Electronic patient and parent reported outcomes in pediatric clinical practice
Haverman, L.

Citation for published version (APA):
Haverman, L. (2013). Electronic patient and parent reported outcomes in pediatric clinical practice

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Chapter 7

Development and Implementation of a Patient Reported Outcome Intervention (QLIC-ON Profile) in Clinical Pediatric Oncology Practice

Vivian Engelen
Lotte Haverman
Hendrik M Koopman
Antoinette YN Schouten-van Meeteren
Esther Meijer-van den Bergh
CM Jantien Vrijmoet-Wiersma
Elisabeth M van Dijk-Lokkart
Bob F Last
Symone B Detmar
Martha A Grootenhuis

Patient Education and Counseling 2010 Nov;81(2):235-44
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Abstract

Objective
The use of patient reported outcomes (PRO) in routine clinical practice is becoming increasingly common, but there is limited knowledge about the development and implementation of PRO. The objective of the current paper is to provide a thorough description of the development and implementation of a PRO on health related quality of life (HRQOL) - the QLIC-ON PROfile - in clinical pediatric oncology practice.

Methods
The development of the QLIC-ON PROfile is explained by elucidating important choices: the HRQOL instrument, the professional that uses the QLIC-ON PROfile, the optimal form of HRQOL feedback and whether or not a clinically important difference is reported. The description of the implementation of the QLIC-ON PROfile focuses on the education and commitment of the professional that uses the QLIC-ON PROfile. Study design and outcome measures are also elaborated on.

Results
Important considerations regarding the development and implementation of PRO interventions are reported. These considerations have also resulted in educational material.

Conclusion
Our study adds to current knowledge of PRO research. This paper can be used as a practical guide for researchers and other professionals, who are interested in setting up PRO interventions in any clinical setting.
Background

The use of patient reported outcomes (PRO) in routine clinical practice is becoming increasingly common, but there is limited knowledge about the development and implementation of PRO. PRO are based on direct reporting by patients without the intervention of an observer. They include the self-assessment of functional status, symptoms, and other concerns such as patient needs and satisfaction with care. Health Related Quality of Life (HRQOL) assessment is a form of PRO that often includes both a patient’s functional status (physical and psychosocial) as well as his or her symptoms. Over the past decade, several studies have focused on the use of PRO in clinical practice. Adult psycho-oncology research shows that PRO facilitates discussion of HRQOL issues during medical consultations, which can improve the HRQOL of patients. In pediatrics, the impact of PRO has been examined to a limited extent. Recently, however, encouraging results have been found by De Wit et al.: periodic monitoring and discussion of HRQOL in adolescents with diabetes had positive effects on their psychosocial well-being and improved satisfaction with care.

Despite these promising findings, it remains difficult to prove the effectiveness of PRO in clinical practice. For this reason Greenhalgh et al. applied a theory-driven approach to the use of PRO to bring together evidence of both whether and how the intervention is effective. The authors conclude that (1) the applied instrument needs to prioritize the views of the individual in order to adequately reflect the individual’s HRQOL; (2) health care providers other than physicians may also find HRQOL information useful; (3) feedback of HRQOL information should be longitudinally measured and presented over a period of time; (4) a clinically important difference or change in HRQOL data does not always resemble physicians’ perceptions of this difference or change; and finally, (5) commitment and education of the PRO user are needed to address the multiple barriers to the use of PRO in clinical practice.

Bearing these five conclusions in mind, there is a shortage of literature addressing the development and implementation of a PRO intervention in clinical practice.

In 2005, we initiated the multicenter sequential cohort QLIC-ON study (Quality of Life In Childhood Oncology) to measure the effect of the use of PRO in clinical pediatric oncology practice. Participants are children with cancer in the period immediately after end of treatment, which is a phase when HRQOL can be affected. Shortly before the first three follow-up consultations with the pediatric oncologist, the child (8 to 18 years of age) or parent (if the child is 0 to 8 years of age) completes a digital HRQOL questionnaire. The outcome (QLIC-ON PROfile) is presented to the pediatric oncologist as a PRO in order to help identify and discuss possible HRQOL problems.

