DIABETES MELLITUS, AGE AND LATE COMPLICATIONS. EFFECTS ON PSYCHOSOCIAL WELL-BEING.

RESULTS OF THE NORD-TR0NDELAG HEALTH SURVEY

Running title: **DIABETES, COMPLICATIONS AND WELL-BEING**

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Diabetes mellitus, age and late complications. Effects on psychological well-being
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OBJECTIVE - The present paper raises the question: Is the observed decrease in quality of life among diabetic patients solely due to aging and to the effect of late complications?

RESEARCH DESIGN AND METHODS - The study relies on questionnaire data from a diabetes and hypertension screening carried out on the entire adult population of a medium-sized Norwegian county (total number of participants = 76,900). Persons with self-reported diabetes were compared with persons without diabetes regarding psychosocial well-being, controlling for sex. Control variables were then introduced, one at a time: Age, self-reported cardiac infarction, stroke, angina pectoris, vision impairment, mobility impairment and "other physical disease".

RESULTS - Psychosocial well-being of the diabetic patients was found to be lower than for persons without diabetes. But controlling for age, the differences between persons with and without diabetes were reduced, and controlling for the above-mentioned diseases/impairments, the differences were further reduced. For most variables the effect was slight but significant. Examination of interaction effects showed that, contrary to older persons, persons between 20 and 40 with diabetes have a psychosocial well-being at the same level as the remaining population of the same age.

CONCLUSIONS - It is the main finding of the present study that if persons with diabetes reported no other diseases or impairments, they would have a quality of life similar to that of persons without diabetes (at the same age). However, the above statement seems to apply mostly to young persons. When approaching middle and old age a very large proportion of the diabetic patients report late complications or other diseases and reduced psychosocial well-being.

Persons with diabetes report lower quality of life than do persons with no reported disease (1-5). The strain of adhering to a strict diet regimen, the fear of episodes of hyper- and hypoglycemia, and the fear of late complications, have been listed as factors predisposing to reduced quality of life.

Several studies have found that cardiac and other complications, frequently occurring among patients with diabetes, aggravate their psychological problems and reduce their quality of life (3, 6-12).

The present paper raises the question: Is the observed decrease in quality of life among diabetic patients solely due to aging and to the effect of late complications? Or, put differently, do persons with diabetes (only diabetes and no other disease or impairments) have a quality of life on the level of persons at their own age with no diseases? Is the presence of diabetes a negative life experience *in itself?*

In the following we shall report from a health screening in a Norwegian county (the Nord-Trøndelag Health Survey).

RESEARCH DESIGN AND METHODS

Sample

In 1984 - 1986 all persons aged 20 years and above in the county of Nord-Trøndelag, Norway, were screened for self-reported hypertension and diabetes. Out of a total of 85,100 individuals*, 76,900 (90.4 %) attended and answered a short questionnaire. The attenders were given a more extensive questionnaire when they left the screening. 62,784 persons (81.6 %) responded, that is 73.8 % of the eligible population. For a study of drop-outs and non-attenders and a thorough discussion on the scope and the nature of the drop-out problem, see (13) and (14).

* 87,285 minus 2,185 excluded because they were dead, had moved out of the county, etc. (13).

A sample of persons who did not attend the screening were interviewed about their non-participation (13). The results of this study indicated that about 60 % of the men and 30 % of the women who did not participate, had been temporarily absent or too busy, and about 30 % of the men and 55 % the women were sick or disabled. The first group (the busy) were younger than the average participants and the second group (the sick) were older. In another study (14) the group answering the first questionnaire, and not the second one, were compared to those answering both questionnaires. The results of this study indicated that there were no differences in life satisfaction or self-assessed health between the two groups.

Among the diabetic patients 55 % were women and the average age was 62 years. Some population characteristics are listed in Table 1.

/Table 1 about here/

Questionnaire data

Questionnaire I (Q I)

All screenees completed a short questionnaire before undergoing medical testing. This questionnaire included questions on employment situation, several known diseases and disabilities (such as diabetes, cardiac infarction, angina pectoris, stroke, impaired vision, impaired mobility), self-assessed health and overall life satisfaction. Valid responses to questions used in the following analyses varied between 76,639 and 75,243 (90.1 % to 88.4 %).

Questionnaire II (Q II)

The participants were given a second questionnaire with a prepaid, addressed envelope and asked to return the questionnaire as soon as possible. Q II contained a total of 42 questions covering several issues, including physical and mental health and psychological well-being. Valid responses to questions used in the following analyses varied between 62,229 and 59,230 (73.1 % to 69.6 %). The two questionnaires are presented elsewhere, both in Norwegian layout and in English translation (13).

