From protocol to personalised care: improving and tailoring diabetes management in general practice

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Socioeconomic status is not associated with the delivery of care in people with diabetes but does modify HbA1c levels: An observational cohort study (ELZHA-cohort 1)

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Abstract

Background. Structured primary diabetes care within a collectively supported setting is associated with better monitoring of biomedical and lifestyle-related target indicators amongst people with type 2 diabetes and with better HbA1c levels. Whether socioeconomic status affects the delivery of care in terms of monitoring and its association with HbA1c levels within this approach, is unclear. This study aims to understand whether, within a structured care approach, 1) socioeconomic categories differ concerning diabetes monitoring as recommended; 2) socioeconomic status modifies the association between monitoring as recommended and HbA1c.

Methods. Observational real-life cohort study with primary care registry data from general practitioners within diverse socioeconomic areas, who are supported with the implementation of structured diabetes care. People with type 2 diabetes mellitus were offered quarterly diabetes consultations. 'Monitoring as recommended' by professional guidelines implied minimally one annual registration of HbA1c, systolic blood pressure, LDL, BMI, smoking behaviour and physical activity. Regarding socioeconomic status, deprived, advantageous urban and advantageous suburban categories were compared to the intermediate category concerning 1) recommended monitoring; 2) association between recommended monitoring and HbA1c.

Results. Aim 1 (n = 13,601 people): Compared to the intermediate socioeconomic category, no significant differences in odds of being monitored as recommended were found in the deprived (OR 0.45 (95% CI 0.19 - 1.08)), advantageous urban (OR 1.27 (95% CI 0.46 - 3.54)) and advantageous suburban (OR 2.32 (95% CI 0.88 - 6.08)) categories.

Aim 2 (n = 11,164 people): People with recommended monitoring had significantly lower HbA1c levels than incompletely monitored people (-2.4 (95 % CI -2.9; -1.8) mmol/mol). SES modified monitoring-related HbA1c differences, which were significantly higher in the deprived (-3.3 (95% CI -4.3; -2.4) mmol/mol) than the intermediate category (-1.3 (95% CI -2.2; -0.4) mmol/mol).

Conclusions. Within a structured diabetes care setting, socioeconomic status is not associated with recommended monitoring. Socioeconomic differences in the association between recommended monitoring and HbA1c levels advocate further exploration of practice and patient-related factors contributing to appropriate monitoring and for care adjustment to population needs.

What's known

- Structured primary diabetes care within a collectively supported setting is associated with better delivery of care, that is, better monitoring of biomedical and lifestyle-related target indicators amongst people with type 2 diabetes
- Appropriate monitoring of these target indicators is associated with better HbA1c levels
- Generally, socioeconomic deprivation is associated with worse diabetes monitoring and unfavourable disease-related health outcomes

What's new

- This study shows that socioeconomic differences with regard to the uptake of diabetes care might be overcome with a collectively supported structured care approach
- Considering that monitoring-related HbA1c differences were particularly high in deprived socioeconomic populations, our findings highlight the importance to adjust structured care to population needs

Introduction

Over the last decades, evidence suggests that people with type 2 diabetes mellitus can have considerable influence on the course of their disease, including the risk of complications. Since the course of type 2 diabetes is strongly affected by smoking behaviour, body weight and physical activity, people with type 2 diabetes need to adopt a healthy lifestyle and develop adequate diabetes-related self-management skills (1, 2). In addition, professional guidelines for general practitioners (GPs) recommend frequent monitoring of people – not only with regard to biomedical indicators such as HbA1c, systolic blood pressure and LDL cholesterol but also regarding lifestyle-related indicators including body mass index (BMI), smoking behaviour and physical activity. People are considered being monitored as recommended if these biomedical and lifestyle parameters are recorded at least once a year (1, 2).

Delivery of diabetes care within a structured setting

However, the increasing numbers of people with type 2 diabetes have led to pressure and limitations in the delivery of diabetes primary care (3). In an effort to improve diabetes primary care, Dutch GPs launched care groups (4). Using a collective approach, these care groups negotiate structured diabetes care protocols with health insurance companies and provide logistic and quality support to individual GP practices. The structured care protocol emphasises prevention and comprises four diabetes consultations a year, during which biomedical and lifestyle indicators are monitored. In addition, people are coached in lifestyle adaptation and the development of self-management skills.

