Individual and partner's level of occupation and the association with HbA(1c) levels in people with Type 2 diabetes mellitus

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Individual and partner's level of occupation and the association with HbA_{1c} levels in people with Type 2 diabetes mellitus: the Dutch Diabetes Pearl cohort

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Abstract

Aims Individual indicators of socio-economic status have been associated with glycaemic control in people with Type 2 diabetes, but little is known about the association between partner's socio-economic status and HbA_{1c} levels. We therefore examined the cross-sectional association between individual and partner's level of occupation on HbA_{1c} levels in people with Type 2 diabetes in the Netherlands.

Methods We included people with Type 2 diabetes with a partner who were treated in primary, secondary and tertiary care in the Diabetes Pearl cohort. Occupational level was classified according to International Standard Classification of Occupations (ISCO)-08 skill levels. Linear regression analyses were performed stratified for sex, and corrected for age, recruitment centre and diabetes medication.

Results In total, 3257 participants (59.8% men, mean 62.2±9.4 years) were included. For men, having a partner with an intermediate level of occupation was associated with lower HbA_{1c} levels [e.g. ISCO level 3: –2 mmol/mol (95% CI –4;–1) or -0.2% (95% CI –0.4;–0.1)], compared with having a partner of the highest occupational level (ISCO level 4). In women, having an unemployed partner was associated with higher HbA_{1c} levels [14 mmol/mol (95% CI 6; 22) or 1.3% (95% CI 0.6; 2.0)], compared with having a partner of the highest occupational level.

Conclusions Partner's occupational status provided additional information on the association between socio-economic status and HbA_{1c} levels in people with Type 2 diabetes. Women seemed to benefit from a partner with a higher occupational status, while men seemed to benefit from a partner with a lower status. Because of the cross-sectional nature of the present study, more research is necessary to explore this association.

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Introduction

Previous research has repeatedly shown that low socio-economic status is associated with poor glycaemic control in people with Type 2 diabetes [1]. Most studies have focused on individual level of education or income in primary care populations [2–5]. Tertiary care populations and indicators of work status have been less often studied [6,7]. Furthermore, none of the earlier studies took into account the role of partner's socio-economic status, other than household income [4]. A partner's socio-economic status could, however, influence individual socio-economic status and diabetes outcomes beyond financial effects; for instance, via shared (healthy) lifestyles or social support [8]. In addition, we hypothesize that these effects might be especially pronounced when

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What's new?

- When studying socio-economic status and diabetes-related health outcomes, most studies focus on individual indicators of socio-economic status. This is the first study to examine the association between individual and partner's level of occupation and HbA_{1c} levels.
- We found that partner's occupational status provided significant additional information about the association between socio-economic status and HbA_{1c} levels in people with Type 2 diabetes: women seemed to have worse, while men seemed to have better HbA_{1c} levels when they had a partner with a lower occupational level. This finding in men contradicts previous findings where low socio-economic status has been associated with worse HbA_{1c} levels.

individual socio-economic status and partner socio-economic status are not matched.

To date, one study has shown the importance of studying partner socio-economic status in diabetes health outcomes. Vandenheede *et al.* [9] found that, in addition to individual educational level, having a partner with a low level of education was associated with a higher risk of diabetes-related mortality [9]. It could therefore be hypothesized that partner socio-economic status may be important for other diabetes health outcomes, such as glycaemic control. The aim of the present study was to examine the cross-sectional association between individual and partner's level of occupation and HbA_{1c} levels in people with Type 2 diabetes in the Netherlands.

Patients and methods

Study design and participants

This study was part of the Parelsnoer Initiative, a partnership between all eight university medical centres in the Netherlands [10]. It was an observational cohort study of 6666 people with Type 2 diabetes who were treated in different geographical areas and in all types of care; i.e. primary, secondary and tertiary care [11]. Data were collected between 2009 and 2015. For this study, we selected people with a partner and with complete data for all variables (Fig. 1). The medical ethical committees of all the university medical centres involved approved the study and all participants provided written informed consent.