Characteristics of the analysis variables

Psychosocial well-being was measured by ten seperate items. The questions chosen were selected from among questionnaires used in previous Norwegian studies (15, 16). The scope of the study did not allow the inclusion of any of the longer established instruments measuring quality of life or psychological well-being (17). The ten questions have been analyzed to validate their overall psychometric qualities (18, 19). Some further psychometric characteristics on our outcome measure and results are reported elsewhere. It was shown that our measure correlated highly with a 23-item version of the Hopkins Symptom Check List (HSCL) (20, 21).

Rather than generating a general index, specific analyses with several different outcome variables were conducted. These dependent variables relate to present employment situation, subjective health, vigor, the use of pain-relieving medication, the use of tranquilizers, sleeping problems, nervousness, loneliness, cheerfulness, and life satisfaction - all self-reported.

The questions presented to the respondents, used as dependent variables in our analyses, were as follows.

Are you employed at present? (Four-step frequency response scale) How is your

health these days? (Four-step frequency)

At present, do you mostly feel strong and fit or tired and worn out? (Seven-step bipolar)

How often have you taken pain-relieving medication over the course of the last month? (Four-step frequency)

How often have you taken tranquilizers/sedatives or sleeping medicines over the course of the last month? (Four-step frequency)

Have you had any problems falling asleep or had any sleeping disorders over the course of the last month? (Four-step frequency)

Over the past month, have you suffered from nervousness (felt irritable, anxious, tense and restless)? (Four-step frequency)

Do you often feel lonely? (Five-step frequency)

Would you say you are usually cheerful or dejected? (Seven-step bipolar)

Considering how you feel these days, are you generally satisfied with your life, or are you generally dissatisfied? (Seven-step bipolar)

As mentioned, independent variables are based on self-reported diseases (diabetes, cardiac infarction, stroke, angina pectoris) and impairments (vision impairment, mobility impairment and impairment due to "other physical disease").

To explore interactions between age and self-reported diabetes, the question on diabetes was combined with the age variable:

- Young (below 40 years of age), Diabetes
- Young (below 40 years of age), Not diabetes
- Middle-aged (40 - 59 years of age), Diabetes
- Middle-aged (40 - 59 years of age), Not diabetes
- Old (60 years and above), Diabetes
- Old (60 years and above), Not diabetes

Unfortunately we have no exact data to discriminate between type 1 and type 2 diabetes. Only 9 % of the diabetic patients were diagnosed before the age of 40 and were at present using insulin. It is thus clear that type 2 patients dominate in our material.

The validity of the answers related to diabetes has been studied in a separate analysis, comparing the questionnaire data with the diagnoses found in the medical files of the general practitioners of one municipality of the county (22). The diabetes diagnosis was verified in 163 out of 169 cases, and types of diabetes treatment were verified in 95 -100 % of the cases. The validity of the self-reported cardiac complications has not been examined. One may note that in this context misclassification due to false positives and false negatives should not represent a major problem since morbidity as perceived by the individual may be more relevant than the results of professional diagnoses. With respect to well-being the fact that a person believes that he/she suffers from a certain disease is probably just as important as a professional diagnosis.

Statistical analyses

The data were analyzed by ANOVA, including Multiple Classification Analysis (MCA) and testing of interaction effects. Beta values from MCA may be conceived of as standardized regression coefficients, but unlike the latter, they also reflect non-linear associations. Analyses of variance with the above-mentioned well-being variables as the dependent variables and the diabetes variable as the main independent factor were performed, controlling for sex. At the next step, age (7 categories) was added as independent variable, and then self-reported infarction, stroke and the other disease/impairment variables, one at a time. Interaction effects between age and diabetes were tested. In cases with significant interaction effects the diabetes/age variable with six values described above was introduced. P-values <0.05 were considered as significant.

RESULTS

A much higher prevalence for a number of diseases among persons with diabetes than among the rest of the sample was observed (Table 2). This applied to young as well as middle-aged and old patients.

/Table 2 about here/

Table 3 presents some results from the ANOVA analyses with outcome variables related to psychosocial well-being. The table gives beta-values for the diabetes variable, as well as "mean differences" (i.e. mean differences between persons with diabetes and persons without diabetes, divided by the standard deviation (Z-scores)), controlled for sex, age and specified diseases/impairments, other than diabetes.

/Table 3 about here/

As shown in Table 3, column I, persons with diabetes were less often gainfully employed than persons without diabetes, a difference mainly due to age differences (diabetic patients being older). The differences between the categories were reduced as more control variables are introduced. There was an interaction effect between diabetes and age related to employment, controlling for other factors (sex and disease/impairment variables). Table 4, column I, shows that the difference between young persons with/without diabetes in employment rate was small, which was to be expected as late complications are rare among the young. The difference was most pronounced among the middle-aged. The interaction effect was statistically significant (p = .004).