Socioeconomic status and barriers in diabetes care

The prevalence and course of type 2 diabetes vary in relation to socioeconomic status (5). For example, prevalence of type 2 diabetes is higher in socially deprived areas (6-8). Although sufficient diabetes monitoring and self-management support are important for all people with type 2 diabetes, individuals in deprived areas are a particularly important target population. In socially deprived areas, smoking, obesity and a lack of physical exercise are common (9-12), and people in these neighbourhoods are more likely to have inadequate perceptions of lifestyle risks and barriers to physical activity. These can include the underestimation of the health risks related to smoking and obesity, as well as erroneous beliefs regarding the importance or added value of physical activity (13-15). Furthermore, higher rates of relapse in unhealthy behaviour (16-19) occur amongst people in socially deprived areas.

We recently found that care group participation by GPs is associated with an improvement of the monitoring of biomedical and lifestyle-related target indicators in people with type 2 diabetes

(20). Monitoring is considered an important measure for quality of care, since it is associated with better HbA1c levels (21). Studies on health inequalities in primary and secondary diabetes care have shown that a lower socioeconomic status is associated with worse monitoring and outcomes in people with diabetes, including early death (5, 22). In a British general practice setting, monitoring of diabetes indicators was shown to be lower in deprived areas or areas with a high number of non-western ethnicities compared to intermediate socioeconomic areas (23). However, it is not known whether this is also the case in a care group setting or if socioeconomic status affects the association between monitoring and HbA1c levels. Therefore, within a collective care group setting offering a structured care approach, the goals of the present study were (1) to compare the odds of people being monitored on biomedical and lifestyle target indicators as recommended in respective socioeconomic categories, and (2) to explore whether the association between recommended monitoring and HbA1c levels (aim 2) was modified by socioeconomic status.

Methods

Study design and population

This observational EerstelijnsZorggroepHaaglanden (ELZHA) real-life cohort study was based on primary care registry data collected in the Netherlands. Data were obtained from Hadoks, formerly known as ELZHA, a care group collective in The Hague. The Hague is one of the largest cities in the Netherlands and is specifically characterised by wide socioeconomic disparities. As of January 2015, ELZHA included 168 GP practices. On a periodic basis, GP members share an overview of their monitoring data of individual people with the care group. In February 2017, all GP practices were informed in writing and, based on an opt-out procedure, invited to participate in the present cohort study, with pseudonymisation of GP practices and data of individuals. For the current study, retrospective registration data from calendar year 2014 were used.

Aim 1: People who received structured diabetes primary care from January to December 2014 were included. Since systolic blood pressure and LDL guidelines are specified for people aged <80 years, people aged ≥80 years were excluded. In case of missing data on age, gender or disease duration, people were also excluded.

Aim 2: In addition to the above-mentioned eligibility criteria, not having an HbA1c measure available was an exclusion criterion for this analysis. Furthermore, professional Dutch GP guidelines are tailored to certain key individual characteristics (age, intensity of medication treatment, and disease duration) and recommend specific HbA1c targets for each of three distinct patient profile groups, as defined by age, disease duration and prescribed medication (see text box 1). A detailed description of the scientific determination of these target values can be found in the guidelines (1). In the current analysis, people without data on medication were also excluded since missing data on medication might reflect administrative omissions rather than the absence of medication treatment.

Box 1: Overview and specifications of HbA1c profiles

Profile 1: 7.0% (53 mmol/mol)
People aged <70 years, and older people with a mild treatment regime (only metformin monotherapy prescription or lifestyle coaching)

Profile 2: 7.5 % (58 mmol/mol)
People aged ≥70 years in need of more intensive treatment and diagnosed with type 2 diabetes <10 years previously

Profile 3: 8.0% (64 mmol/mol)
People aged ≥70 years in need of more intensive treatment and diagnosed with type 2 diabetes ≥10 years previously

