Incidence of diabetes mellitus in Oslo, Norway 1956-65

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SUMMARY A study of the incidence of diabetes mellitus in Oslo for the period 1925-54 (Westlund, 1966), based on a comprehensive compilation of hospital documents, has been extended to 1956-65. The incidence rates for the two periods have been compared, by taking the year of diagnosis and age at diagnosis in each case. The incidence rates for 1925-54 were revised by adding cases for this period discovered during the 1956-65 study, and showed no major changes. In particular, few new cases were found that had been diagnosed during the second world war, so that the dramatic reduction in incidence shown in Westlund's paper is not affected. The trend is fairly constant, with two exceptions: there was an increase in incidence for boys and girls younger than 10 years and a decrease for women aged between 40 and 59 years. After considering the various sources of error in such a comparison it is concluded that since 1950 there may have been a real increase in rates of diabetes in children. The decrease in rates for middle-aged women is not supported by mortality data for which statistics are given for associated as well as for underlying causes. Mortality data are however difficult to interpret, and by relying on hospital documents and death certificates considerably higher incidence rates have been presented than would have been the case had the incidence estimations been based on death certificates alone. The incidence rates in 1956-64 for children tally fairly well with those reported for Great Britain and Ireland (Bloom *et al.*, 1975) and for northern Norway (Bratlid, 1976).

In 1966 a study of the incidence of diabetes mellitus in Oslo was published (Westlund, 1966), based on a comprehensive compilation of hospital documents for the period 1925-55. The main purpose was to study the fluctuations of incidence in relation to the second world war, taking the year of diagnosis and the age at diagnosis in each case.

It was assumed in making such an epidemiological reconstruction that sooner or later nearly all persons with diabetes will visit a hospital and be discharged (alive or dead) with diabetes as one of the diagnoses. Of course, in some cases the delay between diagnosis and first hospital discharge may be long. However, Westlund found that 85% of all persons dying in Oslo during 1951-55 with diabetes mellitus mentioned on the death certificate had been recorded between 1925 and 1955 by the hospital, which suggests a completeness adequate for at least some purposes.

The present study extends the period of compilation to cover the years 1956-65, and the epidemiological technique has been as close to that used by Westlund as possible. The purpose was:

To quantify the deficiencies in incidence rates computed by Westlund caused by delays in the first admittance to hospital of cases actually diagnosed during the years on which he reported.

To determine whether the incidence of diabetes has been increasing in recent decades, and if so, in which age and sex groups.

To make a register of diabetics in hospital for the first time so as to follow-up mortality, particularly cardiovascular mortality, of patients discharged on oral drugs.

The mortality of the recorded patients was followed until 1973, and will be reported later.

Material and methods

Data were collected from 14 departments of internal medicine or paediatrics in Oslo—that is, from all official or semiofficial hospitals in the area. The names of 3368 patients discharged with a diagnosis of diabetes were recorded for the years 1956-65, excluding patients who had earlier been recorded in 1925-55. The hospital records were then located and information was extracted.

The hospital records could not be found for 102 cases (3%) in spite of great efforts. Most of these were of patients over 60 years of age.

One hundred and eleven patients were excluded because they were found not to have resided in Oslo at the time of admission to hospital. A further 282 patients were excluded because they were first diagnosed as diabetics at a hospital which was not included in the study or in hospital departments not included—such as departments of surgery. In most of these it would not have been possible to ascertain the year of diagnosis of diabetes. Some of these patients would in all likelihood not have been living in Oslo at the time of first admission. Fourteen patients were omitted for special reasons.

Included were 2859 Oslo citizens who had been first discharged from hospital with a diagnosis of diabetes during the period 1956-65. Of these 237 had been diagnosed between 1925 and 1954 without being admitted to hospital and were therefore used to amplify Westlund's follow-up study. Three had been diagnosed before 1925, and six in 1955. Out of a total of 2859 patients 140 (5%) were younger than 20 years.

To prepare incidence estimates the year of diagnosis and the age at diagnosis were used for each patient. Patients diagnosed before 1956 or after 1964 were thus not taken into account in calculating the rate for the period 1956-64. Details of the population in Oslo, distributed by sex and age for each of the years between 1956 and 1964 were obtained from the Municipal Office of Statistics.