The aim of the current paper is to provide a thorough description of the development and implementation of the QLIC-ON PROfile based on the five conclusions of Greenhalgh et al. (presented in italics). We also elaborate on the study design and
outcome measures. Through this paper we hope to contribute to current knowledge within PRO research to eventually increase the effectiveness of PRO use in clinical (pediatric) practice in general.

Development of intervention

HRQOL instrument

The applied instrument needs to prioritize the views of the individual in order to adequately reflect the individual’s HRQOL. Possibilities for applying this recommendation in pediatrics are limited due to the cognitive inability of younger children. Such an instrument (e.g., the SEIQoL-DW for adults) is not available for children. Moreover, individualized open instruments are probably more difficult to interpret and time consuming than structured questionnaires and therefore not user-friendly. One should carefully consider whether the type of instrument not only matches the patient but also the type of user of the PRO. Selection criteria for an appropriate HRQOL instrument for participants of the QLIC-ON study were therefore the following: generic and structured nature, broad age range, short completion time, good psychometric properties and availability in the Dutch language. Disease specific instruments were not applicable, since children are off treatment and cancer modules often refer to treatment related symptoms, e.g. nausea.

The TAPQOL, TACQOL, TAAQOL, DUX-25, Kidscreen, PedsQL and CHQ were available in Dutch and compared with each other. The PedsQL (past week - acute - version) appeared to be most appropriate because of its broad age range (5-18 years), its inclusion of self-report as well as proxy-report, its short completion time (approximately 5-10 minutes) and its good feasibility, validity and reliability. The PedsQL self-report form was used for children aged 8 to 12 and 13 to 18, whilst parents of children aged 6 to 7 completed the PedsQL proxy-report. The 23 items are divided into four subscales: physical, emotional, social and school functioning. Since Dutch PedsQL norm scores were not available, data were collected in a previous study.

The TAPQOL was added for parents of children aged 0 to 5 years. This HRQOL instrument focuses on children from 0 to 5 years of age through parent proxy measurement. Completion time is about 5-10 minutes and psychometric properties are satisfying. Forty-three items assess the child’s functioning on 12 scales: stomach, skin, lungs, sleeping, appetite, motor functioning (physical functioning), positive mood, anxiety, liveliness (emotional functioning), problem behaviour, social functioning (social functioning) and communication (communication). Dutch TAPQOL norm scores were available.
User

Greenhalgh et al. \(^{11}\) stated that health care providers other than physicians may also find HRQOL information useful. The QLIC-ON PROfile was presented to pediatric oncologists, since they are the child’s primary and, most often, only contact in the phase after treatment. This makes it difficult to appoint other PRO users. The pediatric oncologist’s responsibility is therefore not limited to physical functioning; systematic monitoring of psychosocial functioning is essential as well. This is especially important for those families that experience this period as a tense and stressful time, because fear of relapse is present \(^{12}\).

HRQOL feedback

Feedback of HRQOL information should be longitudinally measured and presented over a period of time. Single assessment is not considered enough; HRQOL should mirror the decision making process of advice and referral itself \(^{11}\). In the QLIC-ON study HRQOL outcome of each child was provided to the pediatric oncologist during three consecutive consultations; previous results were also depicted on the QLIC-ON PROfile to make monitoring possible. The complete development of the QLIC-ON PROfile is described in the following paragraphs.

Computer program

A computer programmer converted the TAPQOL and PedsQL into computerized questionnaires (Figure 1). After completion, individual outcomes (including previous ones) were digitally presented on the QLIC-ON PROfile. Features to print as well as to back-up and export the HRQOL data to SPSS were also made available. The program was implemented on four laptops, one for each of the four participating centres.

QLIC-ON PROfile

Inspired by previous studies \(^{2,3}\) four QLIC-ON PROfile layout options were designed: 1) line graphs, 2) vertical bars, 3) horizontal bars, and 4) a literal reproduction of the items with reported answers in words. The designs were presented to six pediatric oncologists from the different centres by e-mail and subsequently discussed during a half hour group session with the researchers.

