Indicating that good control may reduce long term complications would encourage better self management. This could result in improved sickness absence which could be surveyed by the occupational physician or personnel department. The early detection of complications may result in treatment to avoid serious problems and could also be performed by occupational physicians. Study of work performed may also indicate factors which could be altered to allow better management of diabetes by the diabetic worker.

These suggestions would depend on the cooperation of the occupational physician, diabetologist and general practitioner; and on the training of the occupational physician in the management of diabetes. The feasability of such "shared care" could be formally studied.

With the information derived from the above studies the diabetologist and general practitioner can advise their diabetic patients on career plans and problems of employment and diabetes. The increased sickness absence and early retiral rates are facts which may be useful in increasing motivation to self-management of diabetes. The possible relationship between control of diabetes and sickness absence may also improve this aspect of care. The unemployment rate shown in Study 1 is

reassuring and may help to show the diabetic patient without significant complications that it is unlikely to be his condition which hinders him from being employed unless he is applying for work from which a diabetic worker is restricted (Study 5). For those diabetic workers with complications the employment picture may be different and requires further specific study.

Further research is suggested from the results of the studies presented in this thesis. Study of the prevalence of unemployment among diabetic subjects in the community would be useful. Study of the sickness absence of diabetic workers by treatment within a large United Kingdom employer may confirm the findings of Study 2 with a fuller randomisation procedure. Study of the control of diabetes and the relationship of control to sickness absence among insulin-treated workers within an organisation matched by other factors is required. Certain organisations appear to employ less than expected numbers of diabetic workers and merit further detailed study. Assessment of ill-health retirals at regular intervals may help to identify changes in morbidity associated with diabetes and its treatment. The employment status should be included as a variable in the analysis of control of diabetes. Finally, specific study is required of the employment problems of subjects with complications of diabetes to identify these and any methods available to maintain these workers in employment.

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Appendix i: Letter to diabetic subjects.

Dear ,

Survey of Employment and Insulin-dependent Diabetes

I would be grateful for your assistance with an important survey into the above subject which I am performing on diabetics who attend Dr BM Frier's clinic in Gartnavel General Hospital.

I would be grateful if you could complete the enclosed questionnaire.

If you are employed I would also be grateful to receive your consent to approach the Personnel Department of your employer for a copy of your sickness absence for 1986, by completing the enclosed consent forms. (The previous work done on sickness absence is over 20 years old and may not be relevant to diabetics in 1987).

All the information will be held in confidence by this department.

Please return the completed forms in the enclosed stamped addressed envelope.

Many thanks for your help with this survey.

Yours sincerely,

Appendix ii: Questionnaire.

SURVEY OF EMPLOYMENT etc. AND INSULIN-DEPENDENT DIABETES MELLITUS

Please tick the appropriate box [ ] or give details in the spaces provided.

NAME:.....D.O.B.....

ADDRESS:.....

.....

DIABETES

1) For how many years have you had diabetes mellitus.....

.....years

2) For how many years have you used insulin injections? ..

.....years

3) How much insulin do you inject each day?(in total) ....

.....UNITS

OCCUPATION

In the following please give as much detail about your occupation as possible e.g. chief chemical engineer rather than engineer.

4) I am (PLEASE CHOOSE ONE ANSWER)

[ ] EMPLOYED .....AND my usual occupation is_____

[ ] UNEMPLOYED .....AND the work I would do if employed

is_____

[ ] STUDENT .....AND my training course is_____

[ ] HOUSEWIFE .....AND my husband's occupation is_____

[ ] RETIRED .....AND my previous occupation was_____

If EMPLOYED answer questions 5 - 8.

5) How many years have you worked for your employer? ...

.....years

6) How many weeks annual leave do you receive? .....

.....weeks

7) Does your employer know of your diabetes? (delete as appropriate).....YES/NO

8) Would you be willing to take part in a study of sickness absence in diabetics?.....YES/NO

If YES: Do you wish mention of diabetes to be withheld in our letter to your personnel department?.....YES/NO

EMPLOYER'S NAME: .....

ADDRESS: .....

.....

Many thanks for your help with this survey.

Appendix iii: Consent form.

GREATER GLASGOW HEALTH BOARD

OCCUPATIONAL HEALTH SERVICE

NAME: ..... D.O.B. .....

ADDRESS: .....

I hereby give consent for the Personnel department of my employer to divulge details of my sickness absence record in confidence to the named Occupational Health Service.

Signature: ..... Date: .....

Appendix iv: Letter to employer (study 2)

Dear ,

RE:

SURVEY OF SICKNESS ABSENCE AND DIABETES

I would be grateful for your assistance with a study which compares the sickness absence of diabetics to non-diabetics.