/Table 4 about here/

Table 3, column II, presents the relationship between subjective health and diabetes. The introduction of age and various disease variables reduced the differences in self-assessed health between persons with/without diabetes. Table 3, column III, gives corresponding results for the variable vigor (the number of respondents was lower as this variable is based on answers to QII). There was no significant interaction between diabetes and age in relation to subjective health or vigor (hence no interaction analysis is presented).

Table 3, column IV, presents the relationship between diabetes and the use of pain-relieving medication. The beta-values were very weak and became even weaker when control variables were introduced. Similar results are seen in Table 3, column V and VI, showing almost no differences in the frequency of sleeping problems and in nervousness between persons with and without diabetes. The relationship between diabetes and nervousness was not statistically significant. However, in the case of nervousness, we found a significant interaction effect (p = .049) between age and diabetes. Young persons with diabetes reported *less* nervousness than did young persons without diabetes (Table 4, column II).

Table 3, column VII, shows that persons with diabetes used more tranqilizers than persons without diabetes. The differences were reduced with the introduction of control variables. For young persons we found the same pattern as for nervousness. Young persons with diabetes used tranquilizers *less* often than did young persons without diabetes, while old persons with diabetes used tranquilizers more often (Table 4, column III). The interaction effect between age and diabetes was significant at the .000 level, controlling for sex and disease/impairment variables.

The next analysis relates to loneliness (Table 3, column VIII), showing small differences and somewhat reduced differences when the control variables were introduced. There was a significant interaction effect between age and diabetes on loneliness (p = .041). Young persons with diabetes reported slightly less loneliness than young persons without diabetes while middle aged and old persons with diabetes reported more loneliness (Table 4, column IV).

The variables cheerfulness and life satisfaction were only weakly related to diabetes (Table 3, columns IX and X). We found larger differences between the young and middle aged persons with/without diabetes than among the old, but the interaction effect between age and diabetes was not significant when we controlled for sex and the disease/impairment variables.

CONCLUSIONS

Our analyses confirm findings from other studies concluding that other diseases/disabilities may aggravate the psychosocial problems of persons with diabetes. It is the main findings above that a large proportion of the difference in psychosocial well-being between persons with and without diabetes disappeared when we "controlled for" the presence of other diseases/impairments. In other words - if persons with diabetes had no other diseases, they would have a quality of life at a level similar to that of persons without diabetes (at the same age).

On the other hand, late complications *are* a frequent aspect of having diabetes. In one sense, then, "controlling away" such complications may be seen as a methodological move without foundation in the real life of the diabetic patient. However, late complications occur to varying extents. With improved medical knowledge and treatment such complications can also be avoided to a larger degree than before. We have also been able to show that young persons with diabetes in some respects have no more - or even less - problems than other people.

To summarize our findings in some more detail: As shown in Table 3, very much (almost all) of the difference in self-reported psychosocial well-being between persons with diabetes and persons without diabetes was related to age differences and to the over-frequency of other diseases/impairments among diabetic patients. The relationships were statistically significant (except in the case of nervousness), but very weak. Considering the beta-values, we found that, controlling for age and disease/impairment, only three values (subjective health, vigor and the use of tranquilizers) were as high as

.020 or higher, the highest being .032 (subjective health). The deviations from mean were as high as .10 or higher in four cases (employment, subjective health, the use of tranquilizers and loneliness), the highest being .20 (again, subjective health).

Interaction effects

Especially young persons (below 40 years of age) with diabetes seemed to have few problems or, rather, no more problems than other persons of their age. As mentioned above, they had in some respects (nervousness, use of tranquilizers and loneliness) a higher well-being than young persons without diabetes, while older persons with diabetes reported less well-being (in terms of the same three variables) than did older persons without diabetes (Table 4). This also applied to sleeplessness, but in this case the interaction effect was not significant. Further, Table 4 shows that young persons with diabetes were slightly less often employed than young persons without diabetes, but the differences were more pronounced among the middle aged and old persons. A similar test was carried out for the vigor-score, but the interaction effect was not significant. In the case of pain-relieving medication and cheerfulness there were no interaction effects between age and diabetes. In the case of subjective health and life satisfaction the differences were more pronounced between the young persons than among the old, but the interaction effect was not significant.