The literal reproduction of the items with reported answers in words was unanimously chosen as the preferred design, since it provided the most detailed individual information. Moreover, this design leads the pediatric oncologist’s attention directly towards the problem by using traffic light colours to accentuate the direction of the answers. According to the pediatric oncologists, the first three options might prolong consultation time, whereas design 4 was the least likely to do so. The second preferred design, the line graphs, was included in the QLIC-ON PROfile as well,
because it adds longitudinal HRQOL information and the possibility to compare the scores of the child to the healthy norm population.

The PROfile provides information regarding the child: name, date of birth, person that completed the questionnaire and period of time. The main part represents the four HRQOL domains, each marked with a coloured line for easy recognition: physical (blue), emotional (green), social (yellow) and school functioning (pink). The items are depicted for every domain, with the answers summarized in a column behind linked to the completion (=consultation) date. An answer accentuated green (‘never’, ‘almost never’) indicates that the child had no problems regarding the subject, orange (‘sometimes’) points out that there were some problems, and a red answer (‘often’, ‘almost always’) illustrates that a child frequently experienced problems. Most recent answers are printed bold to focus the attention of the pediatric oncologist. At the bottom, scale scores are reflected in line graphs presented with the corresponding colours of each domain. In every line graph the scale score of the child is indicated with the completion date. Scores can be compared with previous scale scores as well as with the scale score of the healthy norm population (red dotted line). The layout of the TAPQOL QLIC-ON PROfile is essentially the same as the PedsQL.

Clinically important difference

A clinically important difference or change in HRQOL data does not always resemble physicians’ perceptions of this difference or change 11. It is important to carefully consider whether a calculated clinically important difference (e.g. cut-off points) adds value to the PRO. This depends on factors such as study aims and PRO user. On the QLIC-ON PROfile, healthy norm scores for each HRQOL domain are reported (red dotted line) in the graphs. These scores cannot to be used as cut-off points, since PedsQL and TAPQOL were not designed as screening instruments. The healthy norm scores are merely intended as markers to give the pediatric oncologist a sense of the child’s functioning compared to healthy peers and how the child is resuming normal life. For the purpose of systematically monitoring the child’s functioning, pediatric oncologists are instructed to pay attention to results beneath the healthy norm score. The main focus of the pediatric oncologists, however, should be on the items, where individual differences over time can easily be detected and discussed with help of the traffic light system. These changes, though, are not necessarily of a clinically important nature. Thus, if an answer is accentuated red on the first consultation, orange on the second and green when completing the questionnaire for the third time, it does not necessarily imply a clinically important change. The importance of this change can only be determined by the pediatric oncologist after discussing this (difference in) score with the child and parent. This is exactly what the QLIC-ON PROfile is intended to do.
Implementing intervention

Commitment and education

Commitment and education of the PRO user are needed to address the multiple barriers to the use of PRO in clinical practice. The QLIC-ON study observed this recommendation by applying a pediatric oncologist training program (QLIC-ON education) developed by five researchers, four clinical psychologists and one pediatric oncologist. The QLIC-ON education was described in a trainer manual and aimed at enhancing the effect of the use of the QLIC-ON PROfile in clinical practice. Goals of the QLIC-ON education included helping the pediatric oncologists to obtain knowledge about the background of the QLIC-ON PROfile, fostering awareness of the importance of the use of PRO in pediatric oncology and, most importantly, achieving competence in the use of the QLIC-ON PROfile in clinical practice.

Commitment

Six pediatric oncologists were consulted about their preferences regarding the design of the QLIC-ON PROfile (as stated earlier) in order to develop a sense of commitment. This also involved consulting one pediatric oncologist regarding the development of

Figure 1. Screen lay-out of PedsQL.
the QLIC-ON education, as well as striving for continuity during the consultations by having one pediatric oncologist monitor a child during the three QLIC-ON consultations.

Education
The QLIC-ON education contained three parts: an individual training for pediatric oncologists, a group training for pediatric oncologists, and an explanation for children and parents.

