Patient Assessment of Family Function, Glycemic Control and Quality of Life in Adult Patients With Type 2 Diabetes and Incipient Complications

Bennich, Birgitte Bøcher; Munch, Lene; Egerod, Ingrid; Konradsen, Hanne; Ladelund, Steen; Knop, Filip Krag; Vilsbøll, Tina; Røder, Michael E; Overgaard, Dorthe

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Author: Birgitte B. Bennich, Lene Munch, Ingrid Egerod, Hanne Konradsen, Steen Ladelund, Filip K. Knop, Tina Vilsbøll, Michael Røder, Dorthe Overgaard

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Title

Patient assessment of family function, glycemic control and quality-of-life in patients with type 2 diabetes with incipient complications.

Birgitte B. Bennich. RN, MHSc, PhD student[a,b]

E-mail: birgitte.bennich@regionh.dk

Lene Munch. RN, MHSc, PhD student [a,b]

E-mail: lene.munch@regionh.dk

Ingrid Egerod. RN, PhD, Professor[c,d]

E-mail: ingrid.egerod@regionh.dk

Hanne Konradsen. RN, PhD, Associate Professor[e]

E-mail: hanne.konradsen@ki.se

Steen Ladelund. Principal Statistician[f]

E-mail: steen@ladelund.dk

Filip K. Knop. MD, PhD, Professor[a,g,h]

E-mail: filipknop@dadlnet.dk

Tina Vilsbøll. MD, DMSc, Professor[a,h]

E-mail: t.vilsboll@dadlnet.dk

Michael Røder. MD, DMSc, Senior scientist[i]

E-mail: mir@dadlnet.dk

Dorthe Overgaard. RN, PhD, Associate Professor[b]

E-mail: doov@phmetropol.dk

Author affiliations

a. Clinical Metabolic Physiology, Steno Diabetes Center Copenhagen, Copenhagen University Hospital, Gentofte Hospital, Kildegårdsvej 28, 2900 Hellerup, Denmark

b. University College Copenhagen, Institute of Nursing, University College, Tagensvej 86, 2200 Copenhagen N, Denmark

c. Intensive Care Unit, Copenhagen University Hospital, Rigshospitalet, Blegdamsvej 9, 2100 Copenhagen E, Denmark

d. Faculty of Health & Medical Sciences, University of Copenhagen, Blegdamsvej 3, 2200 Copenhagen N, Denmark

e. Department of Neurobiology, Care Sciences and Society, NVS, Karolinska Instituttet, Alfred Nobels Allé 23, 141 52 Huddinge, Sweden

f. Clinical Research Centre, Copenhagen University Hospital, Hvidovre Hospital, Kettegård Alle 30, 2650 Hvidovre, Denmark

g. Novo Nordisk Foundation Center for Basic Metabolic Research, Faculty of Health and Medical Sciences, University of Copenhagen, Blegdamsvej 3, 2200 Copenhagen N, Denmark

h. Department of Clinical Medicine, Faculty of Health and Medical Sciences, University of Copenhagen, Blegdamsvej 3, 2200 Copenhagen N, Denmark

i. Steno Diabetes Center Odense, Odense University Hospital, J.B. Winsløvs vej 4, 5000 Odense C, Denmark

Corresponding author:

Birgitte B. Bennich. RN, MHSc, PhD student.

Clinical Metabolic Physiology, Steno Diabetes Center Copenhagen, Copenhagen University Hospital, Gentofte Hospital, Kildegårdsvej 28, 2900 Hellerup, Denmark

E-mail: birgitte.bennich@regionh.dk

Running Head:

Family function, glycemic control and quality-of-life in patients with type 2 diabetes

Key Messages:

- Perceived family support and family barriers are associated with diabetes self-management and glycated hemoglobin (A1C) levels in patients with type 2 diabetes.
- A healthy family function is correlated with low burden of diabetes and a strong mental health but not found to be a predictor of glycemic control in this study.
- Family function is likely to impact family-based interventions as to factors involved in diabetes self-management, lifestyle adherence, and quality-of-life.

Keywords:

A1C, Brief FAM-III, family function, glycemic control, quality-of-life, type 2 diabetes

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Abstract

Objectives

The family affects the perception of diabetes self-management in patients with diabetes. Family-related questionnaires have been used to assess the family function, but the Brief Family Assessment Measure (Brief FAM-III), has not previously been used in a diabetes population. We aimed to determine whether the family function is associated with glycated hemoglobin (A1C) as a potential predictor of diabetes self-management.