Measurements

Socioeconomic status

The ELZHA care group setting and the context of the Dutch healthcare system have been described in detail elsewhere (20, 21). For the present study, the socioeconomic status of all urban GP practice locations was determined using a combined deprivation score on the level of neighbourhoods (24), computed by the local municipality of The Hague (24). The following parameters are included in this score: a) percentage inhabitants unemployed for more than 3 years, b) average income, c) percentage non-western migrants, d) average official value of houses, and e) percentage inhabitants that moved in the last 3 years. Based on the deprivation score, all neighbourhoods were divided into three socioeconomic categories: advantageous, intermediate or deprived. Accordingly, practice locations in the city of The Hague were assigned to these categories. However, although official scores were not available for boroughs in the periphery of The Hague (Wassenaar, Leidschendam-Voorburg, Voorschoten and Rijswijk) we applied identical criteria to municipal registration data for these suburbs in order to obtain an approximate indicative deprivation score. The deprivation scores for all boroughs except for Rijswijk appeared homogeneous and were characterised by a high wealth. Rijswijk was, therefore excluded, and remaining peripheral boroughs were assigned to a separate suburban advantageous socioeconomic category. Thus, four socioeconomic categories were compared: intermediate, deprived, advantageous urban, advantageous suburban.

Diabetes monitoring

The extent of registration of six diabetes target indicators (HbA1c, systolic blood pressure, LDL, BMI, smoking behaviour and physical activity) was measured at the end of each quarter of a year. People were regarded 'monitored as recommended' when, in line with professional GP guidelines (1), each target indicator was registered at least once between January and December 2014. If one or more target indicators were not registered in calendar year 2014, people were classified as 'not monitored as recommended'.

Hba1c levels

The Hba1c level was computed in two steps. First, for each quarter, a mean HbA1c value was calculated based on all available HbA1c measurements in that quarter. Based on the mean HbA1c levels for all quarters, a mean was then calculated for the whole calendar year. HbA1c level is presented as mmol/mol.

Analysis

Regarding the characteristics of individuals, categorical variables were reported as numbers and percentages. Continuous variables were reported as means with standard deviation (SD) or, when non-normally distributed, as medians with interquartile range (IQR). For aim 1, multilevel logistic regression analyses were conducted to compare the odds of people being monitored as recommended across neighbourhood deprivation categories with the intermediate category as reference. Multilevel analyses allowed adjustment for individual observations (level 1) per GP practice (level 2). To investigate aim 2, we first conducted multilevel analyses to evaluate whether HbA1c levels of people in deprived and advantageous socioeconomic categories differed from the intermediate category. Second, we explored the association between monitoring as recommended and HbA1c levels. Finally, we examined whether socioeconomic status modified the association between monitoring as recommended and HbA1c levels. For both aims, analyses were performed crude and adjusted for age, duration of type 2 diabetes and gender, which are relevant potential confounders with regard to diabetes monitoring and HbA1c levels (25-27). A p-value <0.05 was considered statistically significant; for effect modification, a p-value <0.1 was considered statistically significant. Descriptive statistics were analysed using SPSS, version 25. Multilevel analyses were performed using ML WiN (Version 2.28).

Patient and public involvement

Because this study was focussed on a GP supporting approach of structured primary diabetes care, people with type 2 diabetes were not actively involved.

Ethical considerations

Since the pseudonymised data of individuals contained no date of birth (calendar age only), data could be aggregated without enabling investigators to identify individual people. Due to the large number of people, informed consent of individual persons was not required. The study protocol was approved by the Medical Ethical Committee of the Leiden University Medical Center (code G16.102).