Individual training
The individual training consisted of an interview and a QLIC-ON PROfile instruction (duration: 1 hour). The interview explored the pediatric oncologist’s vision of his or her role in identifying and discussing HRQOL problems in children with cancer. The aim of the interview was to put the focus of the pediatric oncologist on the subject of the QLIC-ON study: identifying and discussing HRQOL problems. Subsequently, the QLIC-ON PROfile was introduced and explained with respect to layout, content, interpretation and use. Interpretation and use were illustrated by means of a decision tree, which was developed as an aid for interpretation of the QLIC-ON PROfile. The decision tree distinguishes three steps:

1) **Identify**: *Is there a HRQOL problem?*
   - Scan the QLIC-ON PROfile for red and orange coloured items
2) **Discuss**: *What is the HRQOL problem exactly?*
   - Clarify and discuss the red and orange coloured items
3) **Take action**: *What can be done about the HRQOL problem?*
   - Depending on need for care: patient tailored advice or referral

The QLIC-ON PROfile can only be experienced as a useful and easy tool if the users are given some liberty to employ it. Therefore, an important message for the pediatric oncologists was to implement the QLIC-ON PROfile in their consultations in a way that was *personally convenient* to them and use the decision tree as a tool *when needed*. Some pediatric oncologists preferred to use the QLIC-ON PROfile as a conversational guideline during the consultation, whilst others applied it as a supplement to their usual practice by checking the QLIC-ON PROfile at the end of the consultation for missed issues.

The decision tree, some important user instructions, and an example of a QLIC-ON PROfile were summarized in the QLIC-ON Pocket Card, which was distributed to the pediatric oncologist at the end of the individual training as a visual reminder.
Group training
A group training was developed in order to establish advanced skills and in-depth use of the QLIC-ON PROfile. A minimum of three and a maximum of five pediatric oncologists participated per session. Two trainers were present: a researcher and a psychologist.

The theoretical part initially consisted of a presentation elaborating on HRQOL of children with cancer 12,25-29, PRO 1-3,8 and the QLIC-ON study. After the first training sessions, however, pediatric oncologists evaluated that the theoretical part was not as useful as the practical component of the training. Subsequently, the group training was shortened to one hour, and the theoretical part was limited to a core QLIC-ON study description. A short ‘quiz’ regarding the main results of the QLIC-Oncologist Questionnaire was also implemented to enhance awareness of the pediatric oncologists and provide the training with the necessary interaction. The QLIC-Oncologist Questionnaire, derived from two previous studies 30,31, consisted of 12 propositions about the pediatric oncologist’s task regarding HRQOL problems in children with cancer. It was completed by all pediatric oncologists participating in the QLIC-ON study during the control period. The pediatric oncologists were asked to predict what the majority of their colleagues had answered on 5 propositions.

A new dimension in the field of PRO research was introduced in the practical part, which demonstrated three short case studies on film. Each case (duration: ± 5 minutes) showed a real consultation of a child and parent visiting a medical specialist, using an actual QLIC-ON PROfile. Three patients (cases) with different background and patient characteristics (age, gender, ethnicity and medical condition) were selected. To prevent bias, none of the cases involved a pediatric oncologist consultation. Camera work and production were performed by a nurse specialized in filming child and parent interactions in medical settings (Video Interaction Guidance) 32. The consultations were videotaped as a whole; subsequent editing decisions for educational purposes were made by the project group. The cases were implemented in the group training according to the following three steps:

1) Before demonstration: discussion of QLIC-ON PROfile.
   The QLIC-ON PROfile of the child in the film was briefly discussed, e.g.:
   *How would you interpret and discuss this QLIC-ON PROfile?*

2) Before demonstration: watching assignment. A watching assignment was given, to ensure the right focus, e.g.:
   *Pay attention to the questions of the physician.*

3) After demonstration: discussion of use of QLIC-ON PROfile.
   To reflect the content of the cases to the pediatric oncologist’s own clinical practice, questions regarding their personal views and experience were raised, e.g.:
   *What would you have done differently?*
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In addition, each case had its own learning goal: case 1) use of the QLIC-ON PROfile in general, case 2) use of the line graphs, and case 3) use of the decision tree. These were implemented as an extension of the above mentioned third step.

