Monitoring and Discussing Health Related Quality of Life in adolescents with type 1 diabetes improves psychosocial well-being. A randomized controlled trial.

Maartje de Wit, MSC1,2 Henriette A. Delemarre-van de Waal, MD, PHD3,4 Jan Alle Bokma, MD5 Krijn Haasnoot, MD6 Mieke C. Houdijk, MD, PHD7 Reinoud J. Gemke, MD, PHD3 Frank J. Snoek, PHD1,2

1. Department of Medical Psychology, VU University Medical Center Amsterdam, The Netherlands
2. EMGO Institute, VU University Medical Center Amsterdam, The Netherlands
3. Department of Pediatrics, VU University Medical Center Amsterdam, The Netherlands
4. Institute of Clinical and Experimental Neurosciences, VU University Medical Center Amsterdam, The Netherlands
5. Department of Pediatrics, Spaarne Ziekenhuis Hoofddorp, The Netherlands
6. Department of Pediatrics, Medical Center Alkmaar, The Netherlands
7. Department of Pediatrics, Juliana Kinderziekenhuis Den Haag, The Netherlands

**Corresponding author:**
M. de Wit, MSc.
email: m.dewit@vumc.nl

*Monitoring and discussing HRQoL in adolescents*

Clinical Trial Registry # ISRCTN65138334 - www.ISRCTN.org

Received 25 February 2008 and accepted 14 May 2008.

Additional information on this article may be found at http://care.diabetesjournals.org.
Objective To test the effects of monitoring and discussion of health related quality of life (HRQoL) in adolescents with type 1 diabetes in a multi-center randomized controlled trial.

Research design and Methods Four centers were randomly assigned to the HRQoL intervention (46 adolescents) or control (45 adolescents) group, with 3 regular visits scheduled within 12 months in both groups. In the HRQoL intervention group, HRQoL of adolescents was assessed using the PedsQL and outcomes were discussed face-to-face during the consultation. The control group received care as usual. Mean differences between the groups at 12 months in physical and psychosocial well-being (CHQ-CF87/PF50, DFCS, CES-D), satisfaction with care (PEQ-D) and HbA$_1c$ were determined, controlling for baseline scores.

Results Mean scores on CHQ subscales Psychosocial health ($p < 0.001$), Behavior ($p < 0.001$), Mental health ($p < 0.001$) and Family activities ($p < 0.001$) improved in the HRQoL intervention group, except for adolescents with highest HbA$_1c$’s. Adolescents in the HRQoL intervention group reported higher Self-esteem (CHQ) at follow-up ($p = 0.016$) regardless of HbA$_1c$, and were more satisfied with care ($p = 0.009$) than controls. No significant differences between the two groups over time were observed in HbA$_1c$ levels.

Conclusion Periodic monitoring and discussion of HRQoL in adolescents with diabetes is appreciated and has positive effects on their psychosocial well-being, except for those in poorest control.

(RCT: ISRCTN65138334 - [www.ISRCTN.org](http://www.ISRCTN.org))

ABBREVIATIONS: HRQoL = Health Related Quality of Life, PedsQL = Pediatric Quality of Life Inventory, CHQ-CF87 = Child Health Questionnaire-Child Form 87 items, CES-D = Center for Epidemiological Studies Depression scale, DFCS = Diabetes Family Conflict Scale, PEQ-D = Patients’ Evaluation of the Quality Diabetes care
Hormonal and psychosocial changes related to puberty can seriously complicate the diabetes regulation. Indeed, adolescents with type 1 diabetes as a group display the worst glycemic control compared to other age-groups (1, 2). From a developmental perspective, the daily demands of self-regulation can interfere with adolescents’ normal routines and friendships, thereby compromising their emotional and social well-being (3). Moreover, teenagers tend to give high priority to fulfilling their psychosocial needs here and now rather than taking preventive action to avoid health risks on the long term (4). Attaining good health related quality of life (HRQoL) as well as strict glycemic control is a challenge for adolescents with diabetes, their families and health care providers.

Periodic evaluation and discussion of the adolescents’ HRQoL as integral part of diabetes care is recommended to ensure recognition of the teenagers’ perspective, identify psychosocial barriers and promote healthy coping (5, 6). The utility of such an approach has not been tested in pediatric diabetes, but was shown to be beneficial in pediatric rheumatic patients as well as adult diabetes and cancer patients (7-9). We set out to test the effects of systematic monitoring and discussion of HRQoL of adolescents with type 1 diabetes in a randomized controlled trial. We hypothesized this would have a positive effect on the well-being and satisfaction with care of the adolescents, subsequently improving self care and glycemic control.