The above named individual, who has this condition, is an employee of your organisation, and has kindly consented to allow me to approach you for a copy of his/her sickness absence record for 1986. I enclose a copy of the consent form and a form on which to note the absence record.

I would also be grateful to receive information regarding the sickness absence during 1986 of 2 other employees of the same sex, position, age (+/- 2 years), and if possible duration of employment (+/- 2 years) to act as controls. I do NOT require any information which could identify these controls (e.g. name, address).

I enclose CONTROL FORMS on which to note the sickness absence and the age, sex and duration of employment.

Please return all the forms in the stamped addressed envelope provided.

Many thanks for your help with this important study.

Yours sincerely,

Dr. Eugene R. Waclawski.

Appendix v: Subject forms (study 2)

GREATER GLASGOW HEALTH BOARD - OCCUPATIONAL HEALTH SERVICE

SUBJECT NUMBER: __ __ __ __

POSITION: _____

DURATION OF EMPLOYMENT: __ __years.

AGE: __ __years.

SEX:(delete as appropriate) Male/Female.

SURVEY OF SICKNESS ABSENCE

EPISODE	DATE STARTED	DATE ENDED	NO OF WORKING DAYS AFFECTED	REASON (if noted)
1)				
2)				
3)				
4)				
5)				
6)				
7)				
8)				
9)				
10)				
11)				
12)				
13)				
14)				
15)				
16)				
17)				
18)				
19)				
20)				

Appendix vi: Control forms (study 2)

GREATER GLASGOW HEALTH BOARD - OCCUPATIONAL HEALTH SERVICE

CONTROL NUMBER: __ __ __ __

POSITION: _____

DURATION OF EMPLOYMENT: __ __years.

AGE: __ __years.

SEX:(delete as indicated) Male/Female.

SURVEY OF SICKNESS ABSENCE

EPISODE	DATE STARTED	DATE ENDED	NO OF WORKING DAYS AFFECTED	REASON (if noted)
1)				
2)				
3)				
4)				
5)				
6)				
7)				
8)				
9)				
10)				
11)				
12)				
13)				
14)				
15)				
16)				
17)				
18)				
19)				
20)				

Appendix vii: Letter to occupational physicians (study 5).

Dear Dr. ,

SURVEY OF DIABETES AND EMPLOYMENT

I would be very grateful for your assistance with a survey into the above subject.

I enclose a form for completion and would be grateful if you could supply me with information regarding the number of U.K. employees working in your organisation, the number of diabetics employed and their treatment (if known), and the restrictions placed on diabetics by your department.

If you have a policy regarding restrictions and/or review of diabetics at work, I would be grateful to receive a copy.

Many thanks for your help with this survey.

Yours sincerely,

Dr. Eugene R. Waclawski.

(Occupational Health Physician).

Appendix viii: Survey form (study 5).

SURVEY OF EMPLOYMENT AND DIABETES

NAME OF ORGANISATION:

NO. OF U.K. EMPLOYEES:

NO. OF DIABETICS:

No. receiving insulin:

No. receiving oral agents:

RESTRICTIONS ON DIABETICS:

(a) Insulin-dependent diabetics

(b) Non-insulin-dependent diabetics

Appendix ix: Proforma for ill-health retiral survey.

SRC/GDC ILL HEALTH RETIRAL SURVEY

NAME: AGE: ___YRS.

OCCUPATION: SEX: M/F.

DEPARTMENT:

Education	Housing
Roads	Cleansing
Env. Health	Water/Sewers
Parks/Recreatn	Social Work
Libraries/Museum	Headquarters
Other	

DURATION OF EMPLOYMENT: ___YRS

CAUSE OF ILL HEALTH RETIRAL:

(A) (i) Diabetes Yes/No.

(ii) IDDM Yes/No.

(iii) NIDDM Yes/No.

(iv) Duration YRS.

(v) Complications:

Eye	Kidney
HBP	Vascular
CVS	Neurological
	Other

(B) Other Causes of IHR.

(i) Cardiovascular

(ii) Respiratory

(iii) Alimentary

(iv) Neurological

(v) Psychiatric

(vi) Musculoskeletal

(vii) Endocrine

(viii) Haemopoetic

(ix) Skin

(x) Malignancy

(xi) Lung cancer.

SMOKER: YES/NO.

Appendix x.