Table 1 shows that 85% of the males below the age of 20, and 75% of the females below 20 years consulted doctors because of symptoms or complications of diabetes. In cases in which diabetes was discovered in connection with some other

disease or injury, or by a health check, clinical symptoms were present in some of these, and the diagnosis was based on glycosuria and repeated fasting blood sugar values (above 130 mg/100 ml), sometimes this was combined with a pathological blood sugar curve on tolerance test. Borderline cases were excluded. If two or more diagnoses were recorded in the hospital records it seemed to be a matter of choice whether diabetes was the main or the subsidiary diagnosis.

It has not been possible to estimate the percentage of diabetics who have never been admitted to hospital. Consultants and doctors in private practice who treat a large number of diabetics agree that practically all patients below the age of 30 years with recently detected diabetes will have been admitted to hospital; but for patients aged 30-59 years hospital admission may not always have been necessary, and this applies particularly to patients above 60 years who would often be admitted later for other diseases or for diabetic complications.

This bias in underestimating incidence of first diagnosis will, of course, be greater for the more recent years. In particular, many patients who were first diagnosed during the last year of the period of registration will be missed. Accordingly Westlund restricted incidence computations from his 1925-55 material to the years 1925-54. Similarly, from the 1956-65 material we estimated the incidence for only the years 1956-64.

In the course of following-up the mortality rates we noted how often diabetes was mentioned on the death certificates of these diabetics. The findings will be considered in connection with the discussion of mortality statistics as a means of estimating incidence time trends.

Table 1 Reason for detection of diabetes, by age at diagnosis and sex

Sex	Reason for detection	Age at diagnosis (years)										1925-55
		<20		20-49		> 50		Un- known	All ages			
		No.	%	No.	%	No.	%	No.	No.	%	%	
Male	Consulted doctor because of symptoms of diabetes	66	84.6	87	43.3	300	32.0	0	453	36.7	49.2	
	Coma in previously unrecognised diabetes	0	—	0	—	2	0.2	0	2	0.2	0.2	
	Examination in connection with some other disease or injury	4	5.1	42	20.9	447	47.7	2	495	40.0	28.1	
	Health check	1	1.3	34	16.9	56	6.0	1	92	7.4	4.9	
	Other and doubtful	7	9.0	38	18.9	132	14.1	17	194	15.7	17.6	
	All reasons	78	100.0	201	100.0	937	100.0	20	1236	100.0	100.0	
Female	Consulted doctor because of symptoms of diabetes	44	71.0	84	61.8	594	42.5	1	723	44.5	55.6	
	Coma in previously unrecognised diabetes	3	4.8	1	0.7	7	0.5	0	11	0.7	0.8	
	Examination in connection with some other disease or injury	5	8.1	16	11.8	563	40.2	0	584	36.0	26.1	
	Health check	1	1.6	7	5.1	23	1.6	1	32	2.0	1.3	
	Other and doubtful	9	14.5	28	20.6	212	15.2	24	273	16.8	16.2	
	All reasons	62	100.0	136	100.0	1399	100.0	26	1623	100.0	100.0	

Results

CHARACTERISTICS OF THE SERIES

Table 1 shows the 1956-65 material by sex, age, and by the reason for detection of diabetes. The percentage distribution for all ages for 1925-55 is shown for comparison. In every respect there are greater variations by age than by sex. About 85% of men below the age of 20 were diagnosed because they consulted a physician for symptoms of diabetes; for men over 50, this figure decreased to about 30%. For women the percentage varied from about 70% below the age of 20 to about 40% above the age of 50 years. More than one-third of the patients were diagnosed as a result of some other disease or injury.

If the figures for 1925-55 are compared there is a decrease in the percentage of patients of both sexes who were diagnosed because they consulted a physician for symptoms of diabetes and a corresponding increase in the percentage of patients who were discovered to be diabetics as a result of some other disease or injury (from 28% to 40% for men and 26% to 36% for women). The percentage of diabetic patients discovered by a health check was higher for 1956-65 than for 1925-55, particularly for men aged between 20 and 49. The difference is explained by the more extensive use of medical services in factories, offices, etc. during the latter period.

Table 1 suggests that some of the cases that were registered during 1956-65 might not have come to light during earlier periods of less intensive diagnostic practices.

Table 2 gives the interval between diagnosis of diabetes and first hospital admission.

The percentage of cases discovered either during the hospital stay or within the previous month was very similar for both periods. This is also true for cases diagnosed more than one year before

admission. In both periods only about one-third of the cases had been diagnosed more than one month before the admission which recorded the diagnosis in the hospital records. Younger patients had shorter intervals than older. The table shows that no major change has taken place in the delay of admission to hospital of diagnosed diabetics between the two study periods.