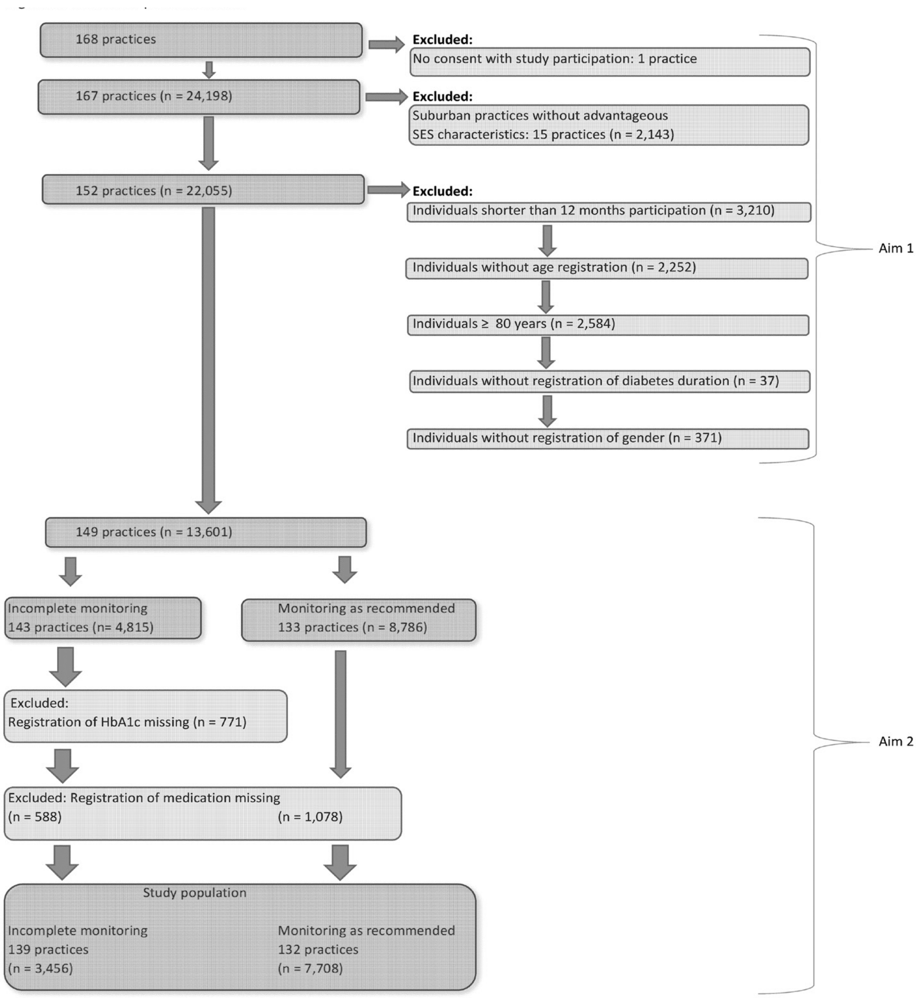

Figure 1. Inclusion of practices and people

Table 1. Characteristics of the study population for aim 1 and 2

	Aim 1				Aim 2							
	Socioeconomic status[a]				**Incompletely monitored**				**Completely monitored**			
	Socioeconomic status				**Socioeconomic status**				**Socioeconomic status**			
	o	--	++ urban	++ suburban	o	--	++	suburban	o	--	++ urban	++ suburban
Practices, n	42	47	26	34	40	46	26	27	39	37	24	32
people, n	3,508	5,968	1,971	2,154	923	1,890	371	272	1,923	3,115	1,208	1,462
Diabetes duration (years): median [IQR]	7 [3-10]	5 [3-9]	7 [4-10]	8 [4-10]	7 [3-11]	3 [3-6]	7 [4-10]	8 [4-10]	7 [4-10]	7 [4-11]	8 [5-11]	8 [5-10]
Age (years) median [IQR]	64 [56-70]	61 [53-69]	66 [59-72]	67 [60-73]	64 [56-71]	61 [53-68]	65 [58-71]	67 [60-73]	64 [56-70]	62 [53-69]	67 [59-73]	67 [60-73]
Gender: female, n (%)	1,535 (44)	2,802 (47)	866 (44)	942 (44)	411 (45)	869 (46)	157 (42)	114 (42)	848 (44)	1,498 (48)	531 (44)	655 (45)
HbA1c profile, n (%)												
1: 7.0 % (53 mmol/mol)[b]					767 (83)	1,650 (87)	303 (82)	219 (81)	1,637 (85)	2,661 (85)	972 (80)	1,175 (80)
2: 7.5 % (58 mmol/mol)[c]					80 (9)	189 (10)	35 (9)	30 (11)	164 (9)	211 (7)	100 (8)	145 (10)
3: 8.0 % (64 mmol/mol)[d]					76 (8)	51 (3)	33 (9)	23 (8)	122 (6)	243 (8)	136 (11)	142 (10)
People being monitored as recommended, n (%)	2,202 (63)	3,463 (58)	1,400 (71)	1,721 (80)								
HbA1c: mean (SD) in mmol/mol					52.8 (11.48)	55.1 (12.70)	52.4 (12.68)	52.1 (12.91)	51.3 (9.52)	53.3 (11.59)	50.9 (9.74)	50.3 (9.27)

a) Socioeconomic status: o = intermediate, -- = deprived, ++ = advantageous

b) Profile 1: people aged <70 years, and older people with a mild treatment regime (only metformin monotherapy prescription)

c) Profile 2: people aged ≥70 years who need more intensive treatment and diagnosed with type 2 diabetes <10 years ago

d) Profile 3: people aged ≥70 years who need more intensive treatment and diagnosed with type 2 diabetes ≥10 years ago