The pediatric oncologists received a QLIC-ON syllabus at the end of the training. It contained hand-outs of the initial (extensive) theoretical part, QLIC-ON reminders, the decision tree, three examples of a QLIC-ON PROfile, all outcomes of the QLIC-Oncologist Questionnaire and five relevant papers \(^2,^3,^8,^{12},^{33}\). To create an extra incentive, the group training was accredited.

Parent and child instruction
The third and final part of the QLIC-ON education aimed at instructing children (above 8 years) and parents participating in the intervention period. While waiting for their consultation in the out-patient clinic, the child or parent filled out the HRQOL questionnaire on a laptop. After completion, the QLIC-ON PROfile was printed, provided and explained to the child and parent. The explanation concentrated on clarifying the layout and content of the QLIC-ON PROfile without interpreting the outcome. The child and parent were informed that the pediatric oncologist would discuss the QLIC-ON PROfile with them during the consultation. They were also invited to feel free to initiate the discussion about their QLIC-ON PROfile with the pediatric oncologist themselves. Children and parents participating in the control period only filled out the digital questionnaire and received no QLIC-ON PROfile and instruction.

Children and parents initially received the complete QLIC-ON PROfile. After a few assessments, however, we noticed that some children became competitive when confronted with the line graphs. They expressed feelings of triumph or disappointment when their score was over or under the red dotted line. This was an undesirable effect of our intervention. After consulting several pediatric oncologists, we decided to provide parents and children with a QLIC-ON PROfile without the line graphs. The pediatric oncologists received the complete QLIC-ON PROfile containing the literal questions with answers as well as the graphs.

A case study
The use of the QLIC-ON PROfile and decision tree in clinical practice can best be illustrated by a case study (Box 1).
Box 1. A case study

Emma is a 10 year old girl diagnosed with Hodgkin lymphoma. She finished treatment 4 months ago and is now in complete remission.

At the moment she is in the out-patient clinic, together with her father, waiting for her third follow-up consultation with her pediatric oncologist. She is holding the QLIC-ON PROfile in her hand, which she has just completed on a laptop (Figure 1) for the third time. Her father has a copy as well and explores his daughters’ answers. In the back of his head, however, he is slightly tense about the consultation to come: what are the blood and urine results? Is the scan result good?

Meanwhile, the pediatric oncologist has rounded off the consultation with his previous patient and takes a brief look at Emma’s QLIC-ON PROfile which is attached to the patient file. He focuses on today’s assessment (June 4th 2007) and immediately identifies a few (possible) problems: ache, worries, bullying, memory problems and frequent hospital visits. Especially worrying, bullying and forgetting seem to have a chronic nature, since they have been going on for a few months now. On top of that the pediatric oncologist concludes from the graph that school functioning is deteriorating, particularly compared to healthy peers.

The pediatric oncologist invites Emma and her father in his consultation room. The atmosphere is familiar, because they know each other well. The pediatric oncologist starts the consultation with common questions, e.g. “How are you, Emma? How is school?” When she answers “Alright”, the pediatric oncologist introduces the QLIC-ON PROfile: “I see that you filled out on the QLIC-ON PROfile that you frequently worry about what will happen to you. Tell me about that. What do you worry about, and when?” a conversation follows. During the course of the consultation and the physical examination the other orange and red items are addressed. Where applicable the pediatric oncologist takes action. Apparently, the worrying and bullying is a persistent problem for Emma. Her father indicates that he and his wife find it difficult to take her worries away, and moreover they weren’t aware of the fact that the bullying was still a problem. The pediatric oncologist decides that Emma might profit from the help of a psychologist, so he refers them. Although Emma’s initial response is a bit hesitant, she agreed to give it a try.

A few months later, when Emma and her father see their pediatric oncologist again, Emma has had three sessions with the hospital psychologist. She feels comfortable with the psychologist and feels free to disclose what’s on her mind. The worries haven’t vanished, but they have definitely decreased. Also, the tips and exercises the psychologist gave her, help her with her social skills. She is now more assertive when classmates tease her. The pediatric oncologist can tell she is much more cheerful now and is pleased to hear she is doing better.
Study design and outcome measures

To ensure optimal evaluation of the effect of the QLIC-ON intervention, it was also crucial to carefully consider study design and outcome measures.