Methods

An explorative study of patients with type 2 diabetes and incipient complications, using Brief FAM-III, a self-report questionnaire comprising three scales assessing family function according to different perspectives: A general score, a dyadic relationship score, and a self-rating score.

Results

We included 127 patients, 72.4% males, mean age 65.23 (SD=10.26), A1C 6.9% (SD=0.9%), diabetes duration 9.1 (SD=0.6) years and BMI 30.8 (SD=0.5) kg/m^2. Mean FAM-III scores for the three scales were 41.7 (SD=1.0), 41.5 (SD=0.9) and 38.5 (SD=1.1) respectively. Correlation coefficients were -0.06 (p=0.37), -0.09 (p=0.18), -0.12 (p=0.06) showing no significant correlation between scales and A1C in the three perspectives before and after adjustment for confounders. Family function correlated with burden of diabetes of 0.14 (p=0.02), 0.24 (p=0.0003) and 0.16 (p=0.01) respectively, and mental health -0.21 (p=0.0007), -0.23 (p=0.0005) and -0.25 (p<.0001) respectively.

Conclusion

Our study suggests that in patients with type 2 diabetes, family function does not predict the level of glycemic control. However, we found an association between a healthy family function, low burden of diabetes, and strong mental health, issues being important for the patient's quality-of-life, compliance with lifestyle factors and diabetes self-management.

Introduction

Diabetes affects around 415 million people worldwide, most of whom are diagnosed with type 2 diabetes (T2D) [1]. Diabetes is diagnosed in 9.4 % of the U.S. population and 5.7% of the Danish population, and the prevalence is increasing [2,3]. Glycemic control of T2D is essential as it has a strong predictive value for microvascular and macrovascular diabetes complications [4]. Glycated hemoglobin (A1C) is considered the standard for long-term evaluation of glycemic control and reflects the average glucose level during the last 12 weeks [5].

Despite advances in diagnostics and treatment, many patients still experience inadequate glycemic control. In order to improve the clinical condition of people with T2D, knowledge of the factors that can potentially influence glycemic control is of great importance. Adherence to behavioral and pharmacological recommendations (e.g.healthy diet, exercise, blood glucose checking, and pharmacological treatment) are important aspects of diabetes management [6,7]. Moreover, interactions between adult patients and their family, perceived family support and family barriers are associated with self-management and A1C levels in patients with T2D [8–11].

Perceived family support, dynamics, and processes affecting management of diabetes has been evaluated by the use of several family assessment instruments [12,13]. Moreover, the level and quality of family functioning are associated with the perceived support or burden of the family regarding diabetes self-management [8,13]. However, research targeting the interface between the family functioning of the family unit and glycemic control of adults with diabetes is scarce. In addition, studies conducted to better understand the influence of family functioning on glycemic control are inconsistent with regard to research methods, population samples, intervention strategies and measured outcomes. Furthermore, the instruments to assess family functioning and the definitions of family functioning varies [14].

The Brief Family Assessment Measure (Brief FAM-III) [15,16] is a brief version of the original FAM-III, and is a non-disease-specific instrument evaluating individual family members' perceptions

of problems and strengths in their family's functioning in the areas of task accomplishment, role performance, communication, affective expression, involvement, control, values and norms. FAM-III and Brief FAM-III have not previously been used in a diabetes population but have been widely used to study the relationship of family functioning related to a number of family issues as; emotional disturbance, coping with disease, cancer disease, eating disorder, affective disorder, chronic heart disease and cystic fibrosis. These studies suggested an association between family function, disease management, and quality-of-life. [15,17,18] The Brief FAM-III is appropriate for preliminary screening to obtain an overall index of family functioning as well as monitoring family functioning over time. The scales take 5 minutes to complete making the instrument useful in time-limited clinical practice [15,16].

We use the instrument to test our hypothesis: The perception of a strong family function is related to improved disease management and glycemic control in patients with T2D.

The primary aim of this study was to evaluate the association between the level of perceived family functioning and the level of glycemic control measured as A1C in patients with T2D. The secondary aims were to assess associations between the family functioning, the burden of diabetes, health-related quality-of-life and A1C and thereby evaluate family functioning as a unique predictor of glycemic control.