However, middle aged and older persons with diabetes did not have the same quality of life as persons without diabetes. Controlling for sex, age, self-reported infarction, stroke, angina pectoris, vision impairment, mobility impairment and "other physical disease", middle aged and old persons with diabetes were less often employed, were less often in good health, and reported less vigor and more loneliness. They used tranquilizers more frequently than middle aged and old persons without diabetes.

Methodological comments

Some methodological comments are warranted. The present study is based on a large, broad population sample. All diabetic patients in the county are included in the study group (except the dropouts). Some statisticians will object to our statements on "significance"as applied to our findings. They may say that such considerations are irrelevant when the study includes the total population of the county. In a strict statistical sense generalization to diabetic patients in other parts of Norway, let alone to patients in the rest of the world, or to future generations of persons with diabetes, is of course not warranted. On the other hand, if our findings should be considered of interest to diabetes care more generally, and not narrowly restricted to the Nord-Tr0ndelag county in 1984-86, which we consider likely, such considerations must implicitly be based on assumptions on some notions on generalizations. Even if we do not expect that relationships such as those reported in this article will be found to be exactly the same in other parts of the world, we consider it a plausible hypothesis that they will not be much different. As to changes over time, we consider it more likely that the difference in psychosocial well-being between (middle aged and old) persons with and without diabetes have been reduced. We plan to study such possible changes in a next step in our research. The Nord-Trøndelag Health Survey was repeated in 1995-97, enabling us to analyze the same population over an 11 year period.

The possibility of a dropout problem remains. We do not know whether the dropouts are proportionally more often in the category of diabetes patients, and more often among the diabetes patients with low well-being. However, with a participation rate close to 90 % a substantial recruitment bias is not likely.

The data are based on self-reports, usually preferred in such studies. A possible weakness is that idealization may be more usual among persons with chronic diseases than among those without such diseases. The validation study referred to above (22), showed that self-report data on diabetes are highly valid.

Concluding statements

Based on this study, diabetes as a disease does not seem to be a heavy burden *in itself.* It is possible that some diabetic patients feel a strain of adhering to a strict diet regimen and experience a threat of late complications and hyper/hypo-glycemia, and that this reduces their enjoyment of daily life. However, this reduction may be largely offset by the patients' ability to adjust to the situation.

On the other hand, the above statement seems to apply mostly to young persons. When approaching middle and old age a very large proportion of the diabetic patients do experience late complications. Thus, the disease diabetes *indirectly* has a serious effect on the quality of life of a large number of the patients. Aging is inevitable, but the prevention of diabetic complications seems to be the foremost task on the part of the health services.