Table 3 gives the reasons for the first admission to hospital of the diabetics.

The percentage admitted for diabetic coma or for insulin shock is remarkably similar in the two series. However, the period 1956-65 shows a much larger percentage admitted for other diseases or injuries. Conceivably, some of this difference may be owing to changes in coding procedures.

Five point four per cent of the males and 5.2% of the females had received insulin before admission and these figures were considerably larger for ages between 20 and 49 years (males 14.4% and females 15.4%). The corresponding figures for all ages in 1925-55 were males 9.1% and females 6.7%.

Table 4 shows the treatment given at discharge from hospital. Below 20 years of age at diagnosis 89.5% of the males and 95% of the females were treated with insulin, compared with 13.8% and 9.2% at the age of 50 and above. For oral drugs the tendency was the opposite. As many as 13.1% of the men and 40.4% of the women in the highest age group were discharged on oral drugs, compared with 1.3% and 1.7% below the age of 20. At ages of 50 or over, half of the patients (52.9% men and 49.9% women) were managed by 'diet only'.

For the period 1925-55 oral drugs were not available and more than half of the patients had been prescribed insulin regimen at discharge. Thus, the relationship between patients on diet alone and patients given drugs (insulin alone or insulin +

Table 2 Interval between diagnosis of diabetes and first hospital admission

Sex	Interval	Age at diagnosis (years)										Un- known	All ages		1925-5
		<20		20-49		>50									
		No.	%	No.	%	No.	%	No.	No.	%	%				
Male	Not diagnosed before admission	2	85.9	31	56.7	374	66.6	0	407	32.9	21.4				
	Not more than one month	65		83		250		0	398	32.2	45.1				
	More than one month, not more than one year	3		29		122		0	154	12.5	9.5				
	More than one year	8	14.1	57	43.3	187	33.4	1	253	20.5	22.8				
	Doubtful	0		1		4		19	24	1.9	1.2				
	All intervals	78	100.0	201	100.0	937	100.0	20	1236	100.0	100.0				
Female	Not diagnosed before admission	6		20		485		0	511	31.5	22.3				
	Not more than one month	43	79.0	57	56.6	446	66.5	—	546	33.6	43.4				
	More than one month, not more than one year	3		21		184		0	208	12.8	10.3				
	More than one year	10	21.0	37	43.4	278	33.5	0	325	20.0	22.6				
	Doubtful	0		1		6		26	33	2.0	1.4				
	All intervals	62	100.0	136	100.0	1399	100.0	26	1623	100.0	100.0				

Table 3 Reason for first hospital admission, by age at diagnosis and sex

Sex	Reason for admission	Age at diagnosis (years)										All ages	1925-55
		<20		20-49		≥50		Un-known					
		No.	%	No.	%	No.	%		No.	No.	%	%	
Male	Coma or precoma	5	6.4	6	3.0	17	1.8	1	29	2.3	2.8		
	Insulin shock	3	3.8	8	4.0	3	0.3	1	15	1.2	0.9		
	For adjustment of previously recognised diabetes or other diabetic complications	3	3.8	26	12.9	70	7.5	3	102	8.3	17.3		
	For adjustment of recently discovered diabetes	63	80.8	94	46.8	266	28.4	0	423	34.2	42.9		
	Other diseases, injuries, and doubtful	4	5.1	67	33.3	581	62.0	15	667	54.0	36.1		
	All admissions	78	100.0	201	100.0	937	100.0	20	1236	100.0	100.0		
Female	Coma or precoma	8	12.9	13	9.6	37	2.6	1	59	3.6	3.8		
	Insulin shock	1	1.6	5	3.7	2	0.1	0	8	0.5	0.3		
	For adjustment of previously recognised diabetes or other diabetic complications	2	3.2	19	14.0	102	7.3	5	128	7.9	19.8		
	For adjustment of recently diagnosed diabetes	42	67.7	64	47.1	492	35.2	0	598	36.8	42.9		
	Other diseases, injuries, and doubtful	9	14.5	35	25.8	766	54.7	20	830	51.2	33.2		
	All admissions	62	100.0	136	100.0	1399	100.0	26	1623	100.0	100.0		