Methods

Study design

The study used an explorative, descriptive cross-sectional design. The sample comprised 140 patients with T2D and was embedded baseline in a randomized controlled trial comparing two diabetes care programs [19]. Eligible patients were recruited either from the diabetes outpatient clinic at Gentofte Hospital, University of Copenhagen, Denmark or at their general practitioner according to where the patient received regular diabetes care. Patients agreeing to participate in the study by oral and written informed consent were invited to a baseline screening visit in the outpatient clinic at Gentofte Hospital and randomized if they met all of the inclusion criteria and none of the exclusion criteria. All

participants were asked to complete a questionnaire packet to be returned within the following 2 weeks. Baseline demographic and anthropometric variables were checked and serum samples were taken for the measurement of A1C levels. Gentofte Hospital is situated in the Copenhagen metropolitan area and covers approximately 10,000 inhabitants diagnosed with diabetes. The diabetes outpatient clinic is responsible for the care of approximately 1200 patients with T2D.

Ethical considerations

The study protocol of the main study was approved by the Committees on Health Research Ethics in the Capital Region of Denmark (H-4-2014-069) and registered at the Danish Data Protection agency (GEH-2015-085) and ClinicalTrials.gov (NCT02586545) and was carried out according to the principles of the Declaration of Helsinki.

Inclusion criteria

The inclusion and exclusion criteria have been described in detail elsewhere [19]. Briefly, patients over the age of 18 years with T2D and at risk stratification characterized by either hyperglycemia (A1C: 7-9% (53-75 mmol/mol)), hypertension (blood pressure: 130/80-160/90 mm Hg) and/or incipient diabetic complications [20,21]. All patients were able to understand, speak and write Danish and volunteered to participate and gave their oral and written informed consent after being introduced to the study.

Exclusion criteria

Patients were excluded from the data analysis if not at least one of the three FAM-III scales were completed since the primary outcome of this study was the correlation among the FAM-III dimensions and A1C. We excluded 13 non-responding patients yielding 127 patients eligible for the study.

Since the Brief FAM-III has not previously been used in a diabetes population, the sample size estimate at 140 participants was based on the power calculation according to the criteria for the randomized controlled trial in which this study is embedded [19].

Measurements

Demographic variables: Included age, gender, marital status, level of education and duration of diabetes.

Clinical outcome variables: A1C levels were performed on a venous blood sample. A1C corresponded to glycemic control and was categorized according to ADA (American Diabetes Association) guidelines for glycemic targets for adults with T2D [5]. Thus, participants with A1C levels lower than 7% (53 mmol/mol) were considered in adequate glycemic control whereas participants with A1C levels higher or equal to 7% (53 mmol/mol) were considered in inadequate glycemic control.

Anthropometric variables: Weight and height were measured using the same calibrated digital scale for all participants. Weight with a precision of 0.1 kilograms and height with an accuracy of 1 millimeter. Abdominal and hip circumferences were measured by one of two study nurses. Waist-hip ratio (WHR) above 0.90 for males and above 0.85 for females is defined as abdominal obesity. Body mass index (BMI) score >30 kg/m^2 represents obesity according to WHO standards [22].

The Brief Family Assessment Measure III

Family functioning was assessed using the Danish validated version of the Brief FAM-III [23]. The Brief FAM-III is a self-report instrument and a short version of the original FAM-III by Skinner et al. (1995) [15] consisting of three scales (General, Dyadic Relationships, and Self-Rating). The general scale examines the family from a systems perspective and offers a general rating of the family functioning; the dyadic relationship scale assesses how family members view their relationship with another chosen family member and in the self-rating scale, individuals rate their own functioning

within the family. Each scale has 14 items assessing the family strengths and weaknesses in 7 dimensions of family functioning including: Task Accomplishment, Role Performance, Communication, Affective Expression, Involvement, Control, Values and Norms. Each item is answered on a four-point Likert scale ranging from 0 (strongly agree) to 3 (strongly disagree). Lower scores on each scale indicate stronger family functioning. A raw score of each scale is summed up and converted to a T-score using a conversion table. T-scores range from 16 to 110 in the General Scale and from 10 to 104 in the Dyadic Relationships and Self-Rating Scales. T-scores lower than 50 indicate less than average family difficulties, while T-scores higher than 50 indicate more than average family difficulties [15]. The patients' perception of family functioning was the primary focus and they were to respond to all of the three scales. The relatives' perception of the dyadic relationship to the patient was reflected in their response to the dyadic relationship scale. [16].