Study design

A sequential cohort design was regarded most suitable for the purpose of the QLIC-ON study. Pediatric oncologists participated in the control as well as the intervention period; children and parents participated in either the control period or the intervention period, but not both. First, a control period (March 2006 - January 2008) was introduced, in which children or parents (N=84) completed the HRQOL questionnaire while waiting for their consultation in the out-patient clinic. The QLIC-ON PROfile was not provided to the pediatric oncologist, the child and the parent. The pediatric oncologist started the intervention period (January 2008 - November 2009) as soon as he had seen all patients participating in the control period during three consecutive consultations. The intervention period consisted of a group of 85 children or parents filling out the HRQOL questionnaire in the waiting room. This time however, the QLIC-ON PROfile was provided to the pediatric oncologist, the child and the parent, to be discussed during the three consultations.

We consider randomization or cross-over designs in PRO studies inappropriate due to the risk of contamination. Randomizing the child is not an option, because in that case the pediatric oncologist has to be trained in advance and be prepared for any child, regardless of control or intervention condition. It is not possible to split or block knowledge: as soon as pediatric oncologists have received the QLIC-ON education and gained some experience in using the QLIC-ON PROfile, bias could occur when seeing children in the control condition. Randomizing the pediatric oncologists is neither a possibility, because of overlapping responsibilities. Children are frequently discussed in team meetings in which all pediatric oncologists participate and it is not uncommon that pediatric oncologists share the treatment of a child. Finally, randomizing the centres would lead to bias as well. Only four centres participated in our study and not all of them contributed equally to the study (the number of participating patients and pediatric oncologists differed greatly). Furthermore, it is not unlikely that there are some differences in hospital policy between the centres (e.g. shared care). Therefore, to prevent bias, a sequential cohort design was considered most suitable for the QLIC-ON study.

Outcome measures

The majority of the outcome measures applied in the QLIC-ON study are known from previous PRO research: communication, advice, referral, satisfaction and HRQOL.
According to Greenhalgh et al (2005), evidence was found for ‘Changes to doctor-patient communication’ when using HRQOL in clinical practice. We assessed communication by means of two methods: 1) a self-constructed questionnaire (regarding the initiative to talk about the four HRQOL domains), 2) audio taping the consultations (a qualitative method to assess conversational topic by means of a checklist). Especially with the audio tapes we hope to gain more insight in the effect of applying the QLIC-ON PROfile in clinical practice, since it is a less frequently used instrument and it goes into more detail. ‘Changes to clinicians management of the patient’ (e.g. advice and referral), ‘Patient satisfaction’ and ‘HRQOL’ are more difficult to find. Still, we have incorporated these assessments in the QLIC-ON study, because they are well known and important as an outcome. Moreover, as can be concluded from previous research, it is not impossible to find change via some of these measures.

In addition to the more established outcome measures, the QLIC-ON study also assessed health care use and health care needs - comparable to ‘Changes to patient health behaviour’ in the model of Greenhalgh et al. Understanding the use and needs regarding health care might partially explain patient satisfaction and HRQOL outcome.

The last outcome measure focused on feasibility, which was obviously only investigated in the intervention group. This does not actually fit the model, however, it can be regarded as a direct outcome, immediately linked to ‘Provision of information from health status measures to clinicians’.

**Discussion**

This paper provides a thorough description of the development, implementation, study design and outcome measures of a PRO on HRQOL in clinical practice (QLIC-ON PROfile). By applying the conclusions of Greenhalgh et al, combined with our own experience, we hope to have maximized the effectiveness of the QLIC-ON intervention. Considerations for future PRO studies in clinical practice are summarized in Table 1.