ACKNOWLEDGEMENTS

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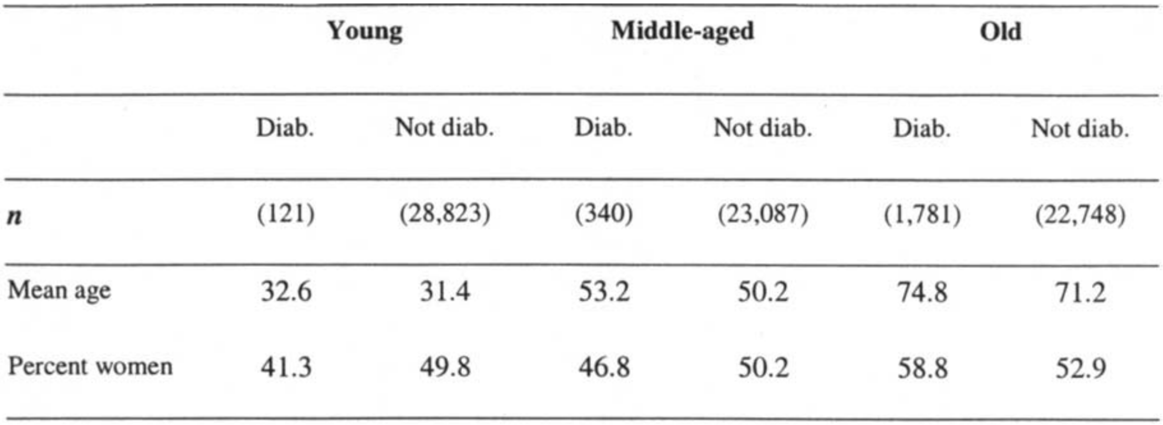
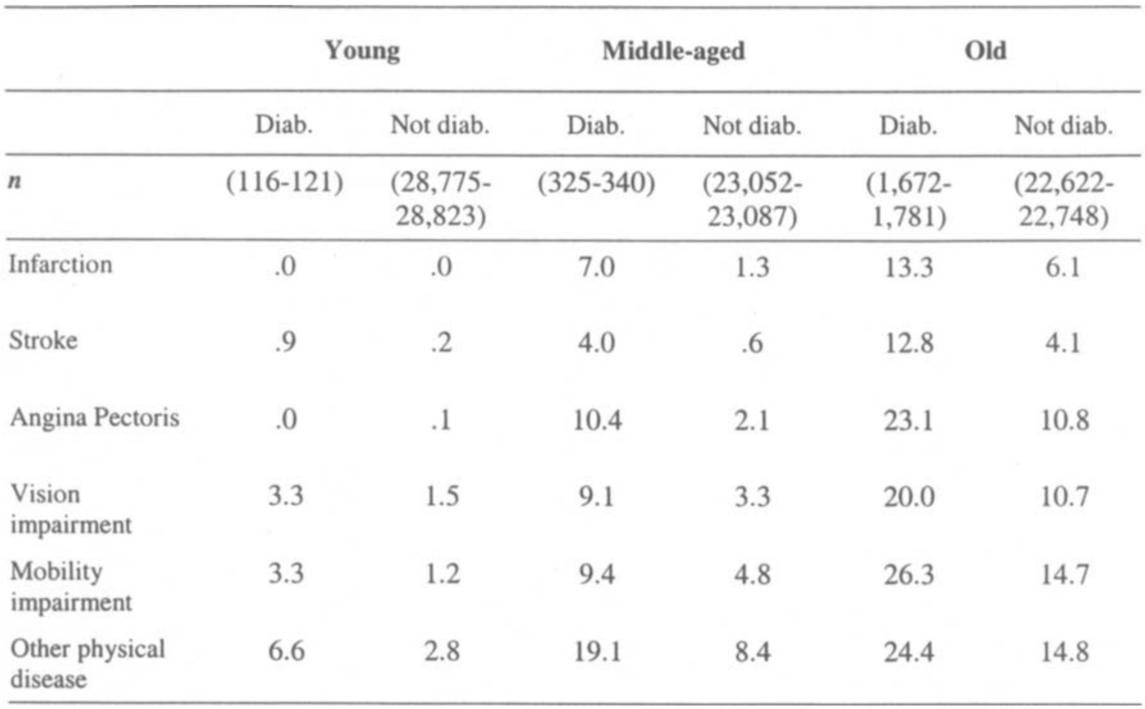
Table 1 Population characteristics. Mean age and percent women in three groups of persons: Below 40 years of age ("Young"), 40-59 years of age ("Middle-aged") and 60 years and more ("Old"), with and without diabetes



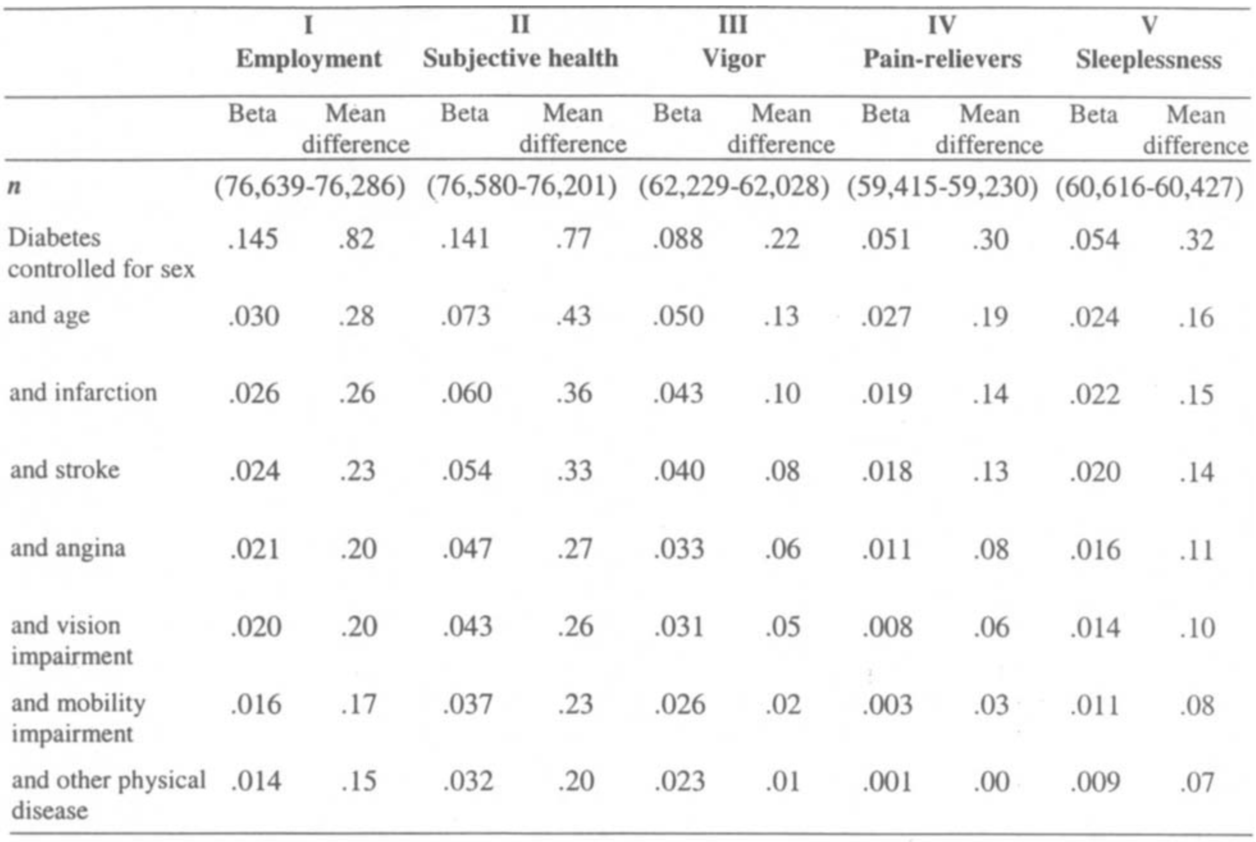
	Young		**Middle-aged**		**Old**	
	Diab.	Not diab.	Diab.	Not diab.	Diab.	Not diab.
n	(121)	(28,823)	(340)	(23,087)	(1,781)	(22,748)
Mean age	32.6	31.4	53.2	50.2	74.8	71.2
Percent women	41.3	49.8	46.8	50.2	58.8	52.9