Diabetes Symptom Checklist-Revised

The patients perceived symptoms and burden of diabetes were assessed by the Diabetes Symptom Checklist-Revised (DSC-R). DSC-R is a disease-specific, self-administered questionnaire measuring the occurrence and perceived burden of physical and psychological symptoms related to T2D [24]. It comprises 34 items grouped into eight domains: hyperglycemic, hypoglycemic, psychological-cognitive, psychological-fatigue, cardiovascular, neurological-pain, neurological-sensory, and ophthalmologic [24,25] For each item, patients responded "yes" or "no" to the experience of the described symptom within the last 4 weeks. Furthermore, they specify how troublesome the symptom has been on a 5-point Likert scale if they typed "yes" initially. The total score ranges from 0 to 5 and was calculated by summing up the item scores and divide by the number of items. Low scores indicated lower diabetes symptom distress. DSC-R is a previously validated, reliable measurement instrument, sensitive to changes over time [25].

SF-36

Short Form 36 (SF-36) is a generic self-administered patient questionnaire measuring health-related quality-of-life comprising 36 questions [26,27]. The 36 items measure eight domains: physical

function, physical limitations, bodily pain, general health, vitality, social function, emotional limitation and mental health. The raw scores of each scale are transformed into a 0–100 score with higher scores indicating less disability and greater quality of the aspects. The eight domains can be divided into the Mental Component Summary (MCS) and the Physical Component Summary (PCS) and Scores, respectively. MCS cut-off score is 42 and PCS cut-off score is 50 [26,27]. SF-36 has been validated and is reliable in a range of languages, including Danish [28].

Data analyses

Kendall's Tau-b Correlation Coefficient was used to assess the association between the scores of Brief FAM-III scales, DCS-R, MCS, PCS and A1C by the assessment of association between pairs of continuous variables and test for independence.

Independent two sample T-tests were used to analyze differences in demographic variables and the mean differences between Brief FAM-III scores and A1C levels in patients with adequate and inadequate glycemic control, respectively.

Multiple linear regression models examined predictive factors of A1C levels (dependent variable) for patients with T2D controlling for covariates including: Demographics, anthropometrics, SF-36, DCS-R, and FAM-III scores. All analyses were performed using SAS v. 9.4. [29]. A value of $p \leq 0.05$ was considered statistical significant.

Results

Sociodemographic characteristics, A1C, family functioning, diabetes distress and quality-of-life according to glycemic control categories.

A total of 140 participants attended the baseline appointment and signed the informed consent forms. Of these participants, 127 (90.7%) completed all the questionnaires including at least one of the Brief FAM-III scales. There were no significant differences between the respondents and the non-respondents in terms of A1C levels, demographic- and anthropometric characteristics.

Of the 127 included, n=83 (65.4%) completed all the four Brief FAM-III scales and n=107 (84.3%) completed all the three patient related scales whereas, n=88 of the relatives (69.3%) completed the

relative related scale: Relative Dyadic Relationship Scale (RDRS) of whom n=24 (26%) were children of the patients and n=65 (74%) were spouses of the patients. The individual responses to the patient related scales were, respectively: Patient General Scale (PGS) n=121 (95.3%), Patient Dyadic Relationship Scale (PDRS) n=109 (85.9%) and, Patient Self-Rating Scale (PSRS) n=118 (92.9%). The mean age of participants was 65.23 years (SD=10.26); 72.4% were male. The mean A1C levels were 6.9% (SD=0.9%). The majority of the participants were well-educated on respective classified levels: 46% high (>15 years), 22.5% high-middle (13-14 years), 22% low-middle (10-12 years) and low 9.5% (≤9 years). Married or cohabiting couples accounted for 65.5% and singles or widows for 34.5%, respectively.

Tabel 1 shows the sociodemographic characteristics of patients with T2D categorized into two groups according to an adequate glycemic control of A1C levels < 7% and an inadequate glycemic control of A1C levels ≥7%. According to these categories, 56.7% of the study population was in adequate glycemic control. We found a wide range of all the variables indicating sufficient variation. Regardless of the patient's level of A1C, there were no significant differences in mean values of the following variables: Brief FAM-III, age, BMI, WHR, DSC-R, MCS and PCS scores. Duration of diabetes was 2.78 years longer (p=0.02) in the inadequate glycemic control group. The mean Brief FAM-III scores could also be found well below the cut-off at 50 for all dimensions indicating a healthy family functioning in both groups. Furthermore, the majority of the patients and relatives scored lower or equal to 50, respectively: PGS, Patient General Scale n=100 (82.6%), PDRS, Patient Dyadic Relationship Scale n= 95 (87.2%), PSRS, Patient Self-Rating Scale n=99 (83.9%), RDRS, Relative Dyadic Relationship Scale n=76 (86.4%). The mean BMI was >30 kg/m^2 in both groups indicating a population of overweight and obese patients. The mean WHR was ≥0.98 in both groups (mean male ratio=1.01/1.03, mean female ratio= 0.92/0.93) also indicating obesity. The mean DSC-R scores for both groups were ≤1.00 pointing out a very low burden of diabetes symptoms. The MCS scores in both groups indicated an experience of good mental health. PCS scores in the groups showed values a little under average according to the experience of physical health. Adjustment for age, social status, educational level, and gender did not alter the results.