METHODS

Participants—Participants in the age range 13 - 17 were recruited from four pediatric diabetes clinics in the Netherlands. Clinics were selected based on willingness to participate, number of patients and similar clinical routines. Exclusion criteria were: diabetes duration < 6 months, mental retardation and not fluent in the Dutch language. The study was approved by the Medical Ethical committees of the participating centers; written informed consent was obtained from patients and parents.

Design—After a baseline assessment of demographics, diabetes duration and treatment regimen, the four outpatient clinics were randomly assigned to either the control or HRQoL intervention group. There were 7 pediatricians in the HRQoL intervention and 6 in control group. Center rather than patient randomization was employed to avoid contamination at the pediatricians’ level. During the 12 month study period, all adolescents had 3 regular appointments at a 3 months interval. At each consultation data were gathered on height, weight, HbA1c levels, and treatment regimen.

Power calculations, taken into account the intercluster correlation (rho=0.006), indicated that a difference of 5 points in mean well-being (range 0-100 and SD = 11) and a difference of 0.5% in mean HbA1c (SD = 1.1) at a 5% significance level with 80% power could be detected with 21 adolescents in each cluster (hospital), thus 42 in each group.

HRQoL intervention group: The HRQoL intervention consisted of two parts: A) monitoring the HRQoL right before the 3-monthly appointment with the pediatrician and B) discussion of the HRQoL scores with the teenager during the appointment. The adolescents completed the PedsQL Generic and PedsQL Diabetes specific modules on a computer, prior to the consultation with their pediatrician. The generic module of the PedsQL compromises a Physical and Psychosocial subscale. The latter consists of an Emotional, Social and School subscale (10).
Monitoring and discussing HRQoL in adolescents

The Diabetes module contains items on symptoms, treatment barriers, treatment adherence, worries and communication (11). A total of 51 questions were answered on a 5 point Likert scale. The computer program automatically calculated the subscale scores of the PedsQL, between 0 and 100, with higher scores representing better HRQoL. Reports with the outcomes of the PedsQL were printed for the pediatrician and the adolescent to be discussed during the consultation.

Prior to the study, pediatricians had received a short training how to interpret and discuss HRQoL scores and were offered a small guide with instructions and a list of the individual items of each PedsQL subscale as a back-up for discussing PedsQL scores. Pediatricians were instructed to start with discussing Generic PedsQL scores, with Dutch norm scores as reference and respectfully invite the adolescent to comment and discuss the outcomes. Thereafter the Diabetes specific subscales of the PedsQL were discussed, exploring possible solutions and actions. Pediatricians were asked to fill out a checklist to document topics and decisions. At the following (second and third) appointments, the pediatrician and adolescent could track and discuss changes in PedsQL scores over time (if any).

Patients and parents were informed at the start of the study that parents were welcome to join the consultation during the last 10 minutes and of course could be present during the whole consultation if so wished by patient and parent.

Control group: The adolescents received care as usual in the control group. To control for answering questions on the computer prior to the consultation, adolescents completed a lifestyle questionnaire instead of a HRQoL questionnaire on the computer, with items on eating, drinking, leisure activities, sports and friends. Patients in the control group were informed that the outcomes of this measurement were not to be discussed during the consultation or thereafter.

Outcome Measures—Baseline and follow-up assessment took place separate from the clinical appointments. Before the first appointment, baseline measures were assessed by sending adolescents and parents a questionnaire booklet on physical and psychosocial well-being to their home address. After the third appointment a similar booklet was sent again and returned to the research team. Parent data will be reported elsewhere.

Physical and psychosocial well-being of the adolescents was measured using the 87-item child report version of the Child Health Questionnaire (CHQ-CF87), covering domains of physical, emotional, social and mental health, rated over the previous 4 weeks (12). Scores are standardized to 0 – 100, with higher scores indicating better well-being.

Depression: Depressive symptomatology was assessed with the 20-item Center for Epidemiological Studies scale for Depression (CES-D) (13). Items are scored on the basis of frequency of depressive symptoms reported in the past week, from 0 (never) to 3 (daily). Total CES-D scores range between 0 (no depressive symptoms) to 60 (most frequent/severe depressive symptoms).

Diabetes-specific family conflict: As previous studies have shown that family conflicts contribute to poor well-being and glycemic control (14; 15), we decided to assess the amount of diabetes specific family conflicts with the revised version of the Diabetes-specific Family Conflict Scale (DFCS). The DFCS assesses the degree of family conflict on 19 management tasks, rated on a 3-point scale (14). Scores range from 19 (minimum) to 57 (maximum).