Results

In this study, 167 of the 168 practices (99 %) representing 24,198 people with type 2 diabetes were initially included. However, following exclusion criteria, all 15 practices situated in Rijswijk (n = 2,143 people) were excluded for being a suburban practice without advantageous SES characteristics (Figure 1). For aim 1, 13,601 people could be included in the analyses. For aim 2, 3,456 incompletely-monitored individuals and 7,708 individuals being monitored as recommended remained for further analysis. Characteristics of the study populations for aims 1 and 2 are presented in Table 1. Of all socioeconomic categories, the deprived category counted the highest number of practices and people.

Aim 1: Association between socioeconomic status and recommended monitoring

Compared to the intermediate category, crude analysis showed significant differences regarding the odds of people being monitored as recommended in all categories (Table 2): In the deprived category, the odds of people being monitored as recommended were significantly lower (OR 0.82 (95% CI 0.75 - 0.89)), whereas these odds were significantly higher in the advantageous urban (OR 1.45 (95% CI 1.29 - 1.64)) and suburban categories (OR 2.36 (95% CI 2.08 - 2.67)). After adjustment for practice level and additionally for age, duration of diabetes and gender, the associations were no longer statistically significant.

Table 2. Aim 1: Association between socioeconomic category and being monitored as recommended (n = 13,601)

	Model 1 [a]		Model 2 [b]	
Socioeconomic category	**OR (95% CI)**	**p**	**OR (95% CI)**	**p**
Deprived versus intermediate	0.82 (0.75 – 0.89)	<0.001	0.45 (0.19 – 1.08)	0.074
Advantageous urban versus intermediate	1.45 (1.29 – 1.64)	<0.001	1.27 (0.46 – 3.54)	0.648
Advantageous suburban versus intermediate	2.36 (2.08 - 2.67)	<0.001	2.32 (0.88 - 6.08)	0.087

a) Crude analysis

b) Model adjusted for age, diabetes duration, gender and GP practice

Aim 2: Comparison of socioeconomic categories on association between recommended monitoring and HbA1c levels

As presented in Table 3, compared to the intermediate category, HbA1c was significantly higher in the deprived category in the crude model (2.3 (95% CI 1.8 – 2.8) mmol/mol) as well as in the adjusted model (1.7 (95% CI (0.6-2.8) mmol/mol). HbA1c levels of the advantageous urban and intermediate categories did not significantly differ in the crude (-0.5 (95% CI -1.2; 0.2) mmol/mol) and adjusted analyses (-0.7 (95% CI -2.0; 0.7) mmol/mol). In the advantageous suburban category, HbA1c was slightly lower than in the intermediate category (-1.1 (95% CI -1.8; -0.5) mmol/mol), but after adjustment, this association was no longer statistically significant (-1.1 (95% CI -2.4;0.2) mmol/mol).

Table 3. Aim 2: Association between socioeconomic category and HbA1c levels in mmol/mol (n = 11,164)

	Model 1 [a]		Model 2 [b]	
Socioeconomic category	**B (95% CI)**	**p**	**B (95% CI)**	**p**
Deprived versus intermediate	2.3 (1.8; 2.8)	<0.001	1.7 (0.6; 2.8)	0.003
Advantageous urban versus intermediate	-0.5 (-1.2; 0.2)	0.161	-0.7 (-2.0; 0.7)	0.316
Advantageous suburban versus intermediate	-1.1 (-1.8; -0.5)	<0.001	-1.1 (-2.4; 0.2)	0.105

[a)] Crude analysis
[b)] Model adjusted for age, diabetes duration, gender, HbA1c profile and GP practice

Table 4. Aim 2: Overview of association between monitoring as recommended and HbA1c levels (mmol/mol) for each socioeconomic category (n = 11,164)