[Insert Tabel 1]

Correlation among Brief FAM-III scores, DSC-R, MCS, PCS, and A1C

Table 2 outlines the association among Brief FAM-III scores, DSC-R, MCS, PCS, and A1C in the study population. The Brief FAM-III dimensions scores including PGS, PDRS, PSRS, and RDRS were all low and negatively yet insignificantly correlated with A1C meaning a slight tendency of an association between a better family functioning and poorer A1C control. The weak and insignificant correlation between Brief FAM-III dimension scores and A1C is illustrated in figure 1 by fairly flat slopes. There was no significant correlation between DSC-R and A1C or between MCS, PCS, and A1C, which means that the burden of diabetes, as well as the patient's experience of their mental and physical health, does not seem to influence the glycemic control as measured by A1C. Furthermore, all Brief FAM-III scales were significantly positively correlated ($p \leq 0.05$).

[Insert Tabel 2]

[Insert Figure 1]

Correlation among Brief FAM-III scores, DSC-R MCS and PCS

Table 3 The Brief FAM-III patient dimensions scores were all significantly positively correlated to the DSC-R score, whereas the Brief FAM-III relative dimension showed a slight positive insignificant correlation indicating a healthy perception of family function is related to low perception of diabetes distress. All the Brief FAM-III dimensions and the DSC-R were negatively significantly correlated to MCS demonstrating that a healthy perception of family function and a low perception of diabetes distress are related to a good perception of mental health. The Brief FAM-III patient dimensions scores were all low and negatively yet insignificantly correlated with PCS meaning a slight tendency of an association between a better family functioning and a good perception of physical health. The relative dimension, RDRS, showed a vague positive and insignificantly correlation with PCS reflecting a possible association between good family functioning and a bad perception of health. DSC-R was negatively significantly correlated to PCS demonstrating that a low perception of diabetes

distress is related to a good perception of physical health. MCS and PCS was low positively yet insignificantly correlated meaning a tendency of a relation between a good mental health and a good physical health.

[Insert Tabel 3]

Discussion

In this study, we found no correlation between glycemic control and family functioning in patients with T2D. Thereby, the perceived family function was not a unique predictor of glycemic control. However, the perceived family function, burden of diabetes and health-related quality-of-life were correlated suggesting a healthy family functioning being associated with less burden of diabetes and a stronger quality-of-life.

The study results showed that above half of the participants (56.7%) were in an adequate glycemic control corresponding to the defined treatment goal of A1C< 7%. The participants were mainly older people with a mean age of 65 years. Older adults are more likely to have time for self-care [30] and to perform frequent self-monitoring of blood glucose [31], behaviors having a positive impact on glycemic control [30,31].

We found no differences due to demographic and anthropometric data according to glycemic control levels except the duration of disease. The participants with longer duration of the disease were significantly more likely to have inadequate glycemic control, which is probably due to the progressive evolution characteristic of T2D [32]. Furthermore, the majority of the participants were well-educated, which is likely to strengthen diabetes management and have a preventive effect on diabetes complications, glycemic control and the perception of diabetes distress [33–35].

Regarding family function, on average all participants had low scores of the Brief FAM-III scales and the majority (>82%) had scores below average indicating a healthy family function. There was no

difference of perceived family functioning by any of the scales regardless of glycemic control indicating no association between family function and A1C levels [16]. Conversely, several studies outline that family functioning influences the perceived support or burden of the family regarding diabetes self-management and this perception furthermore affects A1C levels in patients with T2D [8,13,36,37]. Obstructive family behaviors appear to have a relatively stronger impact on self-management than supportive behaviors and are associated with patients being less adherent to diabetes regimen and medication and thereby in worse glycemic control. On the other hand, studies only showed a marginal association between supportive family behaviors and glycemic control [9,38]. This contributes to the explanation of the non-correlation of A1C and family function in the present study as the majority of the participants are likely to perceive their family's behaviors as supportive. We did not test that assumption and further research is required to assess the association between family function and the perceived supportive and/or obstructive family behavior. Thus, since previous studies [37,38] show that family function relates to glycemic control opposed to our results, it is also important to consider the low frequency of poorly perceived family functioning in our study population suggesting the distribution of variation in these variables might be too small to perform correlation analysis and may justify the absence of correlation in the present study.