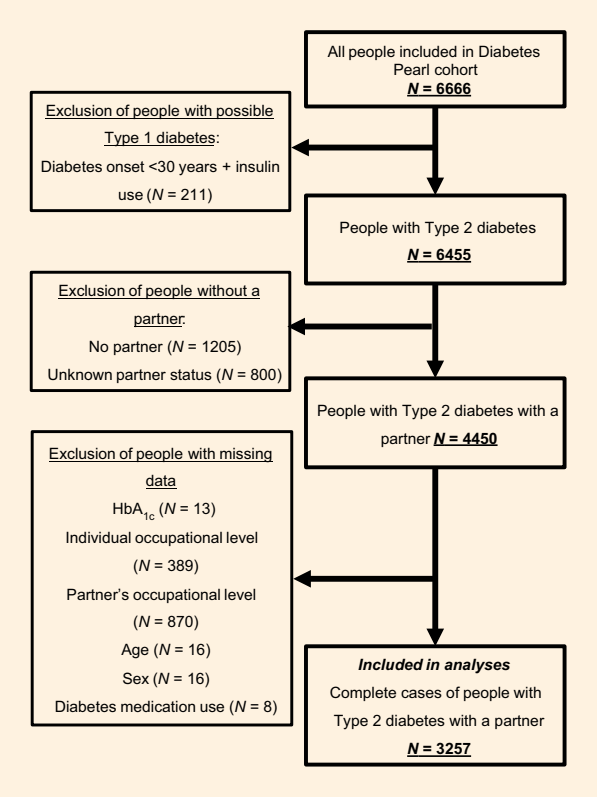

FIGURE 1 Flowchart selection of participants.

Data collection

Socio-economic status

Level of occupation was self-reported via a questionnaire and referred to the participants' current or most recent job. Retired people reported their level of occupation before retirement. Level of occupation was classified based on the International Standard Classification of Occupations (ISCO)-08 standard [12]:

1) ISCO skill level 0, including no occupation, housewife, unemployed;
2) ISCO skill level 1, for example, cleaners, kitchen assistants;
3) ISCO skill level 2 for example, bus drivers, hairdressers;
4) ISCO skill level 3, for example, shop managers, legal secretaries;
5) ISCO skill level 4, for example, medical practitioners, civil engineers.

For exploratory purposes, we created a variable to study (in) equality of the couple's socio-economic status, which was classified as individual level of occupation is equal/ higher/ lower than their partner's level.

HbA_{1c} levels

Fasting blood plasma was used to determine HbA_{1c} levels by high-performance liquid chromatography. One centre (Leiden) used affinity chromatography.

Covariates

Data on age and sex were collected from the hospital information systems. Diabetes medication use was registered

via dispensing labels and categorized as: no medication/diet and lifestyle advise; oral medication only; insulin only; insulin and oral medication. Age and medication were studied as covariates to correct for disease severity. For logistical reasons it was not possible to stratify people by the type of care they received; recruitment centre was therefore chosen as a covariate to correct for centre-specific differences.

Statistical analysis

Data were described using descriptive statistics as mean (± SD), and median (range), or as number (%). Linear regression analyses were conducted between individual and partner's level of occupation and HbA_{1c} level. As a result of significant interaction by sex, our analyses were stratified for sex and were subsequently corrected for our remaining covariates.

Two sensitivity analyses were conducted with different categorizations of combined socio-economic status to assess the robustness of this variable. All analyses were performed with IBM SPSS Statistics (Version 22.0: IBM Corp.).

Results

A total of 3257 participants were included in the study; excluded participants were significantly older, had higher HbA_{1c} levels and more often used insulin (Fig. 1). The sample (59.8% men) had a mean age of 62.2 (±9.4) years and mean HbA_{1c} level of 54 (±13) mmol/mol [7.1 (±1.2)%; Table 1].