There are some points of interest to consider. First of all, for future research we recommend PRO use by other professionals besides physicians, as Greenhalgh et al. suggested. In our study pediatric oncologists were selected because they are responsible for the after-care trajectory, the phase in which the QLIC-ON PROfile is studied. In one centre, however, we also included two nurse practitioners as users, since they carried the same responsibility for after-care as the pediatric oncologists. We believe nurses, nurse practitioners, social workers or psychologists could also be eligible candidates for using HRQOL PRO. From a professional point of view they might even be more interested in and capable of discussing HRQOL than physicians. In addition, it is important to keep in mind possible differences in the use of the**
QLIC-ON PROfile between the four participating centres as a whole. We expect these differences to be minor, since the Netherlands is a small country, with only seven pediatric oncology centres that apply the same (international) treatment protocols. However, our aim was for each child to be seen by the same pediatric oncologist for the time of the three QLIC-ON consultations. Due to hospital policy and the reality of clinical practice this was not always possible in one of the four centres, in which shared treatment was common. In the worst case, this could lead to less continuity of care compared to the other centres, which might impact parent and child satisfaction.

Second, the QLIC-ON study proved to be very labour-intensive. Every child completed the PRO during three consecutive consultations. These assessments took place on a stand alone laptop in the outpatient clinic. A researcher was present during every assessment to set up all materials, to guide them through the procedure, to

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**Table 1. Considerations for future PRO studies in clinical practice**

<table>
<thead>
<tr>
<th>Development</th>
<th><strong>PRO instrument:</strong> HRQOL, symptoms, satisfaction or other</th>
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<tbody>
<tr>
<td></td>
<td><strong>PRO user:</strong> Physician, nurse (practitioner), social worker, or other</td>
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<td></td>
<td><strong>PRO feedback:</strong> Paper-pencil, digital or internet</td>
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<td></td>
<td>Items, graphs or bars</td>
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<td></td>
<td>Accentuation of (individual) outcome</td>
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<td></td>
<td><strong>PRO norm score:</strong> Mean, SD, clinically important difference, none or other</td>
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<tr>
<td>Implementation</td>
<td><strong>PRO commitment:</strong> Involving PRO user in PRO development</td>
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<td></td>
<td><strong>PRO individual training:</strong> Introduction of PRO to user</td>
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<td></td>
<td>User instructions of PRO</td>
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<tr>
<td></td>
<td>Decision tree: aid for interpretation of PRO</td>
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<td></td>
<td>Pocket card: easy user reminder and summary</td>
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<td></td>
<td><strong>PRO group training:</strong> Establish more dept in the use of PRO</td>
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<tr>
<td></td>
<td>Theory: brief background information</td>
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<td></td>
<td>Practice: realistic PRO cases on film</td>
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<td></td>
<td>Group discussions regarding theory and practice</td>
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<td></td>
<td>Syllabus: background information and summary</td>
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<td><strong>PRO patient instruction:</strong> Introduction of PRO</td>
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<td>Free invitation to initiate discussion of PRO with physician</td>
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<tr>
<td>Study design</td>
<td><strong>Randomization:</strong> Randomization, cross-over or sequential cohort design</td>
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<td></td>
<td>Intervention, attention-control and/ or control group</td>
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<td></td>
<td>Longitudinal assessment of PRO: three or more</td>
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<td>Patient and/ or proxy measurement</td>
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<tr>
<td>Outcome</td>
<td><strong>Measures:</strong> Advice, referral, satisfaction, communication, HRQOL or other</td>
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<td>Health care use and needs, feasibility or other</td>
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<td></td>
<td>Audio tape: conversational topics</td>
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<td>Respondents: patient, physician or other</td>
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hand a copy of the QLIC-ON PROfile to the pediatric oncologist and to make sure the consultation was audio taped. We recommend performing future PRO studies and implementations via internet. This gives respondents the opportunity to complete the questionnaire at home and users to retrieve the PRO on the computer in the consultation room.

Third is the timing of assessment. The QLIC-ON sample concerned children aged 0-18 years with different kinds of malignant diagnoses - a very heterogeneous group. For reasons of homogeneity we selected a moment similar for all children: the first three consultations after end of treatment. At this point, however, children and parents are usually familiar with their pediatric oncologist. As a consequence, the QLIC-ON PROfile might reveal results that are already known to the pediatric oncologist. Furthermore, HRQOL problems might be more pronounced during treatment than after treatment. Both reasons could render the QLIC-ON PROfile to be less useful and less effective than when applied during treatment. Nonetheless, we believe timing of assessment should in essence not matter. Pediatric oncologists care for their patients and must therefore always be aware of possible HRQOL problems.