Table 2 Persons with diabetes/without diabetes with specified other diseases or disabilities (percentages). Below 40 years of age ("Young"), 40-59 years of age ("Middle-aged") and 60 years and more ("Old")



	Young		**Middle-aged**		**Old**	
	Diab.	Not diab.	Diab.	Not diab.	Diab.	Not diab.
n	(116-121)	(28,775-28,823)	(325-340)	(23,052-23,087)	(1,672-1,781)	(22,622-22,748)
Infarction	.0	.0	7.0	1.3	13.3	6.1
Stroke	.9	.2	4.0	.6	12.8	4.1
Angina Pectoris	.0	.1	10.4	2.1	23.1	10.8
Vision impairment	3.3	1.5	9.1	3.3	20.0	10.7
Mobility impairment	3.3	1.2	9.4	4.8	26.3	14.7
Other physical disease	6.6	2.8	19.1	8.4	24.4	14.8

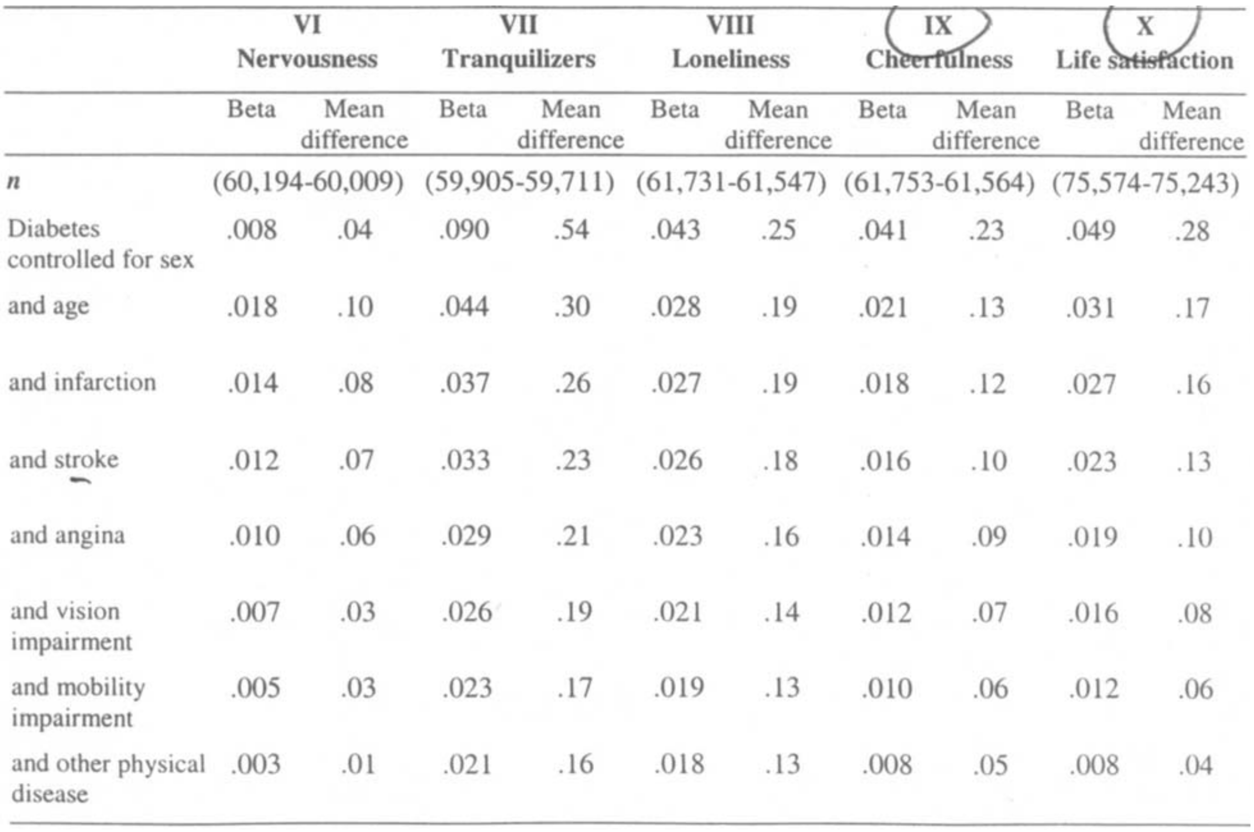
*Table 3 Multiple Classification Analyses (MCA). Beta-values and mean differences between persons with/without diabetes controlling for specified variables**