S.18

Strathclyde Regional Council

FINANCE DEPARTMENT

The Local Government Superannuation (Scotland) Regulations

EMPLOYEE APPLYING TO BE RETIRED ON ILL-HEALTH GROUNDS

MEDICAL REPORT BY EMPLOYING AUTHORITY'S MEDICAL ADVISER

Note for the information of the Medical Adviser:—
The above Regulations allow the payment of an annual pension for life and a lump sum payment where a pensionable employee in the Local Government Superannuation Scheme is incapable of discharging efficiently the duties of the employment by reason of **PERMANENT** ill-health. In most cases, not only are benefits paid earlier than normal but also an addition to actual service in the Scheme is awarded.

Authority ..... Department .....

Surname ..... Forename(s) .....

Date of Birth ..... Nature of duties .....

.....

The above-named pensionable employee of this Authority has passed to me a letter from his/her general medical practitioner indicating that, in the doctor's opinion, the employee is incapable of discharging efficiently his/her duties by reason of permanent ill-health. A copy of the doctor's letter is enclosed.

I should be obliged if you would confirm whether or not you agree with the doctor's opinion.

Signed .....
(Employing Authority Official)

Telephone No. for enquiries .....

Enclosure Dated .....

MEDICAL REPORT (not to be detached)

I ..... of .....

a duly qualified Medical Practitioner, hereby certify that I have examined .....

of ..... employed as a .....

..... by the above Authority and find him/her to be suffering from .....

.....

.....

(please indicate, in full, the nature of the infirmities)

In my opinion this employee *IS / IS NOT **PERMANENTLY** incapable of discharging his/her duties.

Date ..... Signature .....

*Please delete as appropriate

Note: The ENTIRE form, when completed by the Medical Adviser, to be returned to the employing authority for onward transmission to Strathclyde Regional Council, Finance Department, Superannuation Office.

Appendix xi: List of Particularly Suitable Occupations (Lotz U.).

Animal produce work

Announcer

BMSR technique -microcounting

Bookbinder

Brewer/Maltster

Brick layer

Builder

Butcher

Car mechanic

Catgut & string manufacturer

Ceramic ornament production

Chemical production

Cleaning Buildings (sandblasting)

Clothes manufacture

Concrete worker

Data processor

Data preparation

Distillery worker

Electrical fitter (maintenance)

Electrical machine builder

Electrical mechanic

Electrical signal engineer

Electrician (installations)

Enameller

Farm machinery mechanic

Film copier

Food technology assistant

Forester

Glass blower

Glass refiner

Glassware technician

Glassware painter

Horticulturalist

Horse breeding (stud farming)

Joiner

Laboratory assistant

Leather clothing

Leather goods

Machine builder

Machine operator

Machinist

Maintenance mechanic

Milk production

News production

Optician

Organ builder

Orthopaedic shoe-maker

Painter

Petrol pump attendant

Plastic worker

Plumber

Poultry production

Precision instrument maker

Printing

Publishing

Receptionist

Sculptor

Service mechanic - office machinery

Sheet metal worker

Shoe worker

Stone mason

Storeman

Technical layout

Telephonist

Textile industry

Tobacco production

Tool maker

Toy maker

Travelling salesman

Turner

Vine grower

Warehouse management

Wood manufacture

Wood treatment

Yeast production

Appendix xii: Well suited specialised occupations (Lotz U.)

Archive assistant
Basket maker
Beautician
Bee-keeper
Biology lab assistant
Boat-builder
Brass foundryman
Cap & hat maker
Cartographer
Chemist
China/porcelainware maker
Customer services worker
Draughtsman
Economist
Electrical draughtsman
Electrical fitter
Employment recruitment officer
Engraver
Film processing
Financier
Floor layer
Floral artist
Flower/festoon binder
Fur/leather production
Fur goods- sewing & trimming
Furrier
Gardener
Gas fitter
Gents' tailor
Glazier
Goldsmith
Graphic designer
Gunsmith
Haberdasher
Hairdresser
Household appliance fitter
Inspector of metal goods
Librarian
Locksmith
Machinery draughtsman
Mechanic
Mechanic - data processing & office machinery
Metal wind instrument maker
Metal worker

Milliner

Milk technology lab assistant

Model maker

Motor mechanic

Optometrist

Orthopaedic technician

Paving stone layer

Pharmaceutical production

Photographer

Photographic lab assistant

Physical science lab assistant

Piece worker

Piano maker

Postal worker

Potter

Pottery painter

Quality control work

Radio mechanic

Reproduction (photo, print)

Saddler

Salesman

Seamstress

Shepherd

Shoemaker

Silversmith

Spectacle frame maker

Textile designer

Upholsterer

Wood carver

Wooden toy manufacture

Writing