Another point of consideration is that the QLIC-ON study design consisted of two groups: a(n) (attention) control group and an intervention group. It would probably have gained in strength if the sequential cohort design contained three groups: a control, an attention-control and an intervention group. Velikova and colleagues (2004) found a difference in HRQOL subscales between intervention and control, but not between intervention and attention-control. Due to practical limitations (small population size) three groups were not possible in the QLIC-ON study. Furthermore, we realize that our study is at risk for a history effect, since intervention and control group data were not collected at the same time. However, the control and intervention period were contiguous and gradually ongoing over time, and treatment protocols remained comparable within the 3-year time span of the study.

Finally, the outcome measures. Greenhalgh et al. already mentioned that there is little evidence for several outcomes in the model. For the more distal outcomes of patient health status and satisfaction with care, numerous intermediate processes need to occur before any impact could be registered. Maybe satisfaction for example does not offer a true reflexion of patient’s experiences. Subsequent research should therefore consider other measures besides the established ones, which until now have not provided satisfying evidence.

**Conclusion**

In conclusion, each of the five recommendations of Greenhalgh et al. was followed up to a greater or lesser extent, depending on the needs of the QLIC-ON study and our own experience: (1) Although our HRQOL instruments are of a generic and
structured nature, we underlined the individual outcomes by presenting the answers of the respondent on all items; (2) The obvious user of the QLIC-ON PROfile was the pediatric oncologist, yet we acknowledge that other users e.g. nurse(s), social workers or psychologists might fit the use of the QLIC-ON PROfile as well; (3) HRQOL information was collected preceding three consecutive consultations and fed back to the pediatric oncologist longitudinally; (4) The QLIC-ON PROfile is not intended as a screening device but merely as a monitoring tool, thus no cut-off scores were utilized, and scale scores of the healthy norm population were only presented in the graphs to underline the monitoring aspect; (5) With respect to the implementation of the QLIC-ON PROfile a lot of attention has been paid to commitment and education. Especially in the group training, we strove for innovation by adding educational film material, which was also emphasized by Guyatt et al. 37.

It is important to realize that only the results of the QLIC-ON study can determine whether our QLIC-ON PROfile development and implementation have been successful. Nonetheless, this paper provides relevant information for all future PRO studies on how and what to develop and implement, regardless of PRO topic, patient age and disease. In order to increase effectiveness of PRO in clinical practice and to improve patient care, we encourage other researchers to give profound insight in development, implementation, study design and outcome measures as well. To achieve broad use of PRO in diverse clinical settings, it is not only necessary to build upon each other’s methods and results, but also upon each other’s unique experiences in the development of a specific PRO.

Finally, there is the challenge for the more distant future: closing the gap between research and actual implementation in clinical practice. Most important factors for success are - in our opinion - the user-friendliness of the PRO tool and commitment of the users. Both have been stressed in this paper, but also acknowledged by other researchers 34,38. The PRO methods applied in research have mainly depended on the work and effort of one or more researchers (e.g. logistics, assessment, evaluation). In the reality of clinical practice, there is probably no budget for this available. Internet can provide a step towards a solution, since in the Netherlands 87% of the households has access nowadays 39. Less staff is needed, if the PRO is directly linked to patient data (e.g. treatments, consultations) and emails with invitations and questionnaires are automatically generated. An internet-based PRO is currently being studied by our research group.

The second important factor is that the users of the PRO have to be convinced of the benefits of the tool. If there is no enthusiasm among users, the willingness to successfully implement the PRO in clinical practice is very difficult - is our experience. Ways to increase commitment have been described in this paper. In addition, it can be helpful to have at least one ‘user-ambassador’ in the user group to convince the group from within, and not only from external, which researchers often are. Of
course, commitment is expected to rise with figures: proof of effectiveness is likely to encourage medical professionals to use PRO tools in their practice.
Reference List