	I Employment		**II Subjective health**		**III Vigor**		**IV Pain-relievers**		**V Sleeplessness**	
	Beta	Mean difference	Beta	Mean difference	Beta	Mean difference	Beta	Mean difference	Beta	Mean difference
n	(76,639-76,286)		(76,580-76,201)		(62,229-62,028)		(59,415-59,230)		(60,616-60,427)	
Diabetes controlled for sex	.145	.82	.141	.77	.088	.22	.051	.30	.054	.32
and age	.030	.28	.073	.43	.050	.13	.027	.19	.024	.16
and infarction	.026	.26	.060	.36	.043	.10	.019	.14	.022	.15
and stroke	.024	.23	.054	.33	.040	.08	.018	.13	.020	.14
and angina	.021	.20	.047	.27	.033	.06	.011	.08	.016	.11
and vision impairment	.020	.20	.043	.26	.031	.05	.008	.06	.014	.10
and mobility impairment	.016	.17	.037	.23	.026	.02	.003	.03	.011	.08
and other physical disease	.014	.15	.032	.20	.023	.01	.001	.00	.009	.07

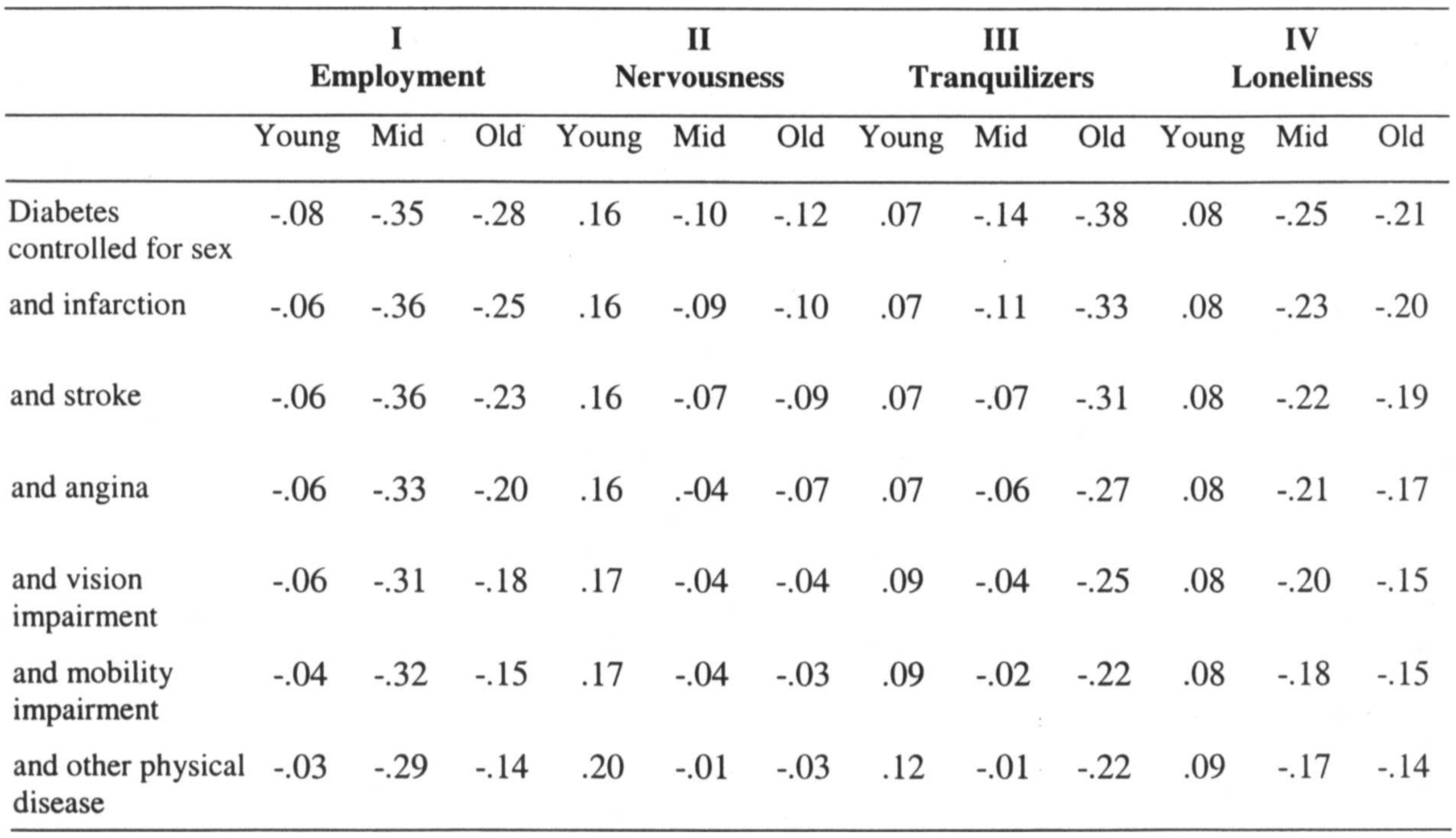
* Z-scores, P< .000 for all well-being variables, except for the variable Nervousness