Moreover, it is important to note that the present study was an explorative cross-sectional study and not a family-based intervention. In that context, several studies found improvements in glycemic control measured by A1C in varied family-based interventions (educational, behavioral and psychosocial), and conversely, no effect in the control groups. Therefore, the lack of correlation between family function and A1C in the present study might also be because of the theoretical framework as family-related improvements of glycemic control are dependent on a family-based intervention to have an impact. In addition, improvements in glycemic control in other studies were only detected in the short-term (less than 12 months post baseline). Effects were not sustained one year after the intervention period indicating a need for stronger family-based components and longer intervention periods with a connection to the healthcare system to maintain the rewarding changes in self-care and clinical outcomes [39–41]. Furthermore, only a few studies target adults aged 65 and

older with T2D and the impact of family functioning and support. Considering the burden and high prevalence of T2D in the older populations, there is a need for family intervention research especially targeting older with T2D and their families. Finally, interventions examining whether the perception of the family function is altered by the evolution of the disease to a worse stage are required [39].

Family function was not a predictor of A1C in our study but we found that a healthy perception of family function correlated to a low sense of diabetes distress and a strong mental health-related quality-of-life. In line with our findings, several studies concerning chronic diseases introduced family function as one of the main factors affecting the quality-of-life and disease management [42–44]. Other studies suggested that unhealthy family function were significantly more predictive of unhealthy behaviors than healthy family function[45]. Moreover, behaviors leading to poorer glycemic control were closely associated with higher diabetes distress and lower self-efficacy [46]. However, studies evaluating the perception of family function by individuals with diabetes are scarce. Interventions addressing family functioning could potentially improve diabetes self-management, prognosis and prevent or delay complications and moreover strengthen quality-of-life.

Diabetes self-management and healthcare factors occur almost entirely in the patients' home in the context of the family environment. Therefore, involving the family in diabetes interventions, education and long-term self-management improvements with a clear description of the family members' roles and participation might be of great potential for diabetes management adherence [47,48]. However, theoretical knowledge about family theory and family-based education seem to be lacking among diabetes educators [49], emphasizing the importance for health care providers and researchers to expand their knowledge on how to integrate assessment of family functioning and dynamics in diabetes-related clinical practice with a potential impact on the patients' diabetes-related outcomes, not least A1C levels[50].

The strength of this study is the well-defined population of patients with type 2 diabetes with incipient complications and the consistency regarding setting and health professionals, as all the participants

were examined at the same place, primarily by the same two physicians and nurses. Furthermore, there was a high response rate to all the questionnaires. However, there are limitations to our study that need to be taken into account in the interpretation of the results. First, no causal explanation is possible due to the explorative cross-sectional design. Combining the results with qualitative interviews and/or using the full version of the FAM-III questionnaire instead of the brief version would potentially be more insightful and demonstrate the impact of the various dimensions of family function on glycemic control and other measures of diabetes management. However, we anticipated that compliance would be too weak using a more comprehensive questionnaire as FAM-III in addition to the rest of the questionnaire packet. Moreover, there is a risk of selection bias because our sample might not be representative of the general population of people with T2D with incipient complications, as it was slightly homogeneous as to the perception of family functioning and the burden of diabetes as well as educational and A1C levels. Additionally, the minority of the study participants were women and a relatively smaller proportion than in the general diabetes population too. Hence, a more differential sample would enhance the credibility of a correlation analysis. Furthermore, the majority of the study population included older people and their perception of family function was mainly related to their spouse. Younger adults with T2D might consider nuclear family, extended family, and friends in their perception of family functioning potentially altering our results. Finally, we primarily focused on the patients' perspectives on family functioning. The family members' perspectives might be quite different and could potentially expand or even change the interpretation of the results.