Satisfaction with care: The Patients’ Evaluation of the Quality of Diabetes care (PEQ-D) assesses the patients’ judgment
about the quality of diabetes care over the past 12 months (16). An example item is: ‘the clarity of the information I receive from my doctor’. Items are scored on a 5 point Likert scale and summed to calculate overall Quality of Care score, ranging from 0 to 100 (poor to optimal quality of diabetes care).

Glycemic control was assessed by HbA1c values which were retrieved from the charts, using the assessment closest to the date of completion of the booklets.

Statistical Analyses—Scoring and substitution of missing values was performed according to manuals (12; 17). For the CHQ, in case of < 50% missing data per subscale, substitution of the mean was used. For the CES-D and DFCS, we substituted missing data with the mean if <25 % of the data was missing. None of the patients had over 25% missing data.

After exploring the change in scores from baseline to follow-up for each group with paired t-test or Wilcoxon signed-rank test in case of non-normality, repeated measures ANOVA analyses using GLM (general linear modeling) in SPSS 14.0 was used. The effect of the HRQoL intervention was compared to the control group on physical and psychosocial well-being, satisfaction with care and glycemic control, controlling for their baseline levels, as well as baseline characteristics (age, gender, center, ethnic minority, family structure, diabetes duration and treatment regimen). Multi linear regression analysis was used to examine the possibility of interaction and confounding effects of demographic and diabetes-related variables with the HRQoL intervention and control group.

First, the effect of the HRQoL intervention on the physical and psychosocial health summary and subscale scores was examined, controlling for its baseline score. In the next step, demographic (gender, age, center, ethnic minority, family structure) and diabetes related variables (diabetes duration, HbA1c, treatment regimen) as well as interaction terms with the groups were added to correct for possible confounders and maintained in the model if significant.

RESULTS

The trial profile is depicted in Figure 1. Of the 171 patients meeting inclusion criteria, 91 (53%) agreed to participate. Baseline characteristics of the study sample have been reported in detail elsewhere (18). There were no differences between participants and non-participants in gender, age, diabetes duration or glycemic control. Ten adolescents (5 in each group) were lost to follow-up during the year due to transfer to other diabetes specialists or no-show. Those who dropped out, had higher HbA1c levels at baseline compared to participants (9.9 % vs. 8.7 %, p = 0.02). There were no other differences on demographic and psychosocial variables. The final sample contained 81 patients: 41 in the HRQoL intervention group and 40 in the control group (Table 1). At baseline, there were no significant differences between the four clinics, or between the HRQoL intervention and control group.

Physical and Psychosocial Health—

Main effects: Physical and psychosocial well-being scores for the HRQoL intervention and control group at baseline and follow-up are shown in the online appendix A1 (Appendix A1 is available at http://care.diabetesjournals.org).

GLM repeated measure analyses with correction for baseline levels showed a significant effect of group over time for the Psychosocial health summary scale of the CHQ-CH87 (p=0.006) (Figure 2A). This effect was mainly due to an improvement in the subscales Behavior (p = 0.007) and Self-esteem (p =0.016) for the HRQoL intervention group, while the scores remained unchanged for the control group.

Interaction effects: Linear regression analyses with inclusion of the interaction
Monitoring and discussing HRQoL in adolescents

terms and possible confounders, revealed an interaction effect on the Psychosocial summary scale between the study groups and baseline HbA1c level (R² = 0.382, p < 0.001). For lower HbA1c levels, scores of the HRQoL intervention group improved, while they remained stable in the control group. Closer inspection of the subscales revealed a significant interaction effect for the subscales Behavior (R² = 0.562, p < 0.001), Mental health (R² = 0.404, p < 0.001) and Family activities (R² = 0.370, p < 0.001). For adolescents with highest HbA1c values (> 9.5%), however, there was no difference between baseline and follow-up scores in the HRQoL intervention (or control) group. For the Self-esteem subscale, we found that scores improved for the HRQoL intervention group between baseline and follow-up, regardless of HbA1c values (R² = 0.382, p < 0.001).

Satisfaction with care: Adolescents in the HRQoL intervention group reported to be more satisfied with their care (on the PEQ-D) at one year follow-up compared to the control group (p = 0.009) (Figure 2B). This effect was independent of HbA1c, demographic and diabetes-related variables.