Table 3 (continued)



	VI Nervousness		**VII Tranquilizers**		**VIII Loneliness**		**IX Cheerfulness**		**X Life satisfaction**	
	Beta	Mean difference	Beta	Mean difference	Beta	Mean difference	Beta	Mean difference	Beta	Mean difference
n	(60,194-60,009)		(59,905-59,711)		(61,731-61,547)		(61,753-61,564)		(75,574-75,243)	
Diabetes controlled for sex	.008	.04	.090	.54	.043	.25	.041	.23	.049	.28
and age	.018	.10	.044	.30	.028	.19	.021	.13	.031	.17
and infarction	.014	.08	.037	.26	.027	.19	.018	.12	.027	.16
and stroke	.012	.07	.033	.23	.026	.18	.016	.10	.023	.13
and angina	.010	.06	.029	.21	.023	.16	.014	.09	.019	.10
and vision impairment	.007	.03	.026	.19	.021	.14	.012	.07	.016	.08
and mobility impairment	.005	.03	.023	.17	.019	.13	.010	.06	.012	.06
and other physical disease	.003	.01	.021	.16	.018	.13	.008	.05	.008	.04

*Table 4 Interaction effects between diabetes and age. Multiple Classification Analyses (MCA). Mean differences between persons with/without diabetes controlling for other diseases/impairments variables, for persons below 40 years of age ('Young'), 40-59 ('Middle') and 60 years and more ('Old')**



	I Employment			II Nervousness			III Tranquilizers			IV Loneliness		
	Young	Mid	Old	Young	Mid	Old	Young	Mid	Old	Young	Mid	Old
Diabetes controlled for sex	-.08	-.35	-.28	.16	-.10	-.12	.07	-.14	-.38	.08	-.25	-.21
and infarction	-.06	-.36	-.25	.16	-.09	-.10	.07	-.11	-.33	.08	-.23	-.20
and stroke	-.06	-.36	-.23	.16	-.07	-.09	.07	-.07	-.31	.08	-.22	-.19
and angina	-.06	-.33	-.20	.16	.-04	-.07	.07	-.06	-.27	.08	-.21	-.17
and vision impairment	-.06	-.31	-.18	.17	-.04	-.04	.09	-.04	-.25	.08	-.20	-.15
and mobility impairment	-.04	-.32	-.15	.17	-.04	-.03	.09	-.02	-.22	.08	-.18	-.15
and other physical disease	-.03	-.29	-.14	.20	-.01	-.03	.12	-.01	-.22	.09	-.17	-.14

** Positive values when persons with diabetes have a higher well-being than persons without diabetes. Z-scores. P< .05 for all variables*