Perspective

Glycemic control is a strong predictor of long-term microvascular diabetes complications but does not provide a comprehensive picture of the patient's diabetes management or perception of burden or well-being. Experiencing a good family function does not necessarily lead to a healthy lifestyle and medication adherence either and thus an improved A1C level. However, since a good family function is associated with advantageous family support, low burden of diabetes and quality-of-life, it is likely to improve the patients' potential to change and maintain a healthy lifestyle, and thus has an indirect

impact on diabetes management and prognosis. To fully understand the influence of family function, future intervention based research focusing on the structure of the family and the dimensions of family function are essential, in order to enhance diabetes management and the cohesion and well-being of the entire family.

Conclusion

Our study suggests that in patients with T2D, family function does not predict the level of glycemic control. However, we found an association between the perception of a healthy family function, low burden of diabetes, and a strong mental health-related quality-of-life. Thereby, the results do not exclude associations between family functioning and the multiple factors involved in diabetes self-management, important for the patient's compliance to lifestyle factors, and quality-of-life.

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Author Contributions

BBB, DO, HK, MR and TV conceived and designed the study and BBB and LM collected the data. BBB, DO, SL, IE and HK analyzed and interpreted the data and BBB drafted the manuscript. LM, DO, IE, HK, SL, MR, FK, and TV critically revised the manuscript and commented on the subsequent drafts. All authors read and approved the final manuscript for publication.

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Author Disclosures

Conflicts of interest: None

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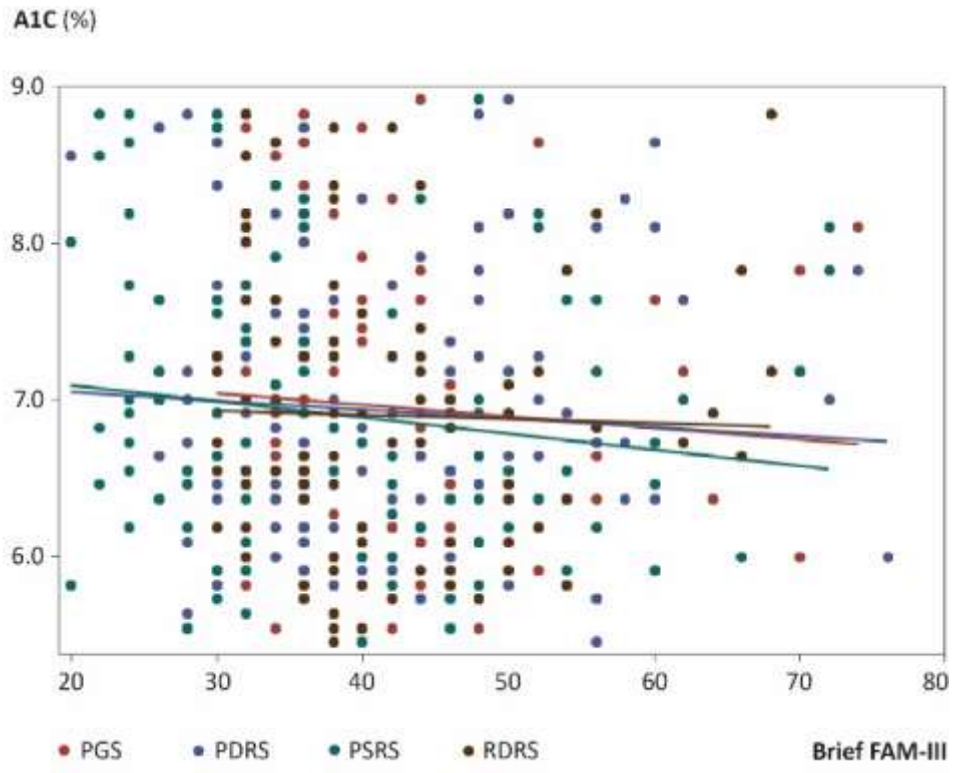
Figure 1

Association between Patient General score (PGS), Patient dyadic relation score (PDRS), Patient self-rating score (PSRS), Relative dyadic relation score (REDS) and A1C



Brief FAM-III measured by *PGS,* Patient General Scale*; PDRS,* Patient Dyadic Relationship Scale*; PSRS,* Patient Self-Rating Scale*; RDRS,* Relative Dyadic Relationship Scale. *A1C,* Glycated hemoglobin.