Socioeconomic category	**Model 1** [a]	**Model 2** [b]
	B (95% CI)	**B (95% CI)**
Full population	-2.1 (-2.5; -1.7)	-2.4 (-2.9; -1.8)
Intermediate	-1.5 (-2.3;-0.7)	-1.3 (-2.2; -0.4)
Deprived	-1.8 (-2.5; -1.1) [c]	-3.3 (-4.3; -2.4) [d]
Advantageous urban	-1.5 (-2.7; -0.2) [c]	-1.9 (-3.3; -0.5) [c]
Advantageous suburban	-1.8 (-3.0; -0.5) [c]	-1.8 (-3.2; -0.5) [c]

[a)] Crude analysis.
[b)] Model adjusted for age, diabetes duration, gender, HbA1c profile and GP practice.
[c)] No significant difference found compared to intermediate category (p-interaction >0.10)
[d)] Significant difference found compared to intermediate category (p-interaction <0.10)

As reported in Table 4, in the full population, being monitored as recommended was associated with a significantly lower HbA1c level in the crude model (-2.1 (95% CI -2.5;-1.7) mmol/mol) and the adjusted model (-2.4 (95% CI –2.9;-1.8) mmol/mol). When assessing whether socioeconomic status modified the association between monitoring and HbA1c level, initially, no significant differences in the association between monitoring and HbA1c levels were found between the intermediate and the other categories (p >0.1). After adjustment, the HbA1c difference associated with monitoring completeness in the deprived category (-3.3 (95% CI -4.3;-2.4) mmol/mol) was, compared to the intermediate category (-1.3 (95% CI -2.2;-0.4) mmol/mol), significantly higher (p-interaction = 0.002). In the advantageous urban and suburban categories, the adjusted analyses demonstrated no significant differences compared to the intermediate category (p-interaction > 0.1).

Discussion

Within a collectively supported structured primary diabetes care setting, this study examined whether socioeconomic status was associated with monitoring of biomedical and lifestyle-related target indicators as recommended by professional guidelines, and whether socioeconomic status modified the association between recommended monitoring and HbA1c levels. First, when comparing the deprived and advantageous categories to the intermediate category, we did not observe statistically significant monitoring differences after adjustment for confounders and practice level. Second, people in the deprived category had significantly higher HbA1c levels than people in the intermediate category. Monitoring as recommended was associated with significantly lower HbA1c levels. Socioeconomic status modified the association between monitoring and HbA1c levels: the HbA1c difference between people being monitored as recommended versus incompletely monitored people was significantly higher in the deprived category than in the intermediate category. In other words, in the deprived category, being monitored as recommended was an even more important indicator of lower HbA1c outcomes than it already was in the other categories.

The absence of significant differences in monitoring completeness between socioeconomic categories might be explained by the focus of collectively supported structured diabetes care. The aims of this approach include improving oversight of the diabetes population and up-to-date monitoring outcomes as well as tailored support for practices to achieve optimal delivery of care (20). Comparable approaches resulted in impressive amelioration of care delivery, regardless of socioeconomic deprivation (28, 29). Interestingly, the crude findings - suggesting significantly lower monitoring in deprived neighbourhoods and better monitoring in advantageous neighbourhoods - are in line with previous findings in other settings (5, 22). Nevertheless, our adjusted results indicate that monitoring is associated with non-modifiable individual characteristics – age, diabetes duration, gender– and practice factors rather than with socioeconomic status. Evidence for the association between these individual characteristics and diabetes compliance seems inconsistent (30, 31), but a range of modifiable practice-related factors affecting people's uptake of diabetes care is reported. Examples include contacting people before appointments or shortly after non-attendance, the extent to which practice staff focuses on practical reasons for non-attendance, and integration of diabetes care with other routine care (32) - although reasons for practice variation in patient uptake of diabetes care sometimes might remain unknown (33). To summarise, consideration of individual characteristics and modifiable practice-related factors might be useful to improve monitoring of people with type 2 diabetes.

Our results concerning the association between socioeconomic deprivation and higher HbA1c levels, which resonate with previous studies (5, 34, 35), are relevant since every 1% reduction in HbA1c is associated with a lower risk on numerous diabetes-related health complications including death (36). In addition, our findings that monitoring as recommended is associated with lower HbA1c levels confirm other work (21). With regard to the modifying effect of SES, the HbA1c difference between people with recommended versus incomplete monitoring was higher in the deprived category than in the intermediate category. Being monitored as recommended was particularly in deprived people associated with better HbA1c levels. Literature about the modifying effect of socioeconomic status on the relationship between chronic conditions and health outcomes is scarce. One study amongst people with type 2 diabetes found effect modification in some subgroups; in high socioeconomic groups, absence of comorbidities was associated with substantially better health outcomes than in low socioeconomic groups (37). Furthermore, the ability to understand and apply disease-related knowledge and having sufficient financial resources contribute to (self-rated) adequate coping in terms of diabetes self-care and medication adherence (38, 39).