Table 4 Treatment at discharge

		Age at diagnosis (years)									
Sex	Treatment on discharge	< 20		20-49		≥50		Un- known	All ages		
		No.	%	No.	%	No.	%	No.	No.	%	
Male	Insulin	68	89.5	93	47.2	114	13.8	2	277	24.9	
	Peroral drugs	1	1.3	43	21.8	274	33.1	4	322	29.0	
	Both insulin and peroral	1	1.3	0	—	1	0.1	0	2	0.2	
	Unknown	0	—	0	—	1	0.1	0	1	—	
	Diet only	6	7.9	61	31.0	437	52.9	6	510	45.9	
	All treatments	76	100.0	197	100.0	827	100.0	12	1112	100.0	
Female	Insulin	57	95.0	69	52.7	114	9.2	2	242	16.7	
	Peroral drugs	1	1.7	24	18.3	502	40.4	10	537	37.0	
	Both insulin and peroral	0	—	1	0.8	4	0.3	0	5	0.3	
	Unknown	0	—	2	1.5	3	0.2	0	5	0.3	
	Diet only	2	3.3	35	26.7	619	49.9	6	662	45.6	
	All treatments	60	100.0	131	100.0	1242	100.0	18	1451	100.0	

oral drugs) was practically the same for both periods.

EFFECT OF PROLONGED REGISTRATION PERIOD ON INCIDENCE BY YEAR OF DIAGNOSIS

As mentioned there were 246 patients discharged in 1956-65 who had been diagnosed in 1955 or earlier. This number should be seen in relation to the 4251 patients recorded for 1925-55.

Of these 237 were diagnosed in the period 1925-54—that is, during the years that Westlund studied incidence rates. We have added these cases to his in the appropriate subgroups and revised the incidence rates. No major changes were observed. In particular, few new cases were diagnosed during the second world war, so that the dramatic reduction in incidence shown in the paper by Westlund (1966) is not affected. Table 5 shows the incidence for the most recent of Westlund's periods (1951-55), with and without

Table 5 Incidence of diabetes diagnosed during 1951-54 with and without adding cases from the 1956-65 hospital material

Age at diagnosis (years)	Males (based on discharges)		Females (based on discharges)	
	1951-55	1956-65	1951-55	1956-65
<10	0.7	0.7	0.6	0.6
10-19	0.7	0.7	1.1	1.3
20-29	1.2	1.2	0.4	0.4
30-39	1.5	1.8	1.0	1.1
40-49	2.7	3.2	1.0	1.2
50-59	6.9	7.8	5.1	6.0
60-69	12.8	15.5	14.0	16.8
70-79	16.1	17.6	25.4	28.2
80+	24.4	25.6	28.4	29.5

the cases discovered by means of the 1956-65 hospitalisation. At ages between 30 and 70 years the prolonged registration increased the incidence by roughly 15% to 20%. At younger and older ages the effect was less pronounced.

INCIDENCE TIME TREND

As in the previous study we assumed that cases diagnosed during the last year of the registration period—that is, 1965—were too incomplete to provide useful incidence estimates. We therefore present estimates for the periods 1956-60 and 1961-64, to be compared primarily with the periods 1946-50 and 1951-54 as given in the previous report (without adding the 1946-54 cases discovered in the present survey).

Table 6 shows incidence per 10 000 population in these four periods by age and sex. The rates are irregular because of the small number of cases in each subgroup.

The main impression is that there has been a fairly constant incidence, certainly very different from that found for cardiovascular disease in Oslo after the second world war (Westlund, 1966). However two features deserve comment: an increase for boys and girls younger than 10-19 years, and a decrease for women aged between 40 and 59. The decrease in middle-aged women was observed previously; in 1931-35 the incidence for women aged between 50 and 59 was 11.9 per 10 000 compared to the 1961-64 rate of 4.1. Data are not available to relate these figures to changes in pregnancy patterns or body weight.

The apparent increase in younger people is

analysed in Table 7 which compares the entire period 1925-54 with 1956-64, by five-year age groups. In children under 10 the incidence in the latter period has nearly doubled. At ages between 15 and 29 years the differences are small.

We have considered the various sources of error in this comparison, but conclude that the most likely explanation is that after 1950 there has been a real increase in the incidence of diabetes in children. Better medical and obstetric care would gradually tend to save relatively more infants who are genetically determined to get diabetes, but it is hardly probable that this will have affected the incidence rates for children under 10 years in the observed period. Of course, new environmental factors (viruses) may be a factor, but this cannot be elucidated from our material. Children at earlier periods may have been misdiagnosed or possibly were not seen by doctors at all and deaths reported as caused by pneumonia or ill-defined diseases.