Table 1 Characteristics of the Dutch Diabetes Pearl sample

		Individual level of occupation				
	Total *N*=3257	ISCO level 0 *N*=249	ISCO level 1 *N*=186	ISCO level 2 *N*=1271	ISCO level 3 *N*=749	ISCO level 4 *N*=802
Sex, *n* (%)						
Men	1947 (59.8)	30 (12)	59 (31.7)	720 (56.6)	515 (68.8)	623 (77.7)
Women	1310 (40.2)	219 (88)	127 (68.3)	551 (43.4)	234 (31.2)	179 (22.3)
Age, years						
Mean (SD)	62.2 (±9.4)	66.7 (±9.7)	60.7 (±10.1)	62 (±9.4)	61.8 (±9.7)	61.9 (±8.6)
Median (range)	62.7 (23.5;87.4)	66.6 (35.8;87.2)	60.8 (28.1;84.9)	62.7 (23.5;87.4)	62.5 (23.7;84.5)	62.5 (35;83.4)
Recruitment centre, *n* (%)						
1. AMC	122 (3.7)	7 (2.8)	8 (4.3)	48 (3.8)	30 (4.0)	29 (3.6)
2. Erasmus Medical Centre	176 (5.4)	17 (6.8)	17 (9.1)	79 (6.2)	34 (4.5)	29 (3.6)
3. LUMC	190 (5.8)	4 (1.6)	11 (5.9)	76 (6.0)	48 (6.4)	51 (6.4)
4. MUMC	1006 (30.9)	63 (25.3)	39 (21.0)	395 (31.1)	247 (33.0)	262 (32.7)
5. RUMC	219 (6.7)	17 (6.8)	12 (6.5)	81 (6.4)	52 (6.9)	57 (7.1)
6. UMCU	361 (11.1)	16 (6.4)	26 (14.0)	122 (9.6)	86 (11.5)	111 (13.8)
7. VUMC	1183 (36.3)	125 (50.2)	73 (39.2)	470 (37.0)	252 (33.6)	263 (22.2)
Diabetes medication use, *n* (%)						
No diabetes medication/ diet	653 (20.0)	41 (16.5)	30 (16.1)	240 (18.9)	171 (22.8)	171 (21.3)
Oral medication only	1467 (45.0)	113 (45.4)	77 (41.4)	560 (44.1)	333 (44.5)	384 (47.9)
Insulin only	367 (11.3)	27 (10.8)	26 (14)	139 (10.9)	84 (11.2)	91 (11.3)
Insulin and oral medication	770 (23.6)	68 (27.3)	53 (28.5)	332 (26.1)	161 (21.5)	156 (19.5)
HbA_{1c} mmol/mol [%]						
Mean (±SD), mmol/mol	54 (±13)	55 (±13)	54 (±13)	54 (±13)	53 (±13)	53 (±13)
Mean (±SD), %	7.1 (±1.2)	7.1 (±1.2)	7.0 (±1.2)	7.1 (±1.2)	7.0 (±1.1)	7.0 (±1.2)
Median (range), mmol/mol	51 (23;127)	51 (32;97)	50 (35;108)	52 (25;123)	50 (23;109)	51 (25;127)
Median (range), %	6.8 (4.3;13.8)	6.8 (5.1;11.0)	6.7 (5.4;12.0)	6.9 (4.4;13.4)	6.7 (4.3;12.1)	6.8 (4.4;13.8)
Optimum glycaemic control [53 mmol/mol (≤7.0%)], *n* (%)	1907 (58.6)	140 (56.2)	111 (59.7)	710 (55.9)	463 (61.8)	483 (60.2)
Suboptimum glycaemic control [53 mmol/mol (>7.0%)], *n* (%)	1350 (41.4)	109 (43.8)	75 (40.3)	561 (44.1)	286 (38.2)	319 (39.8)
Partner's level of occupation, *n* (%)						
ISCO-08 level 0	79 (2.4)	6 (2.4)	4 (2.2)	44 (3.5)	12 (1.6)	13 (1.6)
ISCO-08 level 1	255 (7.8)	27 (10.8)	27 (14.5)	147 (11.6)	31 (4.1)	23 (2.9)
ISCO-08 level 2	1561 (47.9)	147 (59)	117 (62.9)	690 (54.3)	330 (44.1)	277 (34.5)
ISCO-08 level 3	707 (21.7)	37 (14.9)	28 (15.1)	240 (18.9)	217 (29)	185 (23.1)
ISCO-08 level 4	655 (20.1)	32 (12.9)	10 (5.4)	150 (11.8)	159 (21.2)	304 (37.9)

AMC, Academic Medical Centre Amsterdam; ISCO, International Standard Classification of Occupations; LUMC, Leiden University Medical Centre; MUMC, Maastricht University Medical Centre; RUMC, Radboud University Medical Centre; UMCU, University Medical Centre Utrecht; VUMC, VU University Medical Centre.