The high monitoring-related HbA1c difference in the deprived category might be explained by specific characteristics of deprived populations such as inadequate perceptions of lifestyle risks, erroneous health cognitions and beliefs (13-15) and limited disease-related knowledge (40). These factors might, in turn, be related to limited ‘health literacy’, which refers to skills that enable a person to understand health information and to apply this knowledge adequately in daily life (41). This is echoed by studies reporting lower health literacy in deprived areas (42), and associations between low health literacy and unhealthy behaviours (43, 44) or lower treatment compliance (45). In other words, diabetes outcomes in deprived populations are affected by essential person-related factors that are connected to lower health literacy.

To add, in deprived populations, lifestyle counselling is often limited or incompletely delivered (46, 47). This could be understood from frequently reported doubts among health professionals regarding the effectiveness of lifestyle counselling in these populations in general, fear to negatively affect the relationship with the individual patient and lack of confidence in own professional skills to coach these populations successfully (47, 48). Thus, the emphasis on sufficient attention for lifestyle counselling (1, 2) in structured care approaches might be an additional factor explaining the high monitoring-related HbA1c difference in deprived populations.

Strengths and limitations

The current study has several strengths. First, an observational design is a commonly used pragmatic approach to diabetes-related studies in primary care due to several important merits, such as that it does not interfere with the daily routine in family practice. Consequently, our observational real-life setting mirrors actual practice with regard to monitoring and HbA1c levels in primary diabetes care. In addition, the stability and the validity of our findings were both improved by the fact that people were only included if they participated for a minimum of 12 months, and due to correction for age, diabetes duration, gender and GP practice. By contrast, while randomised clinical trials can reduce bias, they often suffer from inadequate power and generalisability (49).

Limitations of this study include the fact that socioeconomic characteristics were only available on neighbourhood level and that people from the district of Rijswijk were excluded due to heterogeneous socioeconomic characteristics. In addition, no conclusions can be drawn regarding causality, and the effect of care group participation on monitoring and HbA1c levels in different socioeconomic categories was unclear. Furthermore, as people older than 80 years old were not included, this might affect the generalisability; our findings is only applicable to a younger diabetes population. Moreover, a missing registration does not by definition imply that care has not been delivered. Therefore, it cannot be ruled out that missing data were due to a lack of time or technical problems rather than an absence of care itself. Finally, this study focused primarily on socioeconomic differences regarding recommended monitoring and associations with HbA1c levels. However, to achieve adequate monitoring might require far more effort in deprived compared to advantageous neighbourhoods, considering the previously described inadequate perceptions of health risks and the higher prevalence and relapse of unhealthy lifestyle-related behaviours. As our data endpoints did not take this possibility into account, our findings underline the need for greater understanding of the outcomes of structured primary diabetes care in a collectively supported approach. Our care group approach, characterised by a focus on prevention in primary diabetes care and systematic quality support for GPs and nurse practitioners, could be a first step in bringing the benefits of modern health facilities to high-risk populations (50). We therefore recommend that future research should aim to provide further insight into the effects of long-term structured primary diabetes care within a care group setting on monitoring completeness, HbA1c levels and their respective interactions. In addition, it could be interesting to explore more in detail how many and which indicators are missing in incompletely monitored people and how this affects health outcomes. Moreover, given that practice and patient characteristics within SES categories might affect the delivery of diabetes care, further exploration of practice-related factors in the context of care provision is recommended.

Conclusions

To summarise, within a collectively supported structured primary diabetes care setting, socioeconomic status was not related to monitoring of biomedical and lifestyle target indicators as recommended by professional guidelines. Recommended monitoring was associated with lower HbA1c levels in all socioeconomic categories. Nevertheless, the observed HbA1c differences between people with recommended versus incomplete monitoring, which were significantly more pronounced in the deprived category, endorse further exploration of practice and patient-related factors contributing to appropriate monitoring. Moreover, these findings advocate care adjustment to population needs with specific attention for deprived populations.

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