Glycemic control: At follow-up, mean HbA1c was 8.4% ± 1.6 for the HRQoL intervention group and 8.3% ± 1.3 for the control group, with no significant difference between the groups in decline in HbA1c levels over time (p = 0.54).

Post-hoc analyses—Change in PedsQL scores in relation to CHQ and PEQ-D scores at follow-up in the HRQoL intervention group: To explore if the changes in PedsQL scores were related to change in CHQ Behavior scores (R² = 0.612, p < 0.001, β treatment barriers = 0.218, p=0.035), while change in the PedsQL Diabetes module total score was related to CHQ Self-esteem subscale, scores at follow-up (R² = 0.486, p < 0.001, β total diabetes = 0.478, p = 0.016). Change in the Emotional subscale scores of the PedsQL were related to CHQ Mental health subscale scores at follow-up (R² = 0.409, p < 0.001, β emotional = 0.316, p = 0.029).

Change in the PedsQL Psychosocial summary score (especially the Emotional and School subscales) was associated with the Family activities subscale of the CHQ at follow-up (R² = 0.693, p < 0.001, β psychosocial = 0.514, p = 0.026). PEQ-D scores at follow-up were not predicted by change in PedsQL scores, suggesting that the reported increased satisfaction with care was independent of changes in HRQoL.

Predictors of HbA1c at follow-up: Since we did not find a significant change in glycemic control, we collapsed both groups to explore predictors for change in HbA1c levels. In a forward linear regression analyses, over 20 % of the variance in change in HbA1c was explained by baseline HbA1c levels and amount of family conflict (DFCS scores) (R² = 0.204, p < 0.001, β baseline HbA1c = - 0.391, p < 0.001, β DFCS = 0.057, p = 0.024). HbA1c explained 14.7 % and DFCS scores explained an additional 5.6 % of the variance in change.

CONCLUSIONS

This is the first trial to demonstrate the positive effects of periodic assessment and discussion of HRQoL in adolescents with type 1 diabetes as integral part of diabetes outpatient care. At one year follow-up patients in the HRQoL intervention group reported significantly less behavioral problems, improved self-esteem and mental health, and increased participation in family
activities. The adolescents in our study reported relatively high levels of well-being at study entry (18), yet, we achieved clinically relevant improvements with effect sizes ranging between 0.36 (moderate) and 0.57 (large). Whether the same or larger effects can be established in teenagers with a less favorable psychological profile remains to be seen.

Interestingly, we found that adolescents with relatively high HbA\textsubscript{1c} values at baseline (>9.5%) did not show improvement (nor worsening) of psychosocial outcomes over time. This may reflect higher levels of complexity in these adolescents or may be related to how PedsQL outcomes were discussed. In this group, pediatricians may be inclined to focus on the importance of achieving strict glycemic control, putting less emphasis on psychosocial issues. Unfortunately, we can not verify whether such differences in communication occurred, as we were not able to record the consultations. Examination of notes made by the pediatricians using a checklist, confirmed HRQoL scores were discussed based on the assessment but not how that was done. Future research should, if possible, include videotaping to observe the behavior of pediatricians and the interaction with the adolescent.

The positive effect of the HRQoL intervention on psychosocial well-being was associated with neither improvement nor worsening of glycemic control. HbA\textsubscript{1c} levels remained constant in both groups, in contrast to the often observed deterioration during puberty. This might be due to a study effect or a selection bias.

The HRQoL intervention was overall well appreciated by the adolescents, independent of their HbA\textsubscript{1c} and whether or not there was improvement in psychosocial well-being. Adolescents indicated on the PEQ-D that discussing HRQoL during the consultation helped the pediatricians to be more supportive and offered more opportunities for shared decision making. Moreover, no adverse effects of the monitoring procedure were reported, in concert with previous studies in adult populations (7; 8).

Some limitations of our study need to be mentioned. Selection bias may have impacted our results, as about half of the eligible patients decided not to participate in the RCT. Previous studies in the adolescent population also showed large refusal rates (19; 20). Poor glycemic control was obviously not a reason for decline and the variation among individual adolescents in physical and psychosocial well-being was quite large. It is of note that the adolescents who dropped out of the study did have higher HbA\textsubscript{1c} levels at baseline compared to the others.