Two other studies on children below 15 years of age were carried out with a similar technique. Bratlid (1976) collected data on children younger than 15 years in the three most northern countries of Norway for the years 1966-74, and found a yearly incidence per 10 000 of 0.92 for boys and 0.66 for girls, compared with 1.2 for boys and 0.95

Table 6 *Diabetes incidence per 10 000 a year, by age and sex in different quinquennia*

Sex	Quinquennium of diagnosis	Age at diagnosis (years)							
		<10	10-19	20-29	30-39	40-49	50-59	60-69	70-79
Men	1946-50	0.5 (6)	0.7 (7)	1.2 (19)	2.1 (35)	2.6 (42)	6.8 (86)	13.6 (93)	15.1 (54)
	1951-54	0.7 (8)	0.7 (6)	1.2 (14)	1.8 (25)	3.2 (43)	7.8 (88)	15.5 (103)	17.6 (58)
	1956-60	1.4 (20)	1.3 (19)	1.3 (17)	1.5 (25)	2.5 (41)	6.8 (105)	17.3 (189)	21.7 (99)
	1961-64	0.9 (11)	1.3 (16)	0.7 (8)	1.2 (14)	3.0 (41)	6.9 (86)	12.3 (121)	19.8 (86)
	Rates 1956-64 in percentage of rates 1946-54	—	—	—	0.61	1.04	0.95	0.85	1.21
Women	1946-50	0.3 (4)	1.3 (13)	0.8 (16)	0.8 (17)	2.2 (46)	8.5 (131)	16.4 (160)	21.6 (125)
	1951-54	0.6 (7)	1.3 (12)	0.4 (5)	1.1 (16)	1.2 (21)	6.0 (84)	16.8 (154)	28.2 (150)
	1956-60	0.7 (9)	0.9 (14)	0.8 (12)	0.8 (14)	1.9 (38)	5.2 (103)	16.3 (235)	28.7 (218)
	1961-64	1.1 (12)	0.9 (12)	0.6 (8)	0.6 (7)	1.8 (28)	4.1 (65)	12.0 (163)	28.2 (192)
	Rates 1956-64 in percentage of rates 1946-54	—	—	—	0.65	1.03	0.56	0.72	1.14

No. of patients diagnosed is given in parentheses

Table 7 *Diabetes incidence per 10 000 a year, 1925-54 and 1956-64 in five-year diagnostic age groups below 30 years, by sex*

Age at Diagnosis (years)	Males			Females		
	1925-54	1956-64	Rates 1956-64 in percentage of rates 1925-54	1925-54	1956-64	Rates 1956-64 in percentage of rates 1925-54
0-4	0.31 (12)	0.67 (9)	2.16	0.16 (6)	0.24 (3)	1.50
5-9	0.86 (29)	1.63 (21)	1.90	0.54 (18)	1.45 (18)	2.69
10-14	0.94 (30)	1.32 (18)	1.40	0.89 (28)	1.14 (15)	1.28
15-19	1.06 (41)	1.19 (16)	1.12	1.15 (48)	0.77 (11)	0.67
20-24	0.83 (38)	0.96 (12)	1.03	0.59 (37)	0.74 (11)	1.25
25-29	1.01 (57)	1.12 (14)	1.11	0.78 (48)	0.52 (9)	0.67

No. of patients diagnosed is given in parentheses

for girls in our study. Taking into account the difference in period and geographical area, and the small number of cases, Bratlid's figures may be said to tally fairly well with ours. The British Diabetic Association sponsored a study (Bloom *et al.*, 1975) of all new cases of diabetes notified in children aged between 10 and 15 years in Great Britain and Ireland for a two-year period starting in November 1972. Notification suggested that there was a minimum yearly incidence of 0.77 per 10 000—that is, a figure on about the same level as the figures obtained in Oslo and in northern Norway.

Mortality trends

These are difficult to interpret, even if—as in Norway—statistics are provided not only for underlying cause but for associated causes as well. Table 8 shows the trend for 1951-70 for ages above 25 in Norway as a whole (Central Bureau of Statistics of Norway, 1947). In contrast to what was found in Oslo, there is an increase in incidence in men aged between 35 and 64. The increase is principally found for associated causes, however, and may therefore to a large extent be a reflection of the increase in cardiovascular mortality in this period. More difficult to reconcile with these findings is that there is no decrease in mortality for middle-aged women. In fact, diabetes as a certified associated cause of death shows an increase between 1951 and 1970 in women aged between 55 and 64.