Table 2 (a) Linear regression analyses between occupational level and HbA_{1c} levels in men

Individual level of occupation	*N*	Unstandardized coefficient (95% CI), mmol/mol	Unstandardized coefficient (95% CI), %	*P*
Crude model	**1947**			
ISCO level 0	30	2 (–3; 6)	0.1 (–0.3; 0.6)	0.526
ISCO level 1	59	**4 (0; 7)**	**0.4 (0.1; 0.7)**	**0.025**
ISCO level 2	720	**1 (0; 3)**	**0.1 (0; 0.3)**	**0.059**
ISCO level 3	515	0 (–2; 1)	–0.1 (–0.2; 0.1)	0.524
ISCO level 4	623	Reference		
*Model 1**	**1947**			
ISCO level 0	30	3 (–1; 8)	0.3 (–0.1; 0.7)	0.109
ISCO level 1	59	0 (–3; 3)	0.0 (–0.3; 0.3)	0.913
ISCO level 2	720	0 (–1; 1)	0.0 (–0.1; 0.1)	0.736
ISCO level 3	515	–1 (–2; 1)	–0.5 (–0.2; 0.1)	0.312
ISCO level 4	623	Reference		
Partner's level of occupation				
Crude model	**1947**			
ISCO level 0	72	**–3 (–7; 0)**	**–0.3 (–0.6; 0)]**	**0.049**
ISCO level 1	174	1 (–1; 4)	0.1 (–0.1; 0.3)	0.308
ISCO level 2	933	**–2 (–3; 0)**	**–0.2 (–0.3; 0)**	**0.025**
ISCO level 3	427	**–2 (–4; 0)**	**–0.2 (–0.4; 0)**	**0.029**
ISCO level 4	341	Reference		
*Model 1**	**1947**			
ISCO level 0	72	–2 (–5; 0)	–0.2 (–0.5; 0)	0.103
ISCO level 1	174	0 (-2; 2)	0 (–0.2; 0.2)	0.686
ISCO level 2	933	**–2 (–3; 0)**	**–0.2 (–0.3; 0)**	**0.009**
ISCO level 3	427	**–2 (–4; –1)**	**–0.2 (–0.4; –0.1)**	**0.005**
ISCO level 4	341	Reference		
Combined level of occupation				
Crude model	**1947**			
Individual SES = partner SES	773	Reference		
Individual SES > partner SES	857	–1 (–2; 0)	–0.1 (–0.2; 0)	0.071
Individual SES < partner SES	317	1 (–1; 2)	0.1 (–0.1; 0.2)	0.449
*Model 1**	**1947**			
Individual SES = partner SES	773	Reference		
Individual SES > partner SES	857	0 (–1; 1)	–0.0 (–0.1; 0.1)	0.697
Individual SES < partner SES	317	0 (–1; 2)	0.0 (–0.1; 0.2)	0.584

ISCO, International Standard Classification of Occupations; SES: socio-economic status.
*Model 1 is corrected for age, recruitment centre and medication use.

In men, after adjustment, having a partner with an intermediate occupational level was significantly associated with lower HbA_{1c} levels [ISCO level 2: –2 mmol/mol (95% CI –3; –1) or –0.2% (95% CI –0.3;0); ISCO level 3: –2 mmol/mol (95% CI –4;–1) or –0.2% (95% CI –0.4;–0.1)] compared with men having a partner of the highest occupational level (Table 2a). In women, having an unemployed partner (ISCO level 0) was significantly associated with 14-mmol/mol (95% CI 6; 22) or 1.3% (95% CI 0.6; 2.0) higher HbA_{1c} levels, after adjustment (Table 2b).

Combined level of occupation was not significantly associated with HbA_{1c} levels in men or women (Table 2a,b). Sensitivity analyses with different categorizations of combined level of occupation were non-significant (data not shown).

Discussion

In the present study, we observed that having a partner with a lower level of occupation was associated with significantly higher HbA_{1c} levels in women, while in men it was the other way around. Furthermore, the absolute difference in occupation level between partners was not associated with HbA_{1c} levels. Partner's occupational status provided significant additional information on the association between socio-economic status and HbA_{1c} levels in people with Type 2 diabetes.

Our results in women are in line with previous research which shows that the socio-economic status of women is more strongly related to their partners' socio-economic status than their own [13]. Contrary to previous studies, we observed in men that having a partner of low socio-economic status appeared to be associated with better glycaemic control. We presume that the majority of these partners are women, who in general spend twice as much time taking care of grocery shopping, dinner preparation and other household chores, than Dutch men do [14]. Also, Dutch women work significantly fewer hours per week compared with men: 26.6 vs 37.7 h [15]. As jobs of the highest occupational level are often full-time positions, it could be that these partners have more time to, for example, take care of the household or help with diabetes self-management of their partner, compared with partners of the highest occupational level.