Another limitation is the fact that we did not assess self-care behavior. We can therefore not exclude the possibility that minor changes in self-management have occurred, although unlikely given the stable HbA\textsubscript{1c} in both groups. In contrast to our expectation, the HRQoL intervention did not impact on glycemic control. We should acknowledge the fact that discussing HRQoL issues does not necessarily lead to talking about diabetes mismanagement (e.g. insulin omission) and indeed pediatricians were not instructed to do so in our study. It would seem worthwhile to test if adding a more focused assessment and discussion of self-care, using a goal-directed ‘conversation map’ facilitates behavior change with subsequent improvements in glycemic control (19).

In line with previous studies, family functioning, along with baseline HbA\textsubscript{1c}, proved to be an important determinant of glycemic control at follow-up, with fewer family conflicts showing better outcomes (14; 21). The PedsQL has good psychometric properties and utility (22), but it contains only one question on family functioning. Expanding the assessment of family functioning as part of periodic monitoring and
discussion of HRQoL in teenagers with diabetes should therefore be considered.

Based on two- to threefold increased rates of depression among teenagers with diabetes (23; 24), screening for concurrent emotional problems is recommended in this age group (5; 6). However, in our study, only three patients reported CES-D scores indicative for depression. Future studies should determine if the PedsQL is suitable as screener for depressive symptoms in adolescents or whether an additional depression screener is needed. In more general terms, further research is needed to test whether systematic monitoring and discussion of HRQoL can effectively help to detect psychological problems at an early stage, thereby preventing further deterioration.

Little is known about the optimal frequency of monitoring HRQoL. The positive results in our study were achieved with monitoring and discussing HRQoL on a 3 to 4 monthly basis, linked to routine outpatient visits. Further research should test whether less frequent monitoring, for example on an annual basis, produces the same outcomes across different patient groups.

In sum, implementing a computer-assisted HRQoL intervention in routine pediatric diabetes care is feasible, well appreciated by adolescents and providers, and results in significant improvements in psychosocial well-being.

ACKNOWLEDGEMENTS
This study is supported by the Dutch Diabetes Research Foundation: grant 2003.00.020
We thank all participating pediatricians and nurses from the following centers for their contribution: Medical Center Alkmaar, Spaarne Ziekenhuis Hoofddorp, Juliana Kinderziekenhuis Den Haag.
REFERENCES
10. Varni JW, Seid M, Kurtin PS: PedsQL 4.0: reliability and validity of the Pediatric Quality of Life Inventory version 4.0 generic core scales in healthy and patient populations. Med Care 39:800-812, 2001


Table 1 - Baseline characteristics of participating adolescents by group

<table>
<thead>
<tr>
<th></th>
<th>HRQoL intervention group</th>
<th>Control group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients (n)</td>
<td>41</td>
<td>40</td>
</tr>
<tr>
<td>Girls / boys (n)</td>
<td>19 / 22</td>
<td>19 / 21</td>
</tr>
<tr>
<td>Age (year)</td>
<td>14.8 ± 1.1</td>
<td>14.9 ± 1.0</td>
</tr>
<tr>
<td>BMI (kg/m2)</td>
<td>21.1 ± 3.6</td>
<td>21.1 ± 3.0</td>
</tr>
<tr>
<td>Diabetes duration (year)</td>
<td>7.2 ± 4.3</td>
<td>6.2 ± 4.3</td>
</tr>
<tr>
<td>Injections per day (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>9.8%</td>
<td>5%</td>
</tr>
<tr>
<td>3</td>
<td>51.2%</td>
<td>30%</td>
</tr>
<tr>
<td>4</td>
<td>29.3%</td>
<td>45%</td>
</tr>
<tr>
<td>pump</td>
<td>9.8%</td>
<td>20%</td>
</tr>
<tr>
<td>HbA1c (%)</td>
<td>8.6 ± 1.4</td>
<td>8.8 ± 1.3</td>
</tr>
<tr>
<td>Single parent families (n)</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>Ethnic minority (n)</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

Table 1 - Data are means ± SD, unless otherwise indicated. There were no significant differences between the HRQoL intervention and control group.

Figure 1 – Flow diagram of the participants through each stage of the trial

Figure 2 – A: CHQ Psychosocial Health sum score at baseline (■) and follow-up (□). CHQ scores were similar at baseline for the control and HRQoL intervention groups. The follow-up scores were significantly higher for the HRQoL intervention group compared to baseline (P < 0.01).

B: PEQ-D scores at baseline (■) and follow-up (□). PEQ-D scores were similar at baseline for the control and HRQoL intervention groups. The follow-up scores were significantly higher for the HRQoL intervention group compared to baseline (P < 0.01).
Monitoring and discussing HRQoL in adolescents

Figure 1
Monitoring and discussing HRQoL in adolescents

Figure 2