The tendency towards an increase in diabetes as an associated cause of death shown in Table 8 does not appear (at least from experience in Oslo) to be a result of better notification—that is, a more frequent entry of diabetes on the certificate when the diagnosis has in fact been made. Westlund found by following-up his 1925-55 material until

1961 that diabetes was mentioned on 67.5% of the certificates. But in the present study, when following-up our 1956-65 material until 1973, we found diabetes mentioned on only 52.6% of the certificates.

No obvious explanation for this difference has been found. It is possible that physicians when filling in death certificates more often left diabetes out in the latter calendar period. They may not have known that the patient suffered from diabetes, or they may have regarded as negligible a diabetes accompanying a more fatal disease. From being commonly regarded as a serious disease in itself, diabetes may in the course of later years more and more have been looked upon as relatively innocent. To be a 'diabetic' may no longer imply the risk that was linked to it in earlier years. This may possibly have influenced the tendency of physicians to omit diabetes as a subsidiary cause of death on the certificate, particularly as cardiovascular disease has come more to the fore.

It is obvious that by combining hospital records for 1956-65 with death certificates we have been able to identify many more patients with diabetes than we would have done by relying on death certificates alone. This experience tallies well with the findings of Tokuhata *et al.* (1975) in a one-year study in Pennsylvania. Nearly 8% of patients with no mention of diabetes on the death certificates were shown, by collecting information from physicians, to have diabetes.

Conclusions

As far as we can interpret, our data show the incidence of diabetes has doubled in children in Oslo between 1925-54 and 1956-64. At the same time, the incidence in middle-aged women appears to have

Table 8 Deaths in which diabetes mellitus was cause (per 100 000 population)

Annual average	Men						Women					
	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	75 years and over	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	75 years and over
1951-55												
Underlying cause of death	3.9	3.4	3.9	9.0	25.9	56.9	2.3	1.9	2.9	11.6	35.5	76.3
Associated cause of death	1.0	1.1	5.0	23.6	66.0	160.4	0.6	1.3	2.3	22.2	108.2	219.2
Both	4.9	4.5	8.9	32.6	91.9	217.3	2.9	3.2	5.2	33.8	143.7	295.5
1956-60												
Underlying cause of death	4.1	3.7	4.5	9.2	23.6	49.7	2.9	2.2	2.6	9.1	37.5	82.8
Associated cause of death	1.3	1.8	6.9	25.0	101.7	220.3	0.5	0.9	2.9	26.3	118.8	324.9
Both	5.4	5.5	11.4	34.2	125.3	270.0	3.4	3.1	5.5	25.4	156.3	407.7
1961-65												
Underlying cause of death	4.3	5.8	5.6	9.0	24.5	74.8	2.9	2.5	3.2	9.4	35.0	99.5
Associated cause of death	1.2	2.1	7.8	33.1	126.6	321.6	0.4	1.8	3.7	32.8	171.5	431.7
Both	5.5	7.9	13.4	42.1	151.1	396.4	3.3	4.3	6.9	42.2	206.5	531.2
1966-70												
Underlying cause of death	2.2	5.4	4.6	7.9	21.7	62.8	2.4	2.0	2.7	7.9	25.3	70.0
Associated cause of death	1.2	3.6	8.5	42.3	169.5	427.8	0.3	1.5	6.0	34.5	186.0	534.3
Both	3.4	9.0	13.1	50.2	191.2	490.6	2.7	3.5	8.7	42.4	211.3	604.3

decreased. In view of difficulties in methods however, artefacts cannot be completely excluded, and mortality data for Norway as a whole do not support the incidence findings in middle-aged women.

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References

- Bloom, A., Hayes, T. M., and Gamble, D. R. (1975). Register of newly diagnosed diabetic children. *British Medical Journal*, **3**, 580-583.
- Bratlid, D. (1976). Report No. 15, pp. 54-57. Nordic Council for Arctic Medical Research: Odense, Denmark.
- Central Bureau of Statistics of Norway (1947). *Mortality Trend and Mortality Pattern 1951/70*, p. 100. Central Bureau of Statistics: Oslo.
- Tokuhata, G. K., Miller, W., Digon, E., and Hartman, Th. (1975). Diabetes mellitus: An underestimated public health program. *Journal of Chronic Diseases*, **28**, 23-35.
- Westlund, K. (1966). Incidence of diabetes mellitus in Oslo, Norway 1925-1954. Report No. 11 of the Life Insurance Companies' Institute for Medical Statistics at the Oslo City Hospitals. *British Journal of Preventive and Social Medicine*, **20**, 105-116.