Tabel 1

Sociodemographic characteristics, A1C, family functioning, diabetes distress and quality-of-life according to glycemic control categories. N=127 (male n=92/female n=35)

Variables	**Adequate glycemic control** A1C<53 n= 72 (71% male)				**Inadequate glycemic control** A1C≥53 n=55 (75% male)			
	Mean	Std dev	Min	Max	Mean	Std dev	Min	Max
Brief FAM-III								
PGS	41.79	9.83	26.00	76.00	41.25	11.89	20.00	74.00
PDRS	41.90	8.26	30.00	70.00	40.78	10.53	30.00	74.00
PSRS	39.16	11.13	20.00	66.00	37.29	13.56	20.00	72.00
RDRS	41.96	8.28	30.00	66.00	40.95	10.32	30.00	68.00
A1C (%)	6.2	0.4	5.4	6.9	7.8	0.6	7	8.9
Age (years)	66.19	10.21	33.00	84.00	63.96	10.29	34.00	82.00
BMI (kg/m^2)	30.43	5.27	21.01	44.87	31.33	5.79	20.37	46.40
WHR (ratio)	0.98	0.09	0.81	1.20	1.00	0.10	0.83	1.29
Duration of diabetes (years)	7.92	6.32	1.00	26.00	10.67	6.42	1.00	28.00
DSC-R	1.00	0.60	0.00	2.44	0.99	0.67	0.00	2.76
SF-36 (MCS)	54.66	7.89	21.40	65.80	55.40	8.72	30.67	70.17
SF-36 (PCS)	49.09	8.13	25.53	59.99	47.35	9.73	21.64	65.59

Brief FAM-III (cut-off score 50) measured by *PGS,* Patient General Scale*; PDRS,* Patient Dyadic Relationship Scale*; PSRS,* Patient Self-Rating Scale*; RDRS,* Relative Dyadic Relationship Scale. Higher *Brief FAM-III* score indicate poorer functioning. *A1C,* Glycated hemoglobin. *BMI* score >30 represents obesity. *WHR,* Waist-hip ratio above 0.90 for males and above 0.85 for females is defined as abdominal obesity. *BMI* score >30 represents obesity. *DSC-R,* Diabetes Symptom Checklist-Revised. DSC-R score range from 0-5. Higher score indicates worse burden of diabetes. SF-36 *MCS,* Mental Component Summary (part of SF-36) range from 0-100. Higher scores represent better health.

MCS cut-off score 42 (indicate risk for major depressive disorder). *PCS*, Physical Component Summery (part of SF-36). PCS cut-off score 50. Higher scores represent better health.

Tabel 2

Correlation among Brief FAM-III scores, DSC-R, MCS and A1C.

Variables	A1C	p-value
Brief FAM-III		
PGS	-0.06	0.37
PDRS	-0.09	0.18
PSRS	-0.12	0.06
RDRS	-0.08	0.29
DSC-R	-0.00	0.99
SF-36 (MCS)	0.06	0.31
SF-36 (PCS)	0.01	0.90

Brief FAM-III measured by *PGS*, Patient General Scale; *PDRS*, Patient Dyadic Relationship Scale; *PSRS*, Patient Self-Rating Scale; *RDRS*, Relative Dyadic Relationship Scale. *A1C*, Glycated hemoglobin. *DSC-R*, Diabetes Symptom Checklist-Revised. *SF-36* (*MCS)*, Mental Component Summary (part of SF-36), *PCS*, Physical Component Summery (part of SF-36).

Note: Kendall's Tau-b Correlation Coefficient is used.

Table 3

Correlations among Brief FAM-III scores, DSC-R, MCS, and PCS

Variables	DSC-R	p-value	SF-36(MCS)	p-value	SF-36(PCS)	p-value
Brief FAM-III						
PGS	0.14	0.02	-0.21	0.0007	-0.09	0.1352
PDRS	0.24	0.0003	-0.23	0.0005	-0.10	0.1209
PSRS	0.16	0.01	-0.25	<.0001	-0.07	0.2784
RDRS	0.07	0.34	-0.13	0.09	0.06	0.3965
DSC-R			-0.30	<.0001	-0.27	<.0001
SF-36(MCS)					0.05	0.3861

Brief FAM-III measured by *PGS*, Patient General Scale*; PDRS*, Patient Dyadic Relationship Scale*; PSRS*, Patient Self-Rating Scale*; RDRS*, Relative Dyadic Relationship Scale. *DSC-R*, Diabetes Symptom Checklist-Revised. *SF-36(MCS)*, Mental Component Summary (part of SF-36). *PCS*, Physical Component Summery (part of SF-36).

Note: Kendall's Tau-b Correlation Coefficient is used.