Table 2 (b) Linear regression analyses between occupational level and HbA_{1c} levels for women

Individual level of occupation	*N*	Unstandardized coefficient (95% CI), mmol/mol	Unstandardized coefficient (95% CI), %	*P*
Crude model	**1310**			
ISCO level 0	219	1 (–2; 3)	0.1 (–0.1; 0.3)	0.458
ISCO level 1	127	–2 (–5; 1)	–0.2 (–0.4; 0.1)	0.198
ISCO level 2	551	0 (-2; 2)	0 (–0.2; 0.2)	0.879
ISCO level 3	234	–1 (–3; 2)	–0.1 (–0.3; 0.2)	0.607
ISCO level 4	179	Reference		
*Model 1**	**1310**			
ISCO level 0	219	1 (–1; 3)	0.1 (–0.1; 0.3)	0.516
ISCO level 1	127	–2 (–4; 0)	–0.2 (–0.4; 0)	0.101
ISCO level 2	551	1 (–1.; 2)	0.1 (–0.1; 0.2)	0.450
ISCO level 3	234	0 (–2; 2)	0 (–0.2; 0.2)	0.905
ISCO level 4	179	Reference		
Partner's level of occupation				
Crude model	**1310**			
ISCO level 0	7	**12 (2; 21)**	**1.1 (0.2; 1.9)**	**0.015**
ISCO level 1	81	2 (–1; 5)	0.2 (–0.1; 0.4)	0.260
ISCO level 2	628	1 (0; 3)	0.1 (0; 0.3)	0.102
ISCO level 3	280	0 (–2; 2)	0 (–0.2; 0.2)	0.924
ISCO level 4	314	Reference		
*Model 1**	**1310**			
ISCO level 0	7	**14 (6; 22)**	**[1.3 (0.6; 2.0)]**	**0.001**
ISCO level 1	81	1 (–2; 4)	[0.1 (–0.1; 0.3)]	0.425
ISCO level 2	628	1 (–1; 2)	[0.1 (–0.1; 0.2)]	0.327
ISCO level 3	280	0 (–1; 2)	[0 (–0.1; 0.2)]	0.606
ISCO level 4	314	Reference		
Combined level of occupation				
Crude model	**1310**			
Individual SES = partner SES	471	Reference		
Individual SES > partner SES	209	1 (–1; 3)	[0.1 (–0.1; 0.3)]	0.198
Individual SES < partner SES	630	–1 (–2; 1)	[–0.1 (–0.2; 0.1)]	0.448
*Model 1**	**1310**			
Individual SES = partner SES	471	Reference		
Individual SES > partner SES	209	1 (–1; 3)	[0.1 (–0.1; 0.3)]	0.268
Individual SES < partner SES	630	0 (–2; 1)	[0 (–0.2; 0.1)]	0.536

ISCO, International Standard Classification of Occupations; SES, socio-economic status.
*Model 1 is corrected for age, recruitment centre and medication use.

The underlying pathways of the association between partner socio-economic status and health outcomes are unclear, but are thought to be complex and have multiple causes. Wilson hypothesizes that it may be attributable to partner selection based on shared characteristics, i.e. low socio-economic status, or perhaps the synchronization of lifestyle behaviours of partners, such as smoking and nutrition [8]. However, as Wilson's hypotheses are based on many assumptions, they could not be verified in our exploratory study. More research is necessary to study the possible underlying mechanisms.

A limitation of the present study is that we did not collect data on other partner characteristics, such as level of education, number of hours worked or spent caring. These data would help identify the possible mechanisms underlying our results. Second, it was shown that excluded participants had worse diabetes-related characteristics, which might have resulted in an underestimation of the true association as these characteristics are often associated with poor socio-economic status [16]. Third, the number of partners in the lowest occupational category was small among women, which means that these results must be interpreted with caution. Finally, diabetes duration could not be studied as a covariate in our analysis because of a high number of missing variables. Future research into the association between partner's socio-economic status and health will be aided by addressing these limitations.

The strengths of the present study are the inclusion of information on partner's socio-economic status, which to date has not been considered when studying HbA_{1c} levels, other than household income. Second, our data are representative of the Dutch population The distribution of the ISCO-classified occupational status in our cohort was largely similar to the Dutch general population [15]. Finally, compared with previous studies on occupational level, we did not exclude housewives, unemployed or retired people, which otherwise could have led to a possible underestimation of the association [17].

To conclude, we found that partner's occupational level provides important information on the association between

socio-economic status and HbA_{1c} levels in people with Type 2 diabetes. Women seem to have worse HbA_{1c} levels, while men seem to have better HbA_{1c} levels when they have a partner with a lower occupational level. Because of the cross-sectional nature of our exploratory study, future research should further explore this association.

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Competing interests

